U.S. Fish & Wildlife Service

Patuxent Research Refuge

Comprehensive Conservation Plan

October 2013

Front Cover:

Pileated Woodpecker
Charles Warren NBII

Back Cover:

Mabbott Pond
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

Comprehensive Conservation Plan
June 2013

Submitted by:

Brad Knudsen
Refuge Manager
Patuxent Research Refuge

6/13/13
Date

Concurrence by:

Anne Sittauer
Refuge Supervisor
National Wildlife Refuge System

7/15/13
Date

Scott B. Kahan
Assistant Regional Director
National Wildlife Refuge System

8/19/2013
Date

Approved by:

Wendi Weber
Regional Director, Region 5

9/30/13
Date

U.S. Fish & Wildlife Service

Patuxent Research Refuge

Comprehensive Conservation Plan

October 2013

Refuge Vision Statement

Patuxent Research Refuge serves 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. Situated in a sea of urban development near the center of the Baltimore-Washington Corridor, Patuxent Research Refuge is an island of green. This large contiguous block of forest, meadows, and wetlands provides habitat for resident and migratory species, and improved air and water quality for the surrounding areas, while fostering a sense of wonder and connectedness to natural areas.

U.S. Fish & Wildlife Service

Patuxent Research Refuge

Comprehensive Conservation Plan

October 2013

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) 253-8688 Email: *northeastplanning@fws.gov*

This Comprehensive Conservation Plan for the 12,841-acre Patuxent Research Refuge (refuge) is the culmination of a planning effort involving the U.S. Fish and Wildlife Service, Maryland State agencies, local partners, refuge neighbors, private landowners, and the local community. This CCP establishes 15-year management goals and objectives for the refuges' wildlife and habitats, public use programs, and administration and facilities.

This plan sets forward the management direction that we think best achieves 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.

Under this plan, we will emphasize the management of specific refuge habitats to support species of conservation concern in the Chesapeake Bay region. In particular, we will emphasize forest biodiversity and ecosystem function. This includes the restoration for a number of impoundments and grasslands to forested areas. In addition, we will strive to promote wildlife-dependent public uses, while allowing for non-wildlife-dependent uses. We will promote higher quality hunting and fishing programs; expand wildlife observation, viewing, and photography opportunities; and initiate new interpretive program and environmental education opportunities.

Chapters

Appendixes

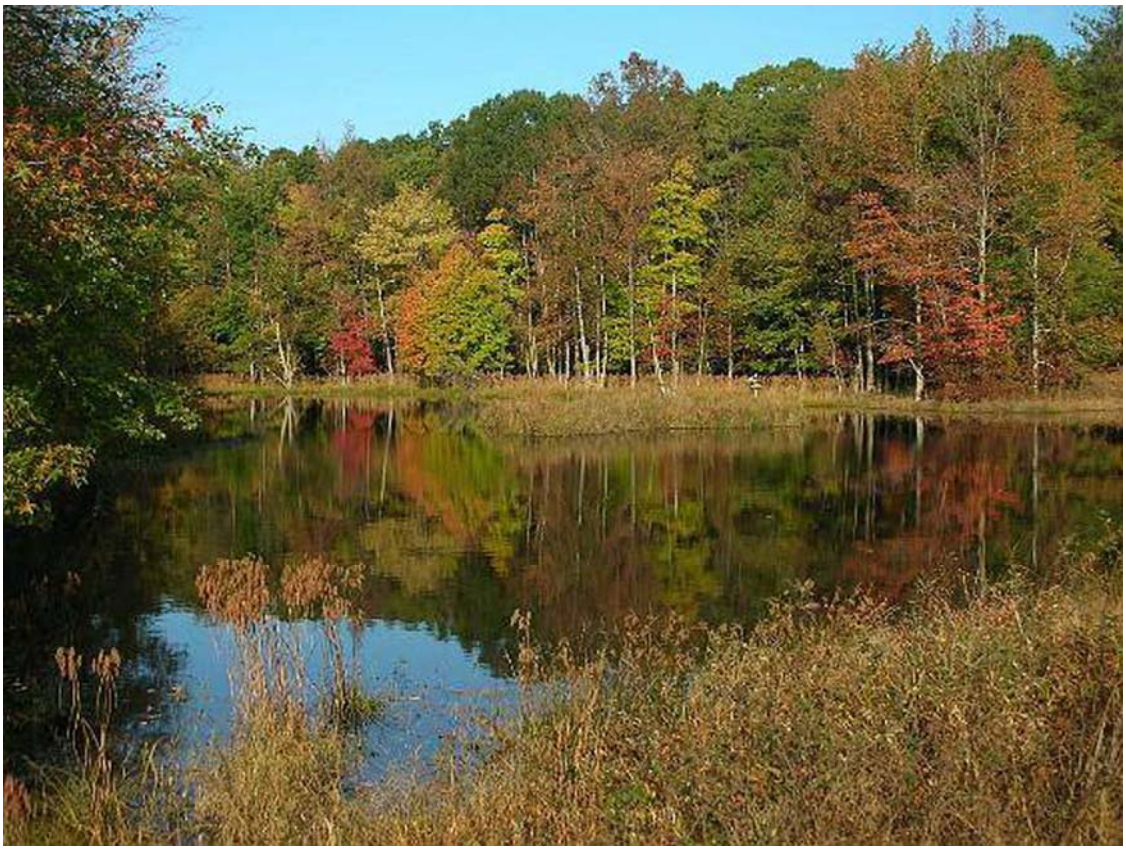
Figures, Tables, and Maps

List of Figures

List of Tables

List of Maps

Chapter 1.



USFWS

Patuxent Research Refuge

The Purpose of, and Need for, Action

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 to serve "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 refuge has grown from 2,679 acres in 1936 to 12,841 acres today.

The 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.

The refuge is unique within the Refuge System by having both a research and wildlife conservation mission and by being co-located with the U.S. Geological Survey (USGS) Patuxent Wildlife Research Center (PWRC). The PWRC 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's Division of Migratory Bird Management also has offices located at the 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 that has become scarce in the Maryland Coastal Plain.

We prepared this final comprehensive conservation plan (CCP) for the refuge as 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; Refuge Improvement Act). An environmental assessment (EA) required by the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321 et seq., 83 Stat. 852) was prepared concurrent with the draft CCP. The decision to adopt this plan and its "Finding of No Significant Impact" (FONSI) are included as appendix H.

This document presents the combination of management goals, objectives, and strategies that will guide the management decisions and actions of Patuxent Research Refuge over the next 15 years. It also helps State and Federal agencies, our conservation partners, local communities, Tribal governments, local communities, and the public understand our priorities and work with us to achieve common goals.

This CCP is organized in five chapters to outline the history, driving mandates and purposes, and conservation priorities guiding the management direction, as well as the existing environment of the refuge.

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

Chapter 2, “The Planning Process,” describes our planning process, including public and partner involvement, its compliance with NEPA regulations, and identifies public issues or concerns that surfaced during plan development.

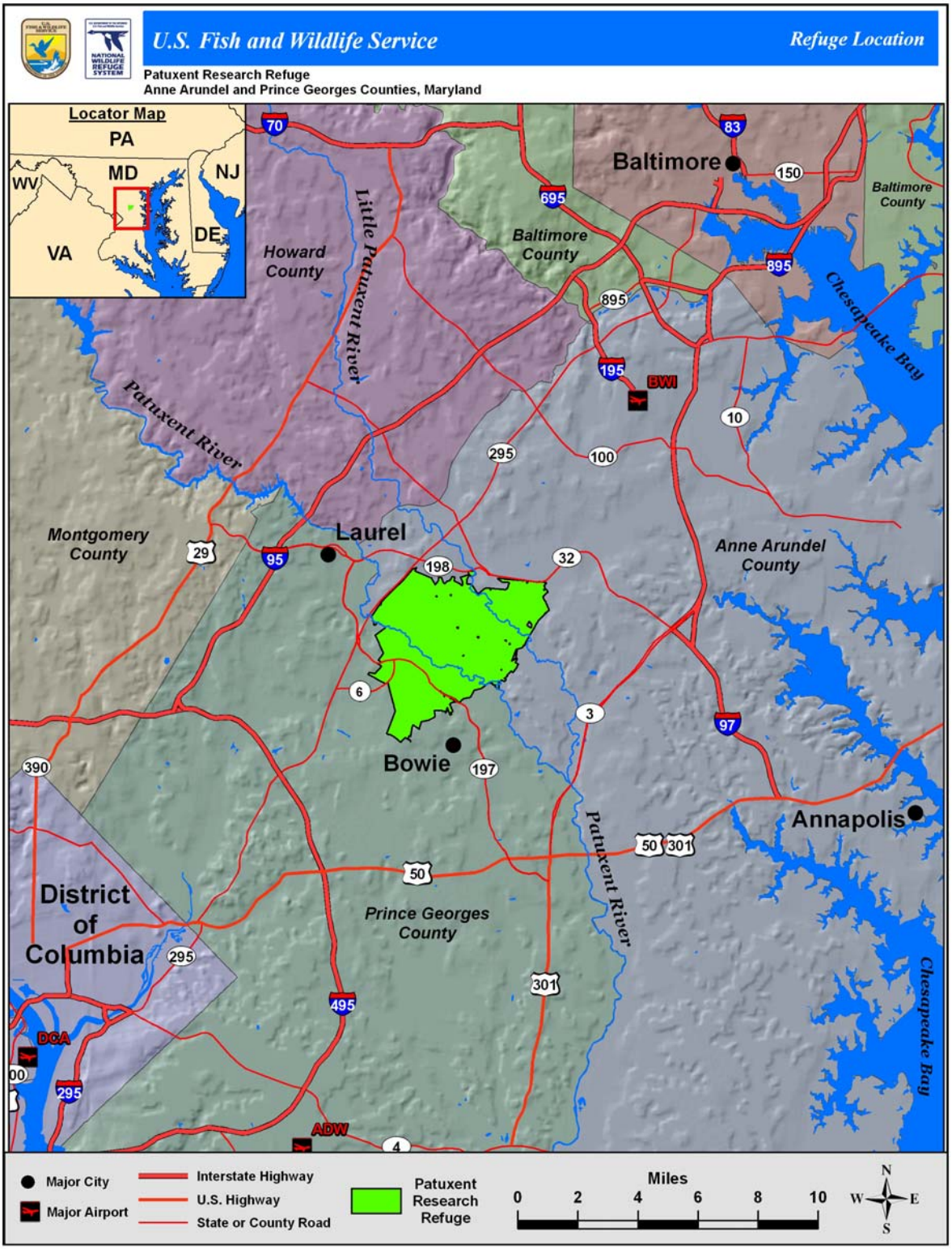
Chapter 3, “Existing Environment,” describes the biological and socioeconomic landscape context as well as the physical, biological, and human environments of the refuge.

Chapter 4, “Management Direction and Implementation,” presents the actions, goals, objectives, and strategies that will guide our decision-making and land management for the refuge over the next 15 years. It also outlines the staffing and funding needed to accomplish that management.

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.

A bibliography, a glossary with acronyms, and nine appendixes 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 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 requires that a thorough analysis be made of a range of management alternatives, including a "no action" alternative that represents current refuge management. The draft CCP/EA evaluated three alternatives (A, B, and C). We analyzed the socioeconomic, biological, physical, and cultural consequences of implementing each alternative, and selected among these alternatives based on their greater or lesser ability to meet the purposes and needs described in this chapter. For the final CCP, we chose alternative B which will provide a high amount of forest restoration while balancing other habitat types that will benefit other priority species as well as a range of habitat types for potential research projects. It is presented in chapter 4 as the management direction that the refuge will implement over the next 15 years.

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 practicable, 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 practicable, 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 provides 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 CCP 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 submitted the necessary documentation and application to the Maryland Department of the Environment. We received confirmation in April 2013 that the CCP is consistent with the Coastal Zone Management Program.

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," in the draft CCP/EA evaluated 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. The Service designed the 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 to serve "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 (BCR 30) Implementation Plan

The implementation plan for BCR 30 (Steinkamp 2008) 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

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:

- 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. The plan can be accessed at:
http://www.dnr.state.md.us/wildlife/Plants_Wildlife/WLDP/divplan_final.asp; accessed Februrary 2013.

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 the CCP. 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
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 program 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 FONSI, 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 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.

Patuxent Research Refuge serves 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. Situated in a sea of urban development near the center of the Baltimore-Washington Corridor, Patuxent Research Refuge is an island of green. This large contiguous block of forest, meadows, and wetlands provides habitat for resident and migratory species, and improved air and water quality for the surrounding areas, while fostering a sense of wonder and connectedness to natural areas.

Chapter 2.

USFWS

Nest Box at Mabbot Pond

The Planning Process

2.1 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 the 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.

On October 10, 2012, we published a Notice of Availability (NOA) in the *Federal Register* announcing the release of the draft CCP/EA for a 45-day comment period from October 10 to November 26, 2012. We distributed the draft CCP/EA to all interested parties, contacted the media, and posted it on our Web site during the comment period. We also hosted two public meetings in October 2012. We reviewed and summarized all comments received, wrote responses, and revised the CCP during December and January. Our response to public comments is in appendix I.

We submitted the final CCP to our Regional Director for approval in May 2013. The Regional Director determined that a FONSI was warranted (see appendix H), and that our analysis was sufficient to simultaneously issue a decision adopting this CCP for the refuge. We announced the final decision by publishing a NOA in the *Federal Register* of the final CCP.

2.2 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.

Biological Program

- Whether and how to reforest non-forested 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

- Determine whether or not to 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.
- How to balance between public use and biology/wildlife.
- Whether and how to maintain horseback riding as a public use opportunity on North Tract.
- Whether or not to improve public access to North Tract by increasing parking areas.
- If other public uses at North Tract can be accommodated during hunting season.
- Whether or not to charge a user fee and/or permit fee to help fund trail projects, etc.

Hiking on the Refuge – USFWS

- Determine if Wildlife Drive should be completed to provide user access to entire loop, and consider various grades of access (auto, horse, bike, or hiker only, or a combination).

Cultural Resources

- Whether or not to inventory historic resources on refuge and provide public access to these resources, and highlight historical significance of refuge.

Partnerships and Outreach

- Whether and how to continue working with local and State organizations in enhancing outreach and funding opportunities in support of refuge mission and goals.
- Whether to develop new partnerships to support refuge mission and goals.
- Whether or not there are issues or opportunities that are common to other Federal land managers in the area.

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

- Whether or not there are land protection needs throughout the Patuxent River watershed.
- Whether or not to add lands to the approved refuge acquisition boundary for conservation purposes, including consideration of easement programs and private lands coordination.

Issues Considered and Dismissed

Whether or not to Eliminate 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 included minor changes to the hunting programs in each of the alternatives presented in the draft CCP/EA.

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 did not include 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 PWRC, 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 did not include 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 in this CCP. 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's 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 purpose and need. Therefore, we have not further analyzed such an alternative.

Chapter 3.

USFWS

Tufted Titmouse

Existing Environment

3.1 Introduction

3.2 Physical Environment

3.3 Habitat Overview

3.4 Wildlife

3.5 Federal and State-Threatened and Endangered Species

3.6 Special Management Areas

3.7 Public Use Resources and Trends

3.8 Archaeological and Cultural Values

3.9 Socioeconomic Environment

3.10 Partnerships

3.11 Administrative Facilities

3.1 Introduction

This chapter describes the current and historic physical, biological, and socioeconomic landscape of Patuxent Research Refuge. Except where noted, the resource descriptions and acreage measurements are applicable to the entirety of the refuge.

Refuge Establishment, Purposes, and Land Acquisition History
On December 16, 1936, President Franklin D. Roosevelt signed EO 7514, which transferred 2,670 acres (1,081 hectares) of land to the USDA 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 the 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-term 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 3-1 and 3-2 for land acquisition totals).

In 1975, 1,250 acres (506 hectares) of surplus land were transferred from the USDA to the Service, 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 softball fields, were transferred to the refuge in 1992.

Table 3-1. 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 3-2. 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."

3.2 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. 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 Park 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

South Tract Road

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 PWRC 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).

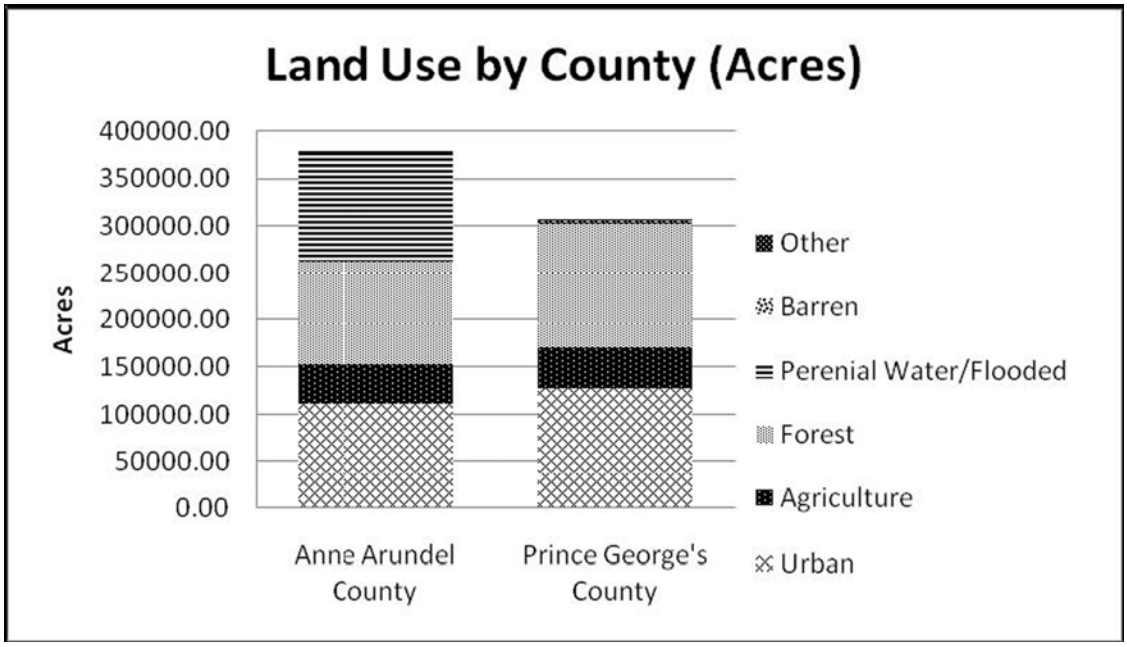
The South Tract, located in Prince George's County, consists of 2,200 acres (890 hectares) and is bordered by the Sandy Hill Landfill (inactive), the Beltsville Agriculture Research Center, and several residential areas. The South Tract houses the NWVC, located at the end of Scarlet Tanager Loop off 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. Most of the land has regenerated to forest, but 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 3-1). 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 3-1. Land Use in Anne Arundel and Prince George's Counties

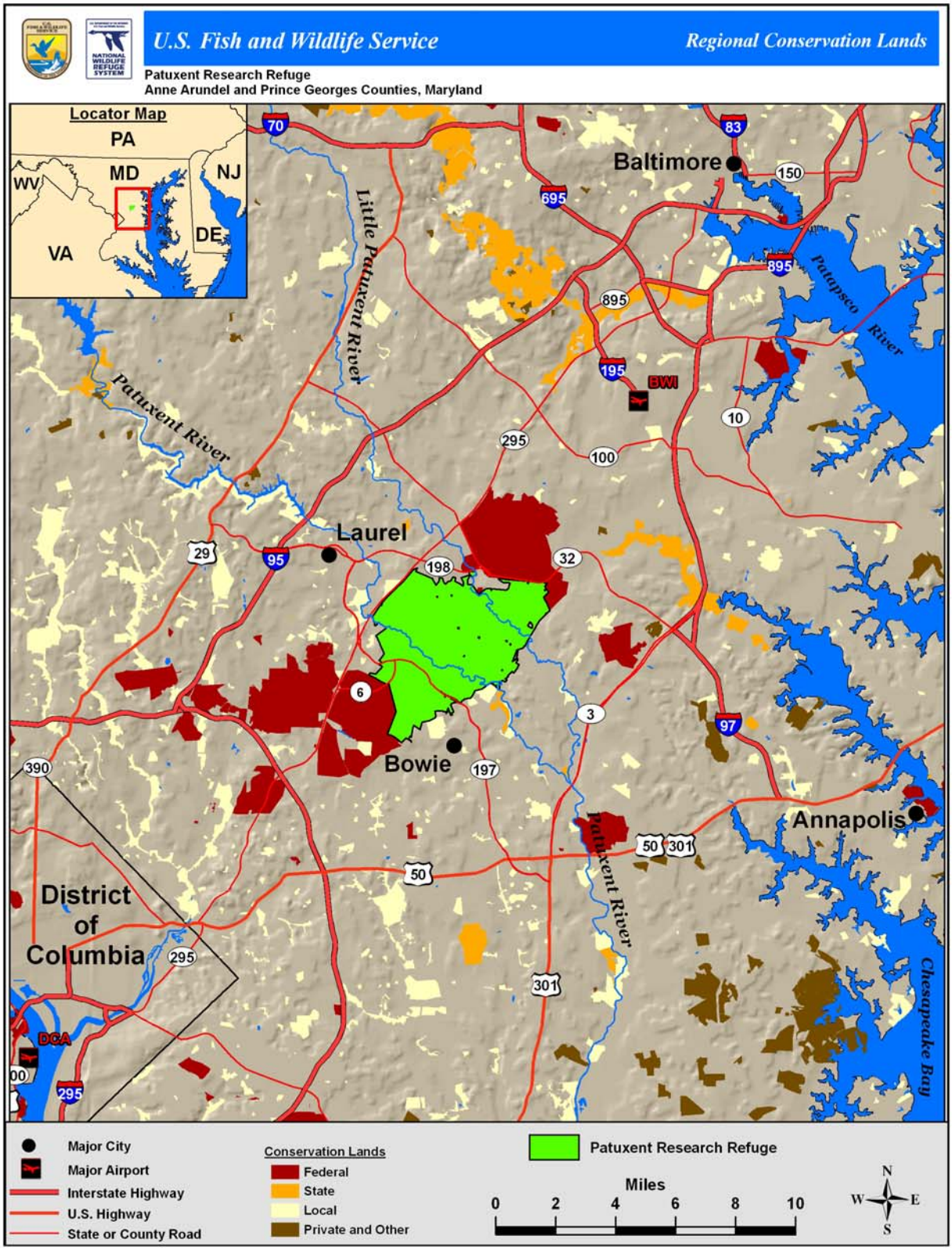


Source: State of Maryland Department of Planning

Regional Protected Lands

A variety of regional parks and protected land are located in Anne Arundel and Prince George's Counties (map 3-1).

Map 3-1. 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. Abandoned gravel and borrow pits are also common 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.

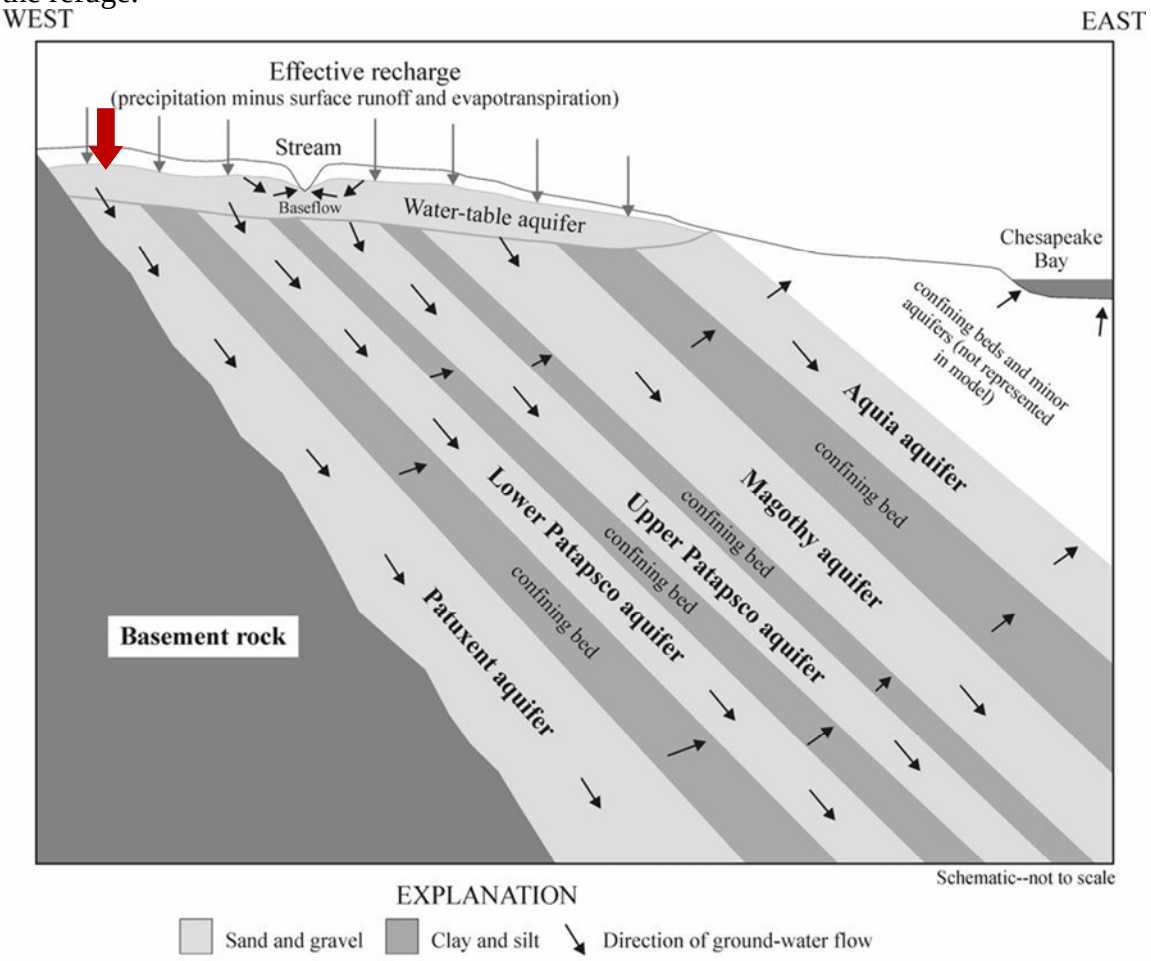
- The Christiana-Sunnyside-Beltsville association is underlain by red clay. The Christiana and Sunnyside soils are well-drained and suitable for deep-rooted vegetation. These soils have generally been put into agricultural production in the region; undisturbed forested areas with these soils are rare. 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 perched 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 3-2). 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 3-2. 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, designated 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 (McGilvrey 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 Corps 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 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.

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 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 the early 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

Fort Meade Contamination Sites

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. In July 1998, the U.S. Environmental Protection Agency (EPA) placed Fort Meade on the national priority list of serious abandoned hazardous waste sites, 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, lead, pesticides, polychlorinated biphenyls, heavy metals, waste fuels, waste oils, and unexploded ordnance (URS 2010). 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.

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. The Department of the Interior, the Department of Army, and the EPA are actively involved in cleanup efforts.

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 19 groundwater monitoring wells on the North Tract to determine if groundwater is also contaminated on the refuge (Wurster 2010).

In addition to hazardous materials being disposed of on the refuge, munitions and unexploded ordinances remain on the transferred land. Ordnance is removed as it is encountered in the field by ordnance demolition teams supplied by Fort Meade or other nearby military bases.

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 as 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).

Stickel Laboratory Leachfield and Old Dump Area
Stickel Laboratory 108, constructed in 1963, contained an office wing, chemistry wing and pathology wing. Throughout much of its occupancy and use, waste laboratory chemicals and pesticides were disposed of down laboratory sink drains where they ended up in a drain field/leachfield constructed specifically for this purpose when the building was first built. An old dump site and slit trench adjacent to the leachfield were also used to dispose of old furniture, tires, and other junk resulting from day-to-day research operations as well as for disposal of left over pesticide concentrates and contaminated research study animal feed, paints, solvents and other chemicals. Use of the leachfield, old dump, and slit trench sites was discontinued in 1986. In 1989, the Service commenced a site evaluation of the Old Dump area and Chemical Leachfield.

During the site investigation, low levels of metals, pesticides, PCBs, volatile and semi-volatile organic compounds, polyaromatic hydrocarbons, and petroleum hydrocarbons were detected both in the Chemical Leachfield and Old Dump Area. The levels of some of the compounds detected were reported above EPA screening levels but below EPA risk-based cleanup goals. Due to the long-term costs of monitoring the Old Dump and Chemical Leachfield, and the potential restrictions and limitations to land use that institutional controls would impose, the Service decided to remove the waste material from the Old Dump Area, and impacted soils from the Chemical Leachfield.

Approximately 18,700 tons of solid waste and impacted soils were removed from the Chemical Leachfield and Old Dump Area. Approximately 7,400 cubic yards of common fill, and 1,900 cubic yards of topsoil (top 9 to 12 inches) were added to the excavated areas to bring them back to grade with surrounding slopes. The topsoil was then hydroseeded with a revised seed. Since then, Patuxent Research Refuge land management practices have maintained the remediated Old Dump and Chemical Leachfield sites as open space through regularly scheduled field mowing and by not allowing the land to be used for construction/development purposes. Monitoring wells constructed at the sites and at other nearby locations have been maintained intact and are available for future use by the EPA, MDE, and the Service.

3.3 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 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.

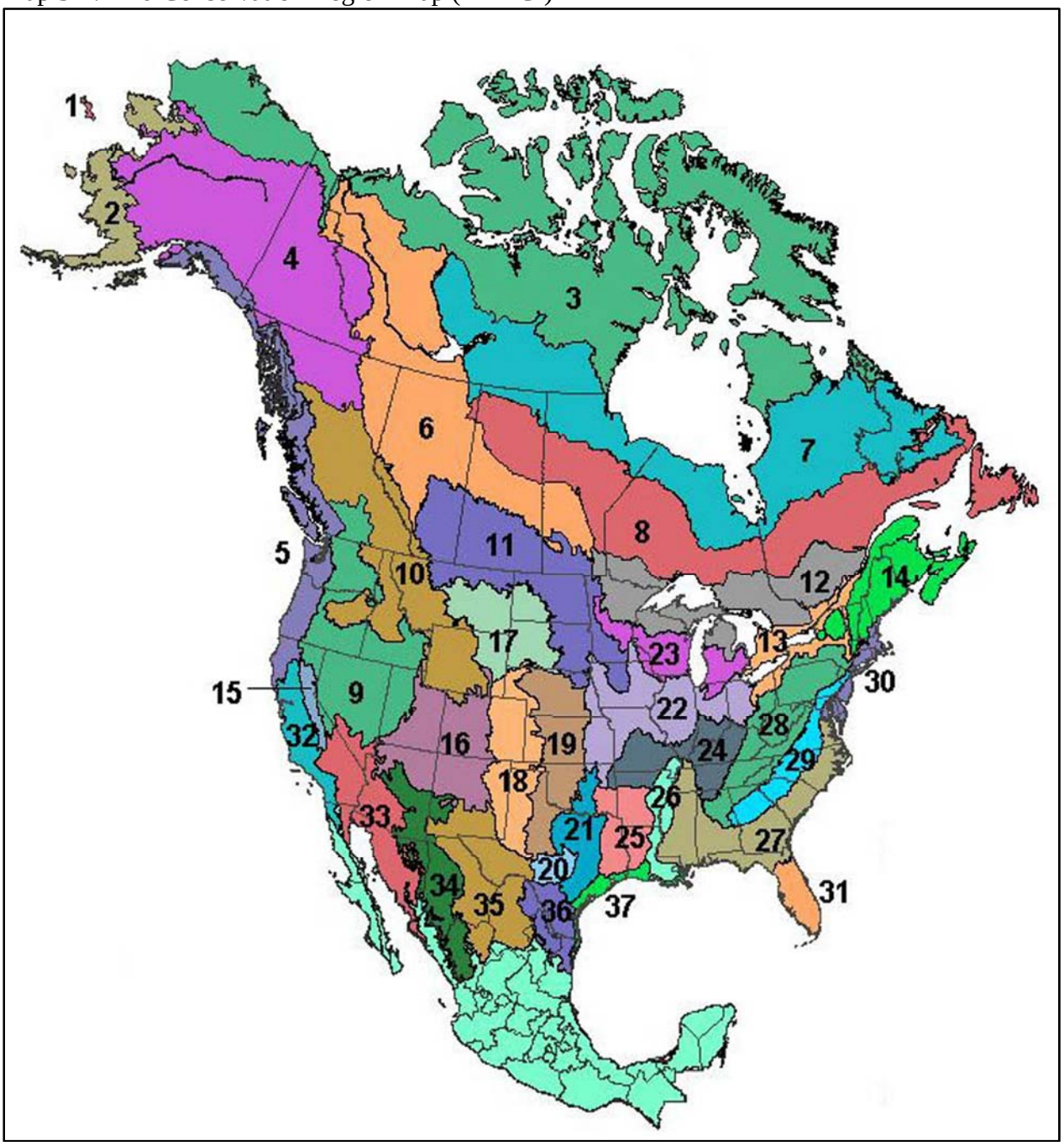
The habitat descriptions below are also important for deriving the priority bird species lists for each habitat type. Map 3-2 shows bird conservation regions (BCRs), ecologically distinct regions in North America with similar bird communities, habitats, and resource management issues. The BCR system 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 3-3 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.

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 falcata)*. Other species include Virginia pine (*Pinus virginiana*), pitch pine (*Pinus rigida*), red maple (*Acer rubrum*), American beech (*Fagus grandifolia*), 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.

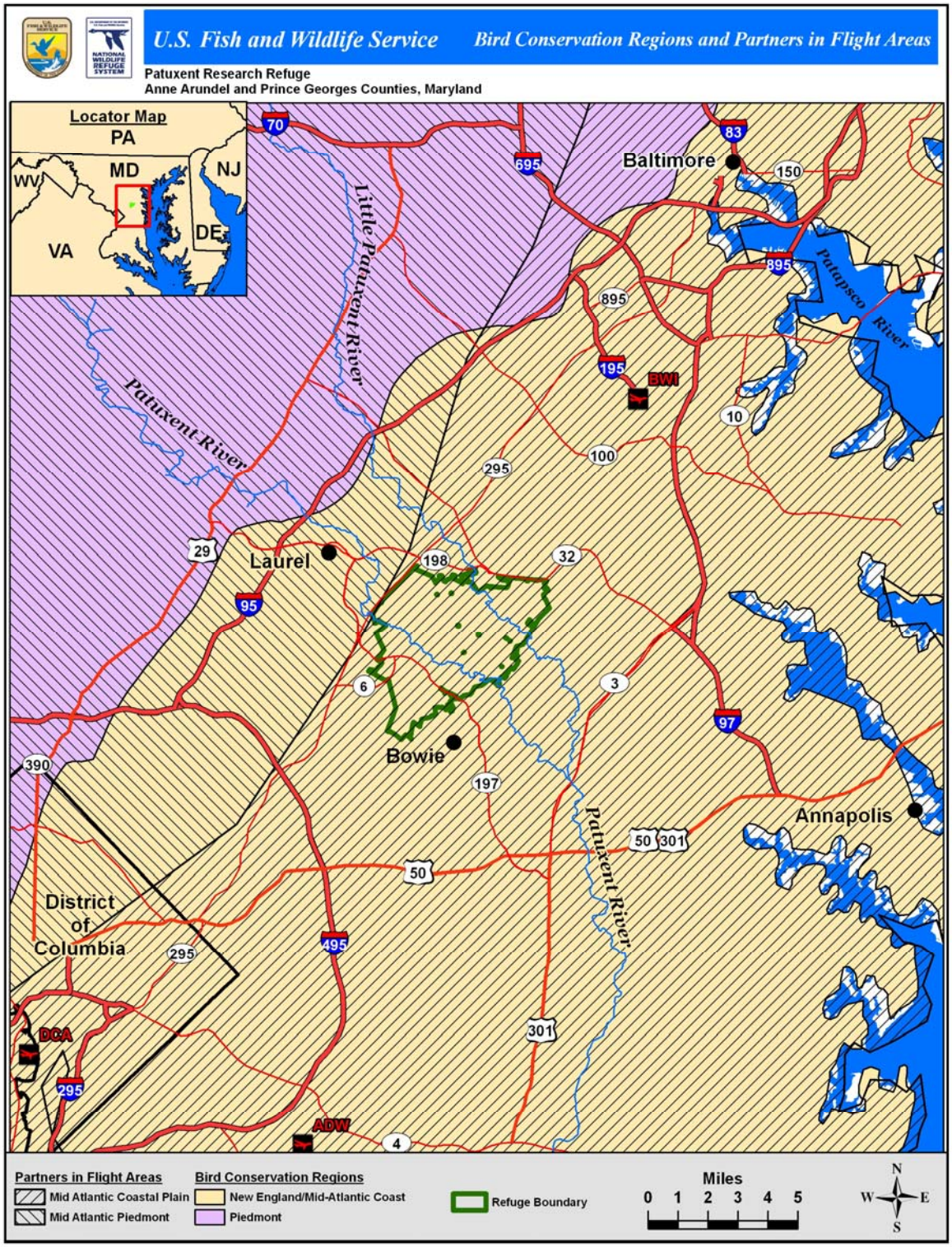
The next most predominant habitat type is bottomland or floodplain hardwood forest characterized by river birch (*Betula nigra*), green ash (*Fraxinus pennsylvanica*), sycamore (*Plantanus occidentalis*), pin oak (*Quercus palustris*), swamp white oak (*Quercus bicolor*), willow oak (*Quercus sphellos*), black oak (*Quercus velutina*), red maple, black gum (*Nyssa sylvatica*), sweetgum, yellow poplar (*Liriodendron tulipifera*), 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.

Map 3-2. Bird Conservation Region Map (NABCI)



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



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 on the North Tract 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, which arrests their natural succession. 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 umbellata*). 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 artemisiifolia*), 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 (*Setophaga discolor*), eastern kingbird *(Tyrannus tyrannus)*, brown thrasher (*Toxostoma rufum*), orchard oriole (*Icterus spurius*), 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 (*Lasiurus 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 pallida*), 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*), and other forest-dependent reptiles such as hog-nosed snake (*Heterodon platirhinos*) and box turtles.

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 3-3 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 3-3. 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
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

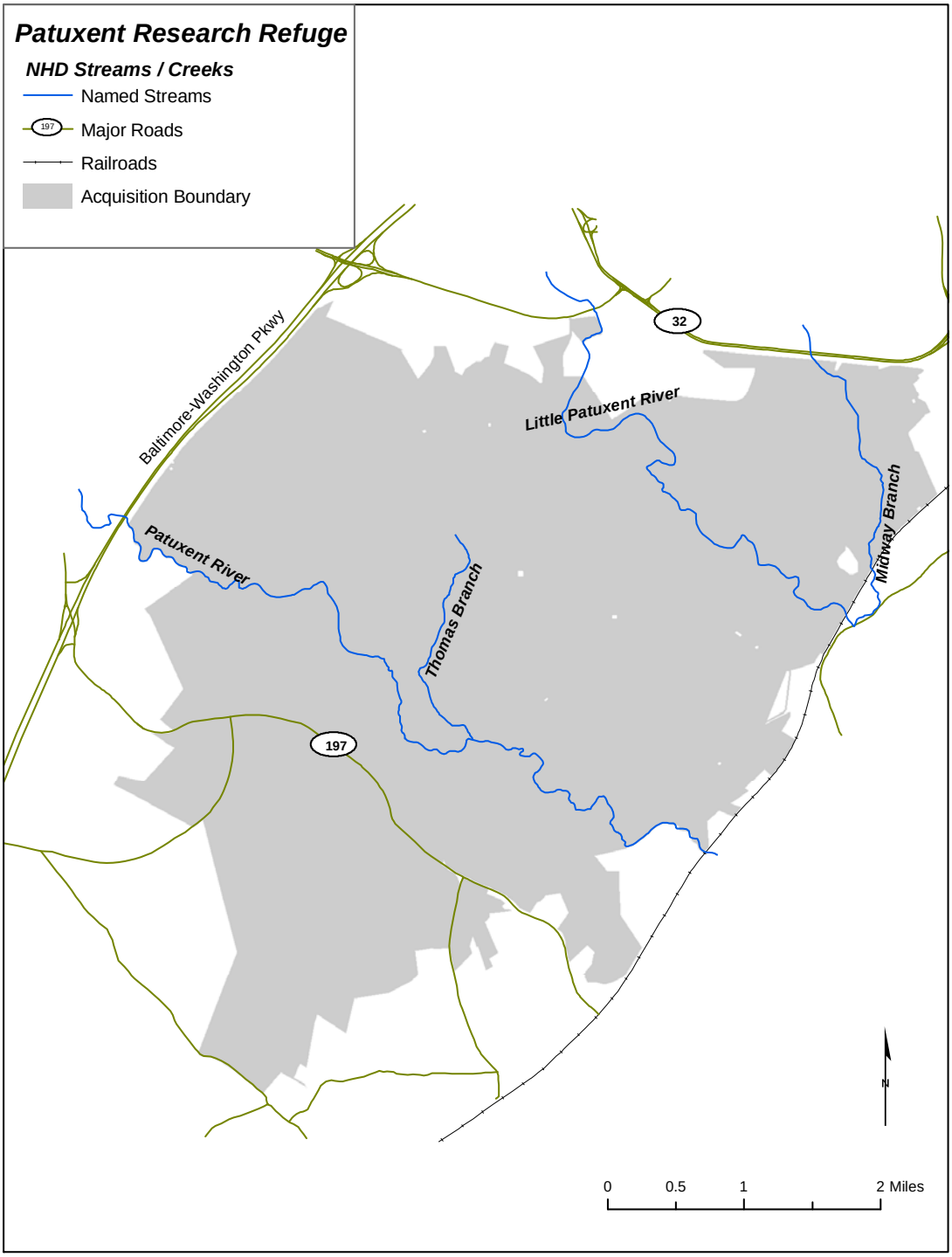
Pond	Acres	Pond	Acres	Pond	Acres
Rogue Harbor	8.2	Shaefer Farm Pond	2.2	End. Species Reservoir	0.40
Duvall 2	7.7	Midway	2.1	Treatment Lagoon	0.32
Hance 1	7.5	Shaefer Farm Pond	1.9	Shaefer Farm Pond	0.31
New Marsh	7.1	Treatment Ponds	1.8	Shaefer Farm Pond	0.29
Uhler 1	6.5	Harding Spring Pond	1.7	Fire 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 3-4). When perennial feeder streams of all the watersheds within the refuge boundary are included there are up to 74 miles of riparian habitat. 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 2012). 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 3-4. 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 2012).



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).

3.4 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 3-4. Species of Greatest Conservation Need by Habitat Type

Habitat Type	Invertebrates	Birds	Amphibians and Reptiles	Mammals	Total
Grasslands	0	14	0	1	15
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 19 species that potentially may occur 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

Six Spotted 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.

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.

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 (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 chytridiomycosis (chytrid) and amphibian ranaviral disease, the latter accounting for the majority of the die-offs. The extent to which these diseases affect amphibians on 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*).

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 *(Setophaga cerulea)*. 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, USFWS 2008, MD DNR 2005a).

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 3-5.

Table 3-5. 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 formosa*) – 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 feet wide (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*).*

Oak-Pine Savannah
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).

3.5 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.

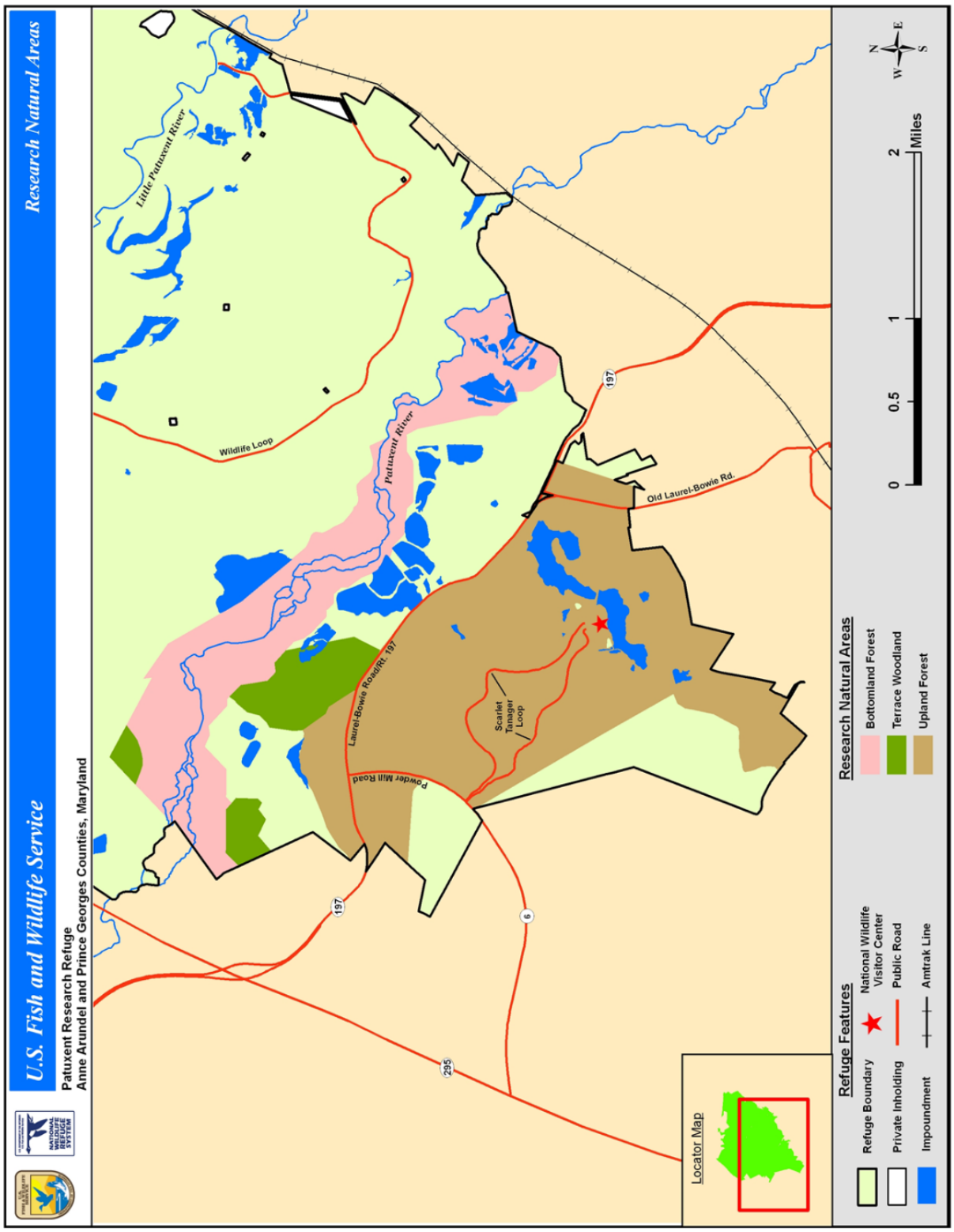
The complete list of State rare, threatened, or endangered, animal and plant species for Prince George's and Anne Arundel Counties, compiled by the Maryland Wildlife and Heritage Service in 2010 can be found on the Maryland Department of Natural Resources (MD DNR) Web site at: *http://www.dnr.state.md.us/wildlife/Plants_Wildlife/espaa.asp*;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

3.6 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 3-5).

Map 3-5. Research Natural Areas of Patuxent Research Refuge



3.7 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 (*http://www.mnha.net/*). 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 3-6). 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).

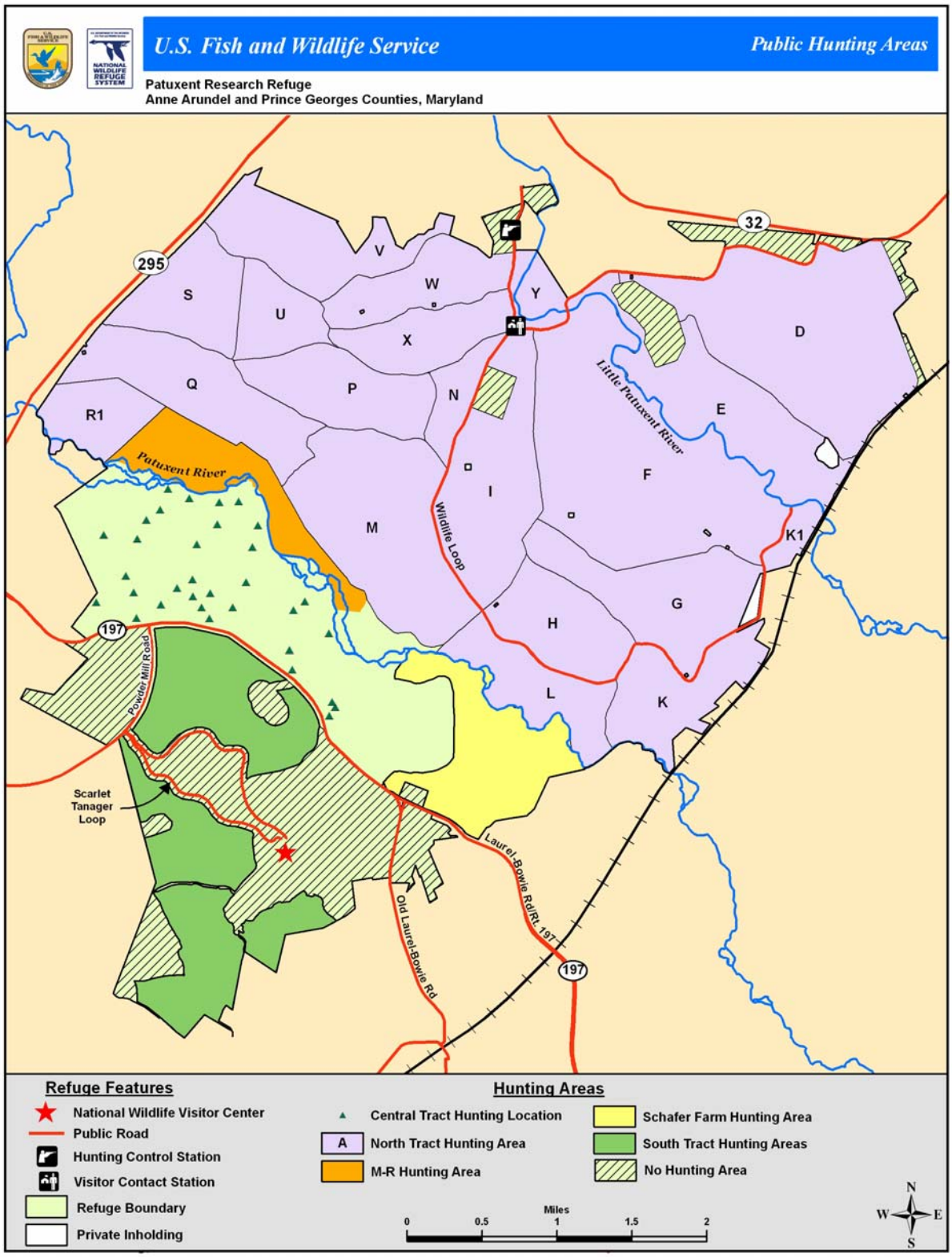
Hunting Opportunities by Refuge Tract

A variety of hunting opportunities are offered on each tract of the refuge (table 3-6). 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 3-6. 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 3-6. 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

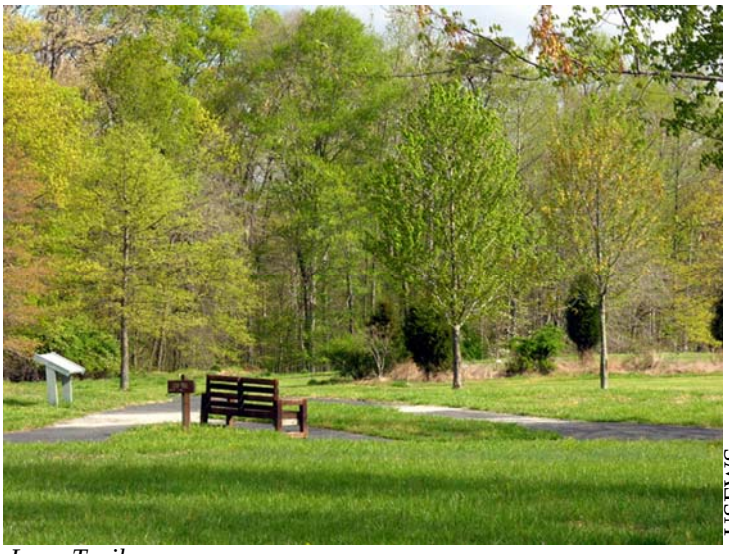
The North Tract offers year-round recreational fishing during the tract's hours of operation. Boats are prohibited on the North Tract. Universally accessible fishing is offered at Lake Allen, New Marsh, and the south side of Bailey Bridge.

- 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 3-7 and 3-8). 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.

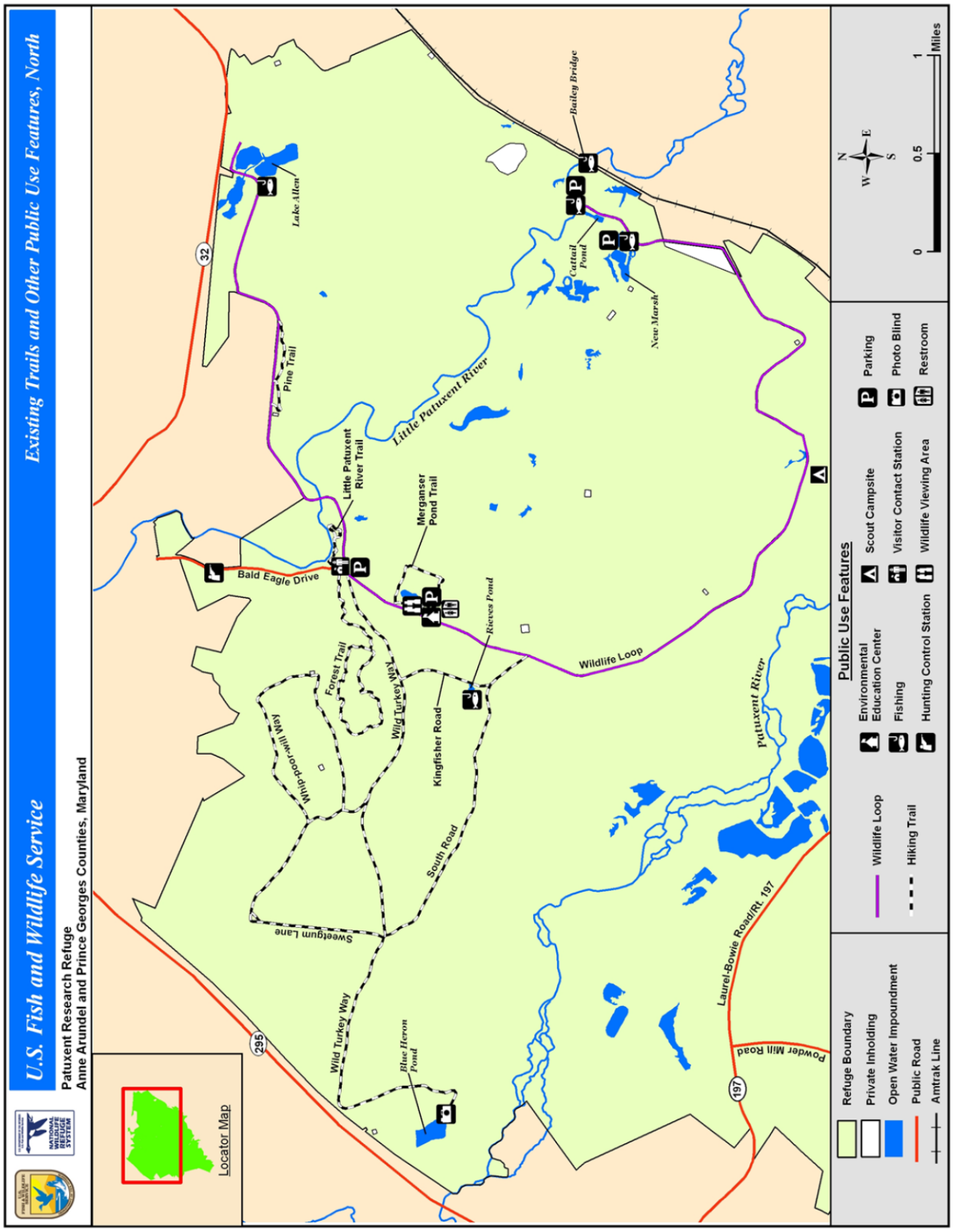
- Pine Trail (.75 miles) provides wildlife-viewing opportunities for hikers, cross-country skiers, and horseback riders. The trail links Wildlife Loop with the St. Peter's Church Cemetery.

- 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.

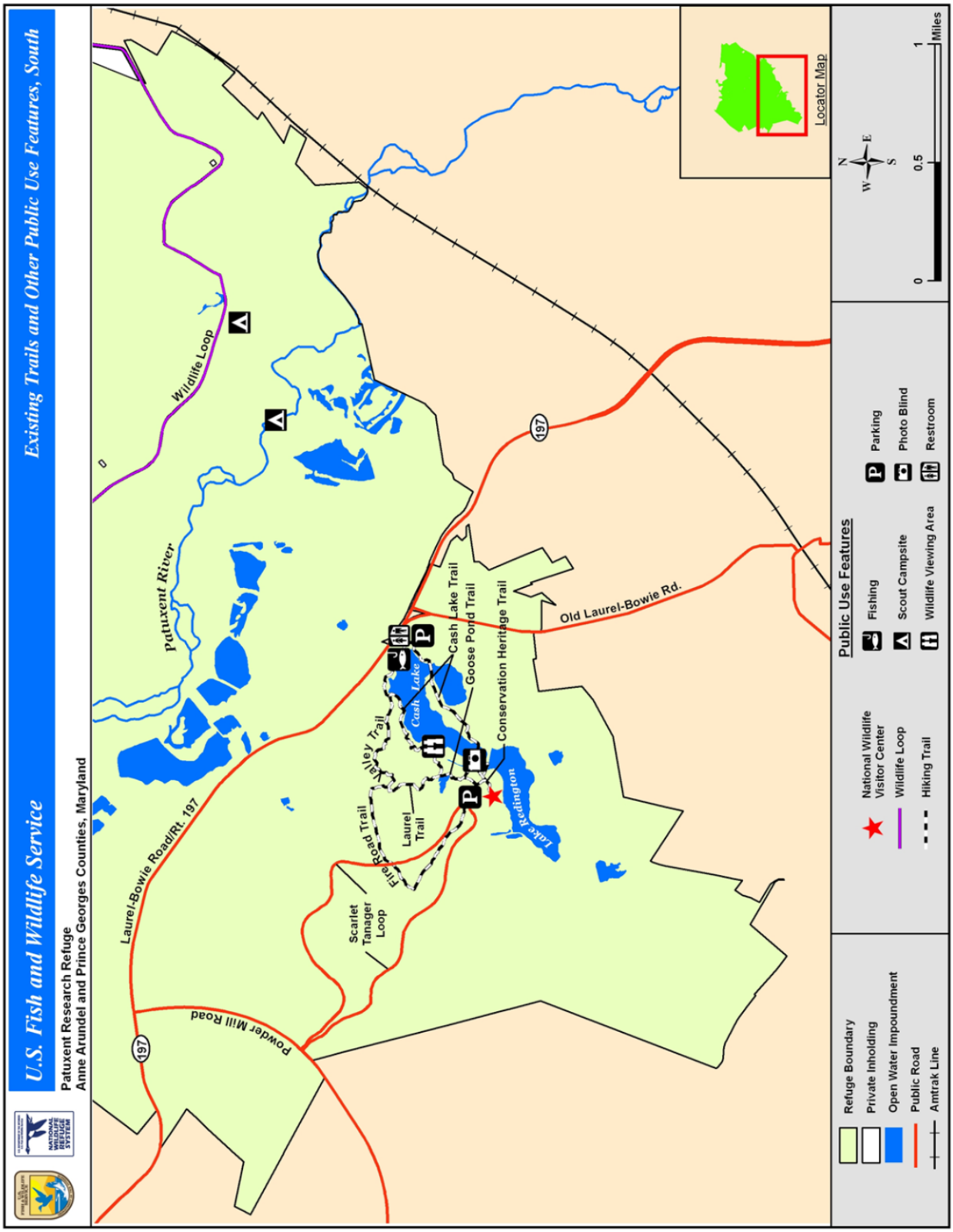
South Tract Trails and Wildlife-viewing Blinds

- 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 3-7. Existing Public Use Opportunities, North



Map 3-8. 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 4, 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 3-7 shows the number of visitors that participated in specific refuge public use activities from 2006 to 2009.

Table 3-7. Visitation for Refuge Public Use Activities Fiscal Years 2007 to 2009

Public Use Activity	Number of Visitors		
	FY 2007	FY 2008	FY 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		
	FY 2007	FY 2008	FY 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
Softball 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**

3.8 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 containing 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.

Snowden Hall - USFWS

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.

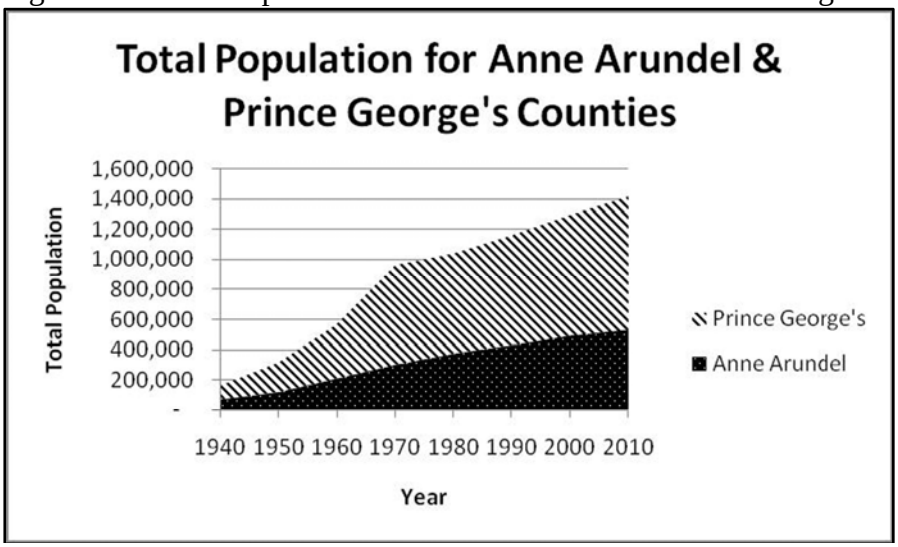
Four of the ten cemeteries were part of the former Fort Meade lands transferred to the refuge in 1991 and 1992. These are the John Penn Cemetery, and three others that are unknown/unmarked. The refuge performs minimal custodial work at the John Penn site.

3.9 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 3-3 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 3-3. 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 3-8, 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 3-8. 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 3-9).

Table 3-9. 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 3-10).

Table 3-10. 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 3-11 shows staffing and funding levels from 2007 to 2011.

Table 3-11. 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.

3.10 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.
- Baltimore-Washington Partners for Forest Stewardship annual forest workshop
- 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

3.11 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 in construction needs, 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 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 4.

USFWS

Ailanthus Webworm Moth

Management Direction and Implementation

4.1 Introduction

This chapter begins with a description of the process we used to formulate the management direction for Patuxent Research Refuge. Next, we present the management direction for the refuge, including the goals, objectives, and strategies for managing the refuge. The array of management action described here are those that, in our professional judgment, will best achieve the refuge's purposes, vision, and goals, and best respond to public issues. Unless otherwise noted, refuge staff will implement all actions.

4.2 Formulating the Management Direction

Relating Goals, Objectives, and Strategies
The management direction we describe in this chapter includes a set of refuge goals, objectives to achieve those goals, and a series of strategies to implement them.

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.

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 this chapter will guide the future development of refuge step-down plans.

Strategies are the specific or combined actions, tools, or techniques we may use to achieve the objectives. The list of strategies under 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 Management Alternatives
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 was 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, and 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 the rationales for each of the objectives. By identifying the resources of concern, we were able to develop the three management alternatives (A, B, and C) that were presented and analyzed in the draft CCP/EA. We chose alternative B as the management direction for the refuge since we believe it combined the actions that would most effectively achieve the refuge purposes, vision, and goals, and respond to public issues. It is presented in this chapter as the management direction that the refuge will implement over the next 15 years.

4.3 General Refuge Management

There are some actions we will take in managing the refuge over the next 15 years that 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 necessarily require public review, but that we want to highlight in this public document.

All of the following actions, which we discuss in more detail below, are current practices or policies that will continue:

- 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.

- Manage firing ranges.
- Manage impoundments.

Steve Noyes

Valley Trail

Biological and Ecological Research and Investigations

In establishing the refuge in 1936, EO 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 3, we have allowed many research projects that meet these criteria. We expect additional opportunities to arise under this 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 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

We 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 will 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 (LPP) 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, and acquire conservation easements and 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.

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.

Managing Invasive Species

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 (bacterial leaf scorch, 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 former military training grounds (North Tract's 8,100 acres/3,278 hectares) transferred 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, 19 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. Fort Meade manages these cemeteries and 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 10 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 completed a 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 3 for more information.

In July 2011, a MOA was signed between the Service, USGS, and the 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.

We will evaluate the potential for our management activities to impact archaeological and historical resources, 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. 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 the appropriateness and compatibility determinations consistent with implementing the management direction described in this chapter. These activities were 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.

The refuge will 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 will be pursued under the management direction, but the refuge will 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.

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
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

management control of 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 a memo with a statement that ongoing uses by other Federal agencies were compatible with ongoing and proposed research at the PWRC. Since this statement addressed only research, we have never made a determination regarding the consistency or compatibility of any of the federal uses with the wildlife conservation purposes of the refuge.

In the time since the initial statement was made, the process for conducting compatibility determinations has changed. The statement of consistency referenced above did not include any analysis, is out of date, requires site investigations, and public input to comply with existing Service policy regarding compatibility determinations. The compatibility policy requires that we assess the impacts of the use on refuge resources, analyze our ability to manage the use, determine impacts to the refuge purpose, and consider impacts to wildlife dependent public uses. Some of the concerns that we have involve the size of the impact zone and required closure of the area to other users, lead deposition and contamination, disturbance to wildlife, and impacts to research projects.

The shooting ranges are maintained for use by FWS officers; in addition use by other agencies is managed by the National Security Agency (NSA), through a special use permit issued by the refuge. At the time the land was transferred to the Service, there were a variety of agencies using the ranges. Records from 2000 through 2012 vary from year to year, at approximately 18,000 to 25,000 users annually, with the exception of 2009 where usage spiked to 27,000 users. However the overall trend demonstrates that usage has increased over time. Users include non-federal law enforcement agencies, and four civilian shooting clubs that were using the ranges at the time of the transfer. In addition, the U.S. Secret Service uses a 1,000 yard range under a separate special use permit, and is responsible for day-to-day maintenance of range facilities. The trap and skeet range that was in use at the time of the transfer was closed in the late nineties because of lead contamination and impacts to migratory birds. The refuge performs limited road maintenance within the range area for cemetery and wildlife survey access. There are multiple issues with the ranges, especially the impact zones, 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.

Since the transfer of the North Tract to the Service, we have been issuing special use permits that are renewed on a 5-year interval. Beginning in 2013, we will begin issuing the permits on a 2-year interval with the intent of completing a compatibility determination for non-Service use of the shooting ranges, including any necessary stipulations to maintain compatibility within 5 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.

As of June of 2013, an initial contaminant study was conducted, and the analysis of that study is currently pending. Due to the expansive area of the ranges, and the complexity of determining the extent of lead contamination from 100 years of use, in addition to expense, an attempt was made to select one priority range and focus efforts on that range. For the 2013 study, Range 8 was selected because it was identified as a "lead ammo" range and because of its heavy usage. The purpose of the study is to estimate the extent of lead contamination, potential risks from spent lead ammo and lead in soil and the aquatic habitats, and to recommend ways to reduce the risk at this site (e.g. BMPs, range improvements, consolidation/closure of ranges, cleanup options, etc.).

To begin analyzing potential lead contamination impacts Ecological Services obtained $47,000, which was primarily funded through the DOI Central Hazmat Fund. The projected study cost for 2014 is $71,425 for additional analysis. This projected cost will support the study of lead contamination at Range 1, which is of particular concern because of its location and the position of the targets. The targets "pop-up" above the berm and spent round goes through the target and continues its trajectory into the area behind the berm which includes Lake Allen, a favorite fishing area on the refuge. However, there is also ample evidence that the berm supporting the target captures spent rounds as well. The refuge will continue to seek funding from the Federal agencies using the range to support required contaminant studies.

The refuge has worked with the 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; such as public use restrictions, research limitations, and lead and contaminant accumulation An example of a public use issue is demonstrated with Lake Allen. Lake Allen is a prime fishing area situated in the impact zone of the ranges so it is not available for public use at least 80% of the year due to range use. 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 employee softball leagues, comprised of 36 teams, that occur from April through August. We have never issued a compatibility determination for the softball fields, but have previously issued a special use permit to the NSA for the leagues. 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. We recognize that it will not be easy to relocate the league and find facilities that will accommodate the number of teams that the league supports. We will allow the league to use the fields through the 2016 season. After the 2016 league season, we will require the NSA to relocate the fields, remove the associated infrastructure and restore the land 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 3 presents our levels of staffing, operating, and maintenance funds for the refuge over the last 5 years.

Permanent Staffing and Operational Budgets

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 established in the CCP. In 2007, our Regional Directorate completed the "Strategic Workforce Plan for the National Wildlife Refuge System in Region 5" (Phase 2; January 16, 2007) to support a new base budget approach. Its goal is a maximum of 75 percent of a refuge station budget to cover salaries and fixed costs, while the remaining 25 percent or more would be operating and maintenance funds. Our strategy is to improve the capability of each refuge manager to do the highest priority work, and not to have most of a refuge budget tied up in inflexible fixed costs. This strategy was successful for a few fiscal years; however, we now anticipate a level or declining budget environment, which will impact flexibility in managing financial resources and may have implications for the level of permanent staffing. A new round of workforce planning began in 2013 in response to the sequester and anticipated future budget reductions.

Within the constraints or opportunities of our budget and in conformance with future workforce plans, we would seek to fill any currently approved but vacant positions. In the event that the Refuge System budget increases in the future, 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. 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's 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 3).

The refuge will continue to 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). The refuge will strive to update and modify the Wisdom of Wildness exhibits, and to construct additional space for environmental education and interpretation classes and storage on South Tract.

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 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. Safety and maintenance requirements for paved roads may differ from unpaved road. Paved roads should be maintained at widths that ensure safe passage for vehicles at posted speeds. Roadside vegetation management should facilitate water flow from road surface to drainage facilities where they exist, and protect paved surfaces from tree root damage. Trees should not impinge upon drainage ditches or culvert flow.

To minimize forest fragmentation from roads, unpaved road widths should be maintained at no more than 30 feet in deep forest (widths greater than this cause fragmentation) (MD DNR 1999) and should not be daylighted, graveled, or paved.

The activities at the refuge and PWRC require state-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 program 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 sustainable building design (Dyrland et al. 2009).

Hours of Operation

The refuge will 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). When feasible, South Tract trails and grounds will operate from dawn to dusk. The refuge will continue to allow scientific, education, and agency partners to use conference facilities for information exchange.

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.

Managing Firing Ranges

We have identified specific actions that will improve management of the firing ranges in order to protect the health of wildlife and the safety of users:

- 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 to 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 permits to 2-year special use permits. 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).

Managing Impoundments

Patuxent Research Refuge currently has over 500 acres of impoundments, some of which are pseudo-impoundments (i.e., water bodies unintentionally created by other activities that affect flow, yet lack structures for manipulating water levels). A number of these impoundments, particularly on Central Tract, straddle feeder streams making their way through floodplain forest toward the Patuxent River.

The Central Tract impoundments were originally created decades ago for research on impoundment management techniques for waterfowl and shorebirds, but research of this type has not occurred for years. The management and maintenance of these aging impoundments has been a challenge to budgets and staff, and questions have been raised about their relative contribution to breeding or wintering waterbirds, as they lie outside of the core Atlantic Flyway, versus their potential to contribute to forest ecosystems, particularly floodplain forest, and to the health of the Patuxent River and the Chesapeake Bay. Refuge staff, along with partners within the Service, MD DNR, and PWRC, examined the management of impoundments across the refuge and through a Structured Decision Making (SDM) process, to obtain informed guidance on the future management of these impoundments.

The SDM process evaluated and provided scores or rankings for the costs and benefits to wildlife and the environment for each impoundment under different scenarios, such as: continuing to manage as is (dynamic or static levels), restoring to either natural hydrology, or converting to green-tree reservoir. The process generated portfolios listing the impoundments' the total maximum benefit scores. Generally, portfolios which contained the most conversions to green-tree reservoir or floodplain forest and swamp

scored highest in wildlife value and benefits. One of the benefits included in the process was reduction in forest fragmentation. None of the portfolios, including the final chosen portfolio, resulted in actual loss of wetlands, just changes in wetland types.

Some wetlands were deliberately excluded from the SDM process because of the cost of deconstruction, their value to the refuge for visitor services for recreation or education, their value to the scientific community for future research, or because they were naturally occurring, pseudo-impoundments. Most gravel pits were eliminated from the SDM process as they would require an extensive permit process, filling and land alterations, and associated costs. They would also incur considerable collateral damage from equipment access. However, to ascertain that the costs of retaining the gravel pits would truly be greater than the gain in resource benefit, and to compare the cost and benefit analysis of gravel pits against other impoundment types, we ran the SDM model for the three gravel pits of the Gravel Pit Pond series which are of varying sizes. Impoundments such as Cash Lake and Lake Allen, were not considered in the SDM process because they serve too important a role in our support of the priority public uses. Naturally occurring wetlands, such as Shangri-la or other ox-bows found on the North Tract and most pseudo-impounded wetlands (created by beaver dams, or unintentional result of a road or some alteration to flow, yet have no means of manipulating the water level), were also excluded from the SDM process. The SDM process is described in greater detail in Appendix G. Appendix J contains the master list of impoundments and wetlands throughout the refuge, and includes acreage figures, and habitat descriptions for each. The SDM process resulted in 14 impoundments listed for either restoration to natural hydrology or conversion to green-tree reservoir. Their total acreage is approximately 197 acres (89.5 hectares). Most of that acreage is open water (about 125 acres), but nearly 42 acres of emergent wetlands and nearly 30 acres of floodplain shrub wetlands within the impoundment boundaries will be affected or potentially converted to floodplain forest-swamp or depressional forest wetland types. We anticipate that there may also be gains in emergent, shrub wetlands, or floodplain forest and swamp where low lying areas surrounding the impoundments experience new hydrological regimes. Table 4-1 below displays the 14 impoundments and wetlands that were finally selected for restoration or conversion, their individual acreages, the habitat types we anticipate they will transition to, and the method used. Most impoundments already have a water control structure, which allows for manipulation, but a few are pseudo-impoundments.

For any restoration or amendment, we will acquire necessary approvals and permits and consult with appropriate agencies or partners before beginning work to alter impoundments (such as analyzing residual legacy soils for some impoundments). The goal of restoration or impoundment amendment is to change the type of wetland found in the impoundment’s footprint, and will not result in an overall loss of wetlands (e.g., emergent wetland to forested wetland). A variety of management techniques may be utilized to convert impoundments, depending on immediate and neighboring site conditions. Management techniques used to accomplish impoundment conversion might include opening water control structures, replacing culverts, or installing agri-drains to aid in restoring natural hydrologic condition.

Table 4-1 Impoundments and Wetlands Being Conserved or Restored – Methods and Resulting Habitat Types

Impoundment Name	Current Acreage	Acreage of Projected Habitat Type	Method Used To Achieve Projected Habitat Type
Baileys Bridge			
Floodplain Forest and Swamp		0.73	Open WCS* permanently to achieve natural hydrology
Open Water	0.73		
Blue Gill			
Deciduous Pine and Mixed Forest		1.42	Open WCS permanently to achieve natural hydrology
Open Water	1.42		
Duvall 1			
Floodplain Forest and Swamp		14.98	Install agridrain to convert to GTR**
Open Water	14.98		
Duvall 2			
Floodplain Forest and Swamp	1	7.68	Install agridrain to convert to GTR
Floodplain Shrub Wetland	0.25		
Open Water	6.43		
Goose			
Deciduous, Pine and Mixed Forest		1.24	Install agridrain to achieve natural hydrology
Open Water	1.24		
Hance 1			
Floodplain Forest and Swamp		7.45	Open WCS permanently to achieve natural hydrology
Floodplain Shrub Wetland	2.74		
Open Water	4.72		
Hance 2			
Floodplain Forest and Swamp		6.22	Open WCS permanently to achieve natural hydrology
Emergent Wetland	1.54		
Floodplain Shrub Wetland	1.48		
Open Water	3.2		
Harding Spring			
Depressional Forest Wetland		1.71	Install agridrain to achieve natural hydrology
Open Water	1.71		
Hobbs			
Floodplain Forest and Swamp		10.79	Install agridrain to convert to GTR

Impoundment Name	Current Acreage	Acreage of Projected Habitat Type	Method Used To Achieve Projected Habitat Type
Open Water	10.79		
Knowles 1			
Floodplain Forest and Swamp		43.15	Open WCS permanently to convert to GTR
Floodplain Shrub Wetland	4.19		
Open Water	38.96		
Knowles 2			
Floodplain Forest and Swamp	0.21	19.28	Open WCS permanently to convert to GTR
Floodplain Shrub Wetland	7.25		
Open Water	11.82		
Knowles 3			
Floodplain Forest and Swamp	1.72	15.83	Open WCS permanently to convert to GTR
Floodplain Shrub Wetland	6.54		
Open Water	7.57		
Millrace			
Floodplain Forest and Swamp		57.65	Install agridrain to convert to GTR
Emergent Wetland	38.44		
Floodplain Shrub Wetland	7.38		
Open Water	11.83		
Snowden			
Depressional Forest Wetland		8.25	Open WCS permanently to convert to GTR
Open Water	8.25		
Total Acres	**196.37**		

**represents Water Control Structure*
***represents Green Tree Reservoir*

4.4 Refuge Management Goals, Objectives, and Strategies

The management direction chosen for the refuge 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, we will enhance our present visitor services programs in a manner that addresses the national and regional Service policies and the mandates of the refuge. We strive to strike a balance between wildlife-dependent and non-wildlife-dependent uses found to be compatible on the refuge.

Habitat Management
Habitat management will expand forested areas throughout the refuge. This includes a gain of approximately 275 acres in additional floodplain forest derived from restoring or converting 14 impoundments to the natural hydrology or green tree reservoirs; or from managed grassland or scrub-shrub habitat that will be allowed to revert to floodplain forest. Upland forest will also increase by about 190 acres by allowing a number of small patches of grasslands throughout the refuge to revert to forest.

We will reduce the amount of managed grassland habitat by about 263 acres, resulting in approximately 255 acres of high quality habitats with respect to configuration, context, and avoidance of forest fragmentation. Grasslands of suitable size, configuration, and context (approximately 50 acres, block shapes, closer to other open lands) for obligate grassland nesting birds and open-field generalist will be provided. Reforesting impoundments and grassland areas will benefit forest interior dwelling species by increasing the acreage of interior, contiguous forest surrounded by highly urbanized areas. It will also improve water quality as related to the Patuxent and Little Patuxent Rivers, and ultimately the Chesapeake Bay watershed.

An oak-pine savannah of about 132 acres, indicated by soil type and an assemblage of rare fauna, will be maintained to promote this rare, native habitat type and support species such as the darkling beetle, tiger beetle, native bees and other pollinators. Impoundments that support fishing or important amphibian breeding areas will also be maintained. Habitat types and management are displayed in map 4-1.

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

USFWS

We will 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 and for more current baseline data. Through these endeavors we will 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

We will strive to increase wildlife-dependent public use opportunities and allow for appropriate, compatible non-wildlife-dependent uses (maps 4-2 and 4-3). We will promote high-quality hunting and fishing programs through improved habitat management strategies. In addition, we will expand wildlife observation, viewing, and photography opportunities and initiate new interpretive programs and environmental education opportunities both on and offsite.

Refuge Administration

We will 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 will need to exist.

Goals, Objectives, and Strategies

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. See Table 4-2 for a list of surveys and inventories necessary to evaluate the success of management strategies for priority biological objectives.

Strategies

- Develop and implement an inventory and monitoring plan for the refuge.

Monitoring Elements

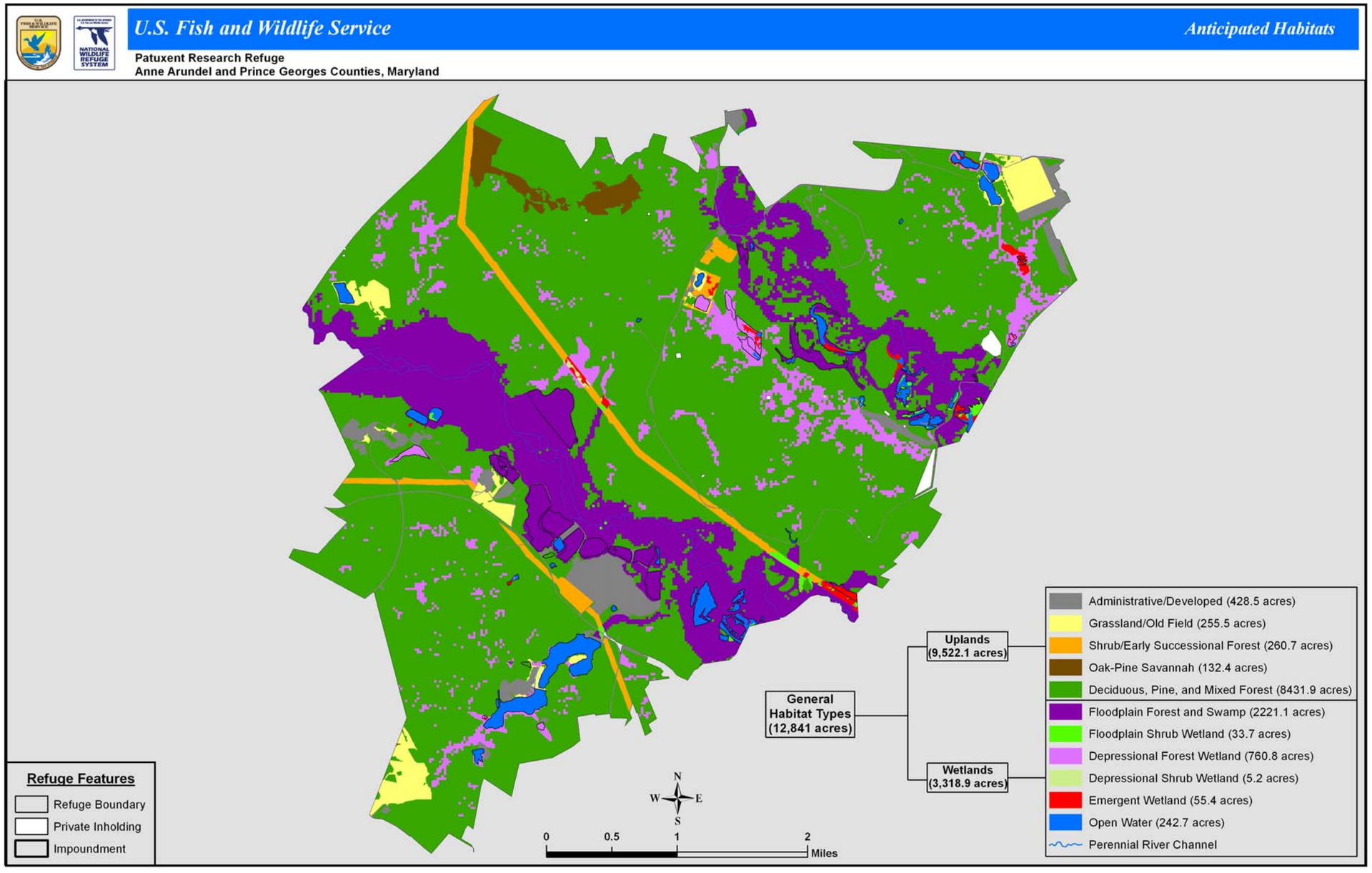
- Track the number of inventory and monitoring surveys conducted annually.
- Update the inventory and monitoring plan as additional resources of concern may be identified.

Rationale

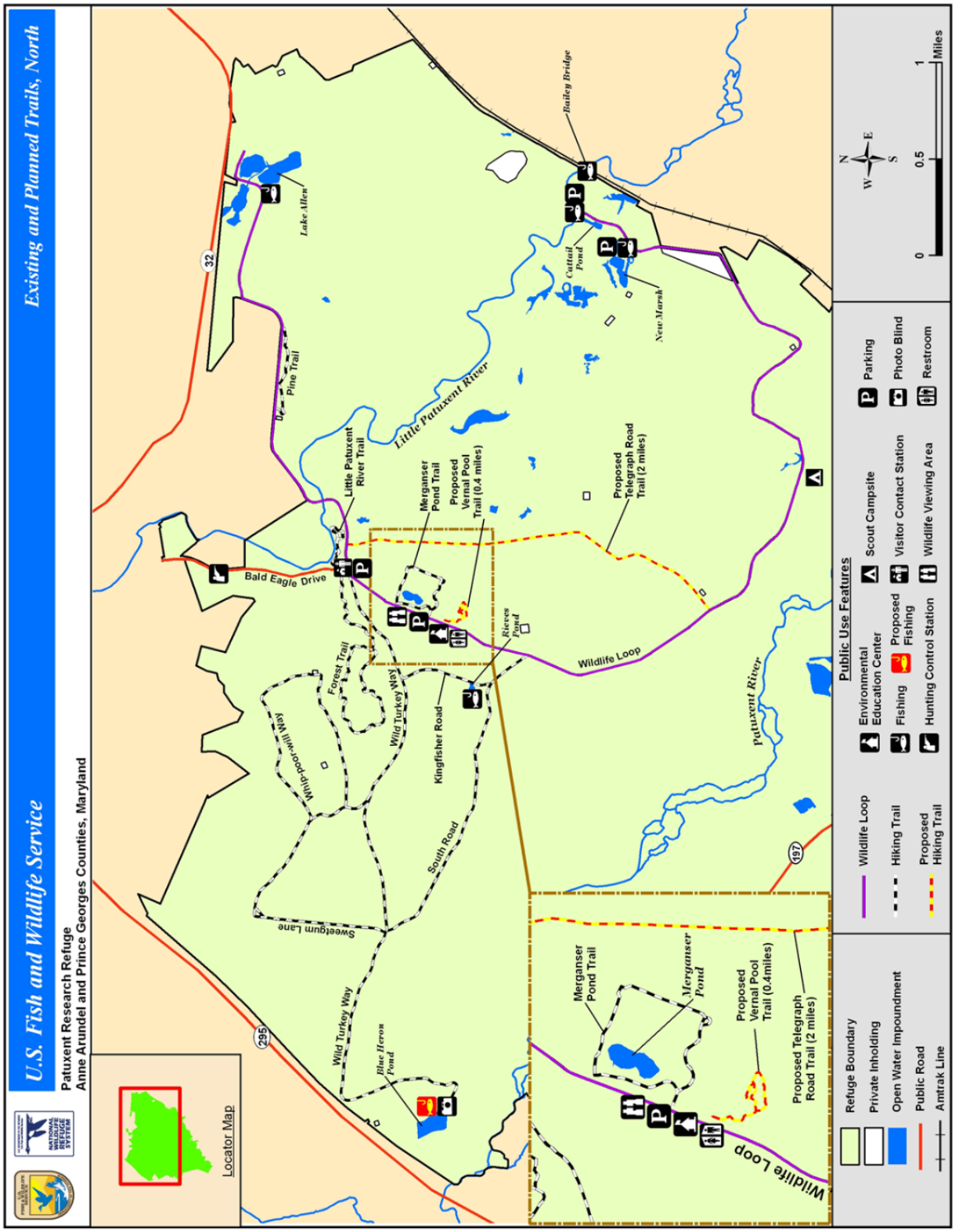
Inventorying and monitoring of refuge resources will allow us to know if key wildlife and habitat objectives are being met. Data derived from inventory and monitoring efforts will be used to assess past management actions and potentially drive management actions to be taken in both the short and the 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.

Map 4-1. Anticipated Habitat Types and Management



Map 4-2. Planned Public Use, North


U.S. Fish and Wildlife Service
Existing and Planned Trails, North
Patuxent Research Refuge
Anne Arundel and Prince Georges Counties, Maryland
Locator Map
Lake Allen
Bailey Bridge
Cattail Pond
New Marsh
Little Patuxent River
Pine Trail
Little Patuxent River Trail
Merganser Pond Trail
Proposed Vernal Pool Trail (0.4 miles)
Proposed Telegraph Road Trail (2 miles)
Bald Eagle Drive
Rieves Pond
Forest Trail
Wild Turkey Way
Kingfisher Road
Wildlife Loop
Patuxent River
Whippoorwill Way
Sweetgum Lane
South Road
Blue Heron Pond
Merganser Pond
Proposed Telegraph Road Trail (2 miles)
32
295
197
Refuge Boundary
Private Inholding
Open Water Impoundment
Public Road
Amtrak Line
Public Use Features
Wildlife Loop
Hiking Trail
Proposed Hiking Trail
Environmental Education Center
Fishing
Hunting Control Station
Scout Campsite
Proposed Fishing
Visitor Contact Station
Wildlife Viewing Area
Parking
Photo Blind
Restroom
N
W
E
S
0
0.5
1
Miles

Map 4-3. Planned Public Use, South

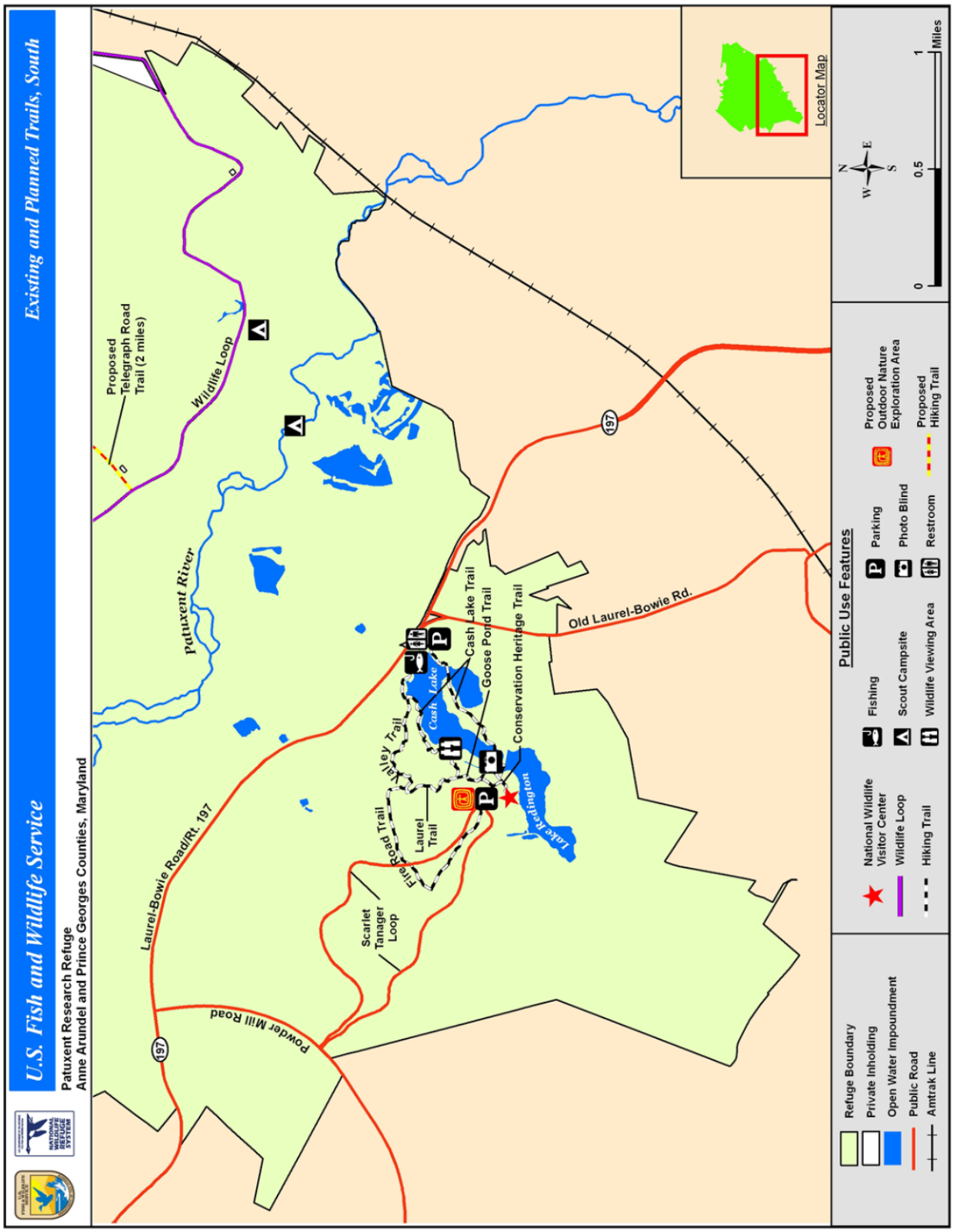

U.S. Fish and Wildlife Service
Existing and Planned Trails, South
Patuxent Research Refuge
Anne Arundel and Prince Georges Counties, Maryland
Proposed Telegraph Road Trail (2 miles)
Wildlife Loop
Patuxent River
Laurel-Bowie Road/Rt. 197
Powder Mill Road
Scarlet Tanager Loop
Fivemile Road Trail
Laurel Trail
Valley Trail
Cash Lake
Cash Lake Trail
Goose Pond Trail
Conservation Heritage Trail
Lake Redington
Old Laurel-Bowie Rd.
197
Locator Map
Public Use Features
Refuge Boundary
Private Inholding
Open Water Impoundment
Public Road
Amtrak Line
National Wildlife Visitor Center
Wildlife Loop
Hiking Trail
Fishing
Scout Campsite
Wildlife Viewing Area
Parking
Photo Blind
Restroom
Proposed Outdoor Nature Exploration Area
Proposed Hiking Trail
N
W
E
S
0
0.5
1
Miles

Table 4-2 List of Surveys and Inventories Necessary to Evaluate Success of Management Strategies for Priority Biological Objectives

		Obj. 2.1 Floodplain Forest	**Obj. 2.2 Upland Mixed Forest**	**Obj. 2.3 Oak-Pine Savannah**	**Obj. 3.1 Coastal Plain River/ Stream**	**Obj. 3.2 Impoundment Wetlands**	**Obj. 3.3 Non-Impounded Wetlands**	**Obj. 4.1 Shrub-Early Succession Forest**	**Obj. 4.2 Grassland/ Old Fields**
1	Timber cruise for forest health and diseases, age structure, species composition	X	X	X					
2	Invasive species mapping, control and monitoring	X	X	X	X	X	X	X	X
3	Rare plant community inventory	X	X	X			X	X	X
4	Stream physical and biological condition assessment and remediation	X	X		X				
5	Acoustical bat survey; roosting bat survey	X	X	X	X	X	X		X
6	Amphibian monitoring	X	X	X		X	X		
7	Priority birds survey by habitat and season	X	X	X		X	X	X	X
8	Box turtle population survey	X	X						
9	Native pollinator (bee, lepidopteran, beetle) survey		X	X					X
10	Passage and presence of priority fish, other priority aquatic species				X				
11	Percent canopy of oak, pine, grassland (response to fire/mechanical treatments for restoration)			X					X
12	Conversion to natural hydrology, greentree reservoir, functionality & capacity					X			
13	Deer population survey	X	X	X				X	

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).
- Continue to provide a secure land base for captive animal colonies, endangered species propagation, contaminant studies, etc.
- 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 threats to the 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 ranavirus chytrid fungus impacts on wood frog populations.
- 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:

- Conduct feasibility study and options and identify sections 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).

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 practicable, 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 the biological integrity of the current 2,018 acres (917.4 hectares) of native floodplain forest and shrub and 757.8 acres (344 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. We will also promote natural succession to floodplain forest and related communities of potentially 275 additional acres (125 hectares). 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.

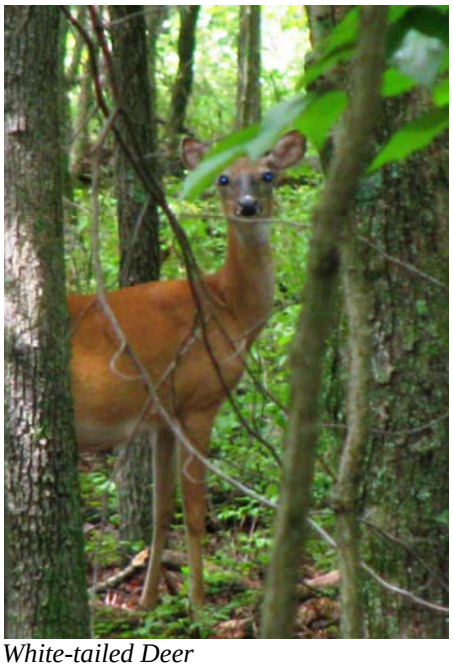
Strategies

- Restore the natural hydrology or convert to green-tree reservoir 14 impoundments: Bluegill, Duvall 1 and 2; Goose Pond; Hance 1 and 2; Harding Spring Pond; Hobbs; Knowles 1, 2, and 3; Millrace; Snowden; and Baileys Bridge Marsh. We project that the open water, emergent, shrub wetlands portions of these impoundments will provide most of the approximately 197 acres additional acreage for floodplain forest and swamp or depressional forest swamp. Another 72-80 acres lying just outside some of the impoundments are also expected to become floodplain forest or shrub. See Table 4-1 for more details on acreages, landcover types and actions considered for each impoundment.
- 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.
- 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.
- 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, 500 acres or more (202 hectares) when 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. 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.
- 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.

- To minimize forest fragmentation, constrain road widths to the minimum needed for vehicle passage, avoid "daylighting," graveling, and paving where possible.
- 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, and ability to regenerate.
- Support ongoing big-tree surveys, native plant surveys, and plant mapping on the refuge.
- Protect areas containing rare native plant communities.

Monitoring Elements

- 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.
- 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. Adjust harvest rates as needed.
- 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 ranavirus, and enact measurements to prevent spread 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

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 type 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.

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 the biological integrity of the current 8,242 acres (3,335 hectares) of native, mature upland forest communities with 80 percent closed canopy and less than 10 percent invasive species. Expand upland forest acres by about 190 acres (86.3 hectares) to increase forest interior and reduce fragmentation. Upland forest should contain a diverse age structure and well-developed understory and midstory to provide breeding, migration, and 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 bats, wood frog, forest salamanders, 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.
- Maximize forest interior (forested areas which are greater than 300 feet or 91 meters, from the forest edge) by connecting fragmented tracts and small openings with large contiguous forested polygons. Strive for blocks as close to 500 acres (202 hectares) as possible, and in shapes that maximize forest interior habitat. Reforest through natural succession or restoration plantings.
- Allow 262 acres (119 hectares) of grasslands to undergo succession. These additional acres of upland forest would come mostly from the conversion of scattered grassy areas that were administratively managed or early successional old fields that are shrubby and too small to manage. Due to hydrology or proximity to wetlands, we anticipate that only 190 acres (86.3 hectares) will become upland mixed forest. This includes 8.5 acres gained from impoundment

restoration. Approximately 72 acres (32.7 hectares) will become wet meadow, depressional shrub 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 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.
- To minimize forest fragmentation, constrain road widths to the minimum needed for vehicle passage, avoid "daylighting," graveling, and paving where possible.
- 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, and ability to regenerate.
- Support ongoing big tree surveys and conduct native plant surveys and plant mapping on the refuge.
- Protect areas containing rare native plant communities.

Monitoring Elements

- 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.
- 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.

- 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.

- Inventory and map 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 ranavirus, and implement measures to prevent spread of fungus between vernal pools.

- Monitor for gypsy moth and other 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

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 the restoration of approximately 132 acres (60 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 to benefit rare darkling and tiger beetle species, upland chorus frog, native bees, Indian skipper (*Hesperia sassacus*) and other pollinators, and sandy barren plant communities.

Strategies

- The acres to be restored to oak-pine savannah largely comes from the NT-8 (Drop Zone), approximately 40 acres (16 hectares), and areas along Sweetgum Road in the northwest section of North Tract consisting of dense, monocultures of Virginia pine on sandy soils that have been identified as potentially rare habitat.
- Mechanically thin dense and stagnating pine stands and monocultures of sweetgum 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. Provide a permanent firebreak around restoration units to facilitate maintenance by fire.

- 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

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. In fact, these North Tract pine and oak communities associated with sandy soils may indeed be a remnant of what ecologists refer to as the pine barrens pine-oak plant community, closely related to the pitch-pine and oak barrens of New Jersey (Riordan 2006). 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, and has recently documented a list of native bee species in the adjacent powerline right of way which contains the same soils. 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 practicable, 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
Restore and protect the biological integrity of the aquatic habitats 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. Restore the 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 nephelometric turbidity units (NTU, units established by EPA to measure suspended solids), and depths less than 20 inches for glassy darter
    - Stream reaches with stable banks and substrates for triangle floater
- 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. Identify stream reaches to conduct abiotic stream quality measurements such as pH, NTU, and water depths, for sensitive anadromous species such as darters.
- 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, biodegradation, 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 assessments for physical and chemical properties (heavy metals, oxygen, turbidity, and pH) to determine suitability for passage and nursery habitat for interjurisdictional and trust fish species.

Monitoring Elements

- Conduct periodic surveys along appropriate reaches for A. lamprey, darters, triangle floater, and anadromous migratory fish such as river herring.
- 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.
- Monitor and control invasive exotic plants along streams such as lesser celandine and Japanese knotweed (*Polygonum cuspidatum*).

Rationale

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.

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 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

Continue to protect and maintain the biological integrity of approximately 353 acres (160 hectares) of impounded wetlands, while restoring approximately 197 acres (90 hectares) to floodplain forest and swamp, green tree reservoirs, or floodplain shrub wetland. Remaining impoundments will continue to benefit American black duck, wood duck, green heron, and other species of conservation concern such as least bittern, elfin skimmer, aquatic reptiles and amphibians. Anticipated gains in floodplain forest and swamp acres will benefit species described above in objective 2.1.

Strategies

- Fourteen impoundments are slated to be discontinued with management as dynamic wetlands. We will either permanently open their water control structures,

or if no water control structure exits, install agridrains, in order to permit return of natural hydrological flow or green tree reservoir management. The 14 impoundments are Millrace; Baileys Bridge Marsh; Blue Gill; Duval 1 and 2; Hance 1 and 2; Hobbs; Knowles 1, 2, and 3; Snowden Pond; Goose Pond; and Harding Spring Pond. Under this objective, 123 acres (52 hectares) of open water, and about 40 acres (18 hectares) of emergent wetlands are expected to succeed into floodplain forest or swamp, or depressional swamp. Nine impounded acres within uplands may revert to upland forest types. About 72-80 additional acres of low-lying areas adjacent to targeted impoundments are also expected to be influenced by this change in hydrology toward floodplain forest and swamp. See Table 4-1 for more details on acreages, landcover types and actions considered for each impoundment.

- Of the 197 acres that will be restored, we project that 184.7 acres will become floodplain forest-swamp, 9.96 acres will become depressional forest (from Snowden at 8.25 and Harding Spring at 1.71), and 2.65 acres will become deciduous pine and mixed forest.
- Continue managing Uhler 1, 2, Patuxent Marsh, Mallard, Green Tree Reservoir (at North Tract Wildlife Viewing Area), and Mabbott Pond as dynamic wetlands.
- Continue managing the primary public use ponds such as Cash and Redington Lake, Lake Allen, Blue Goose Pond, Merganser Pond, Rieves Pond.
- Allow natural succession, or do supplemental plantings of native trees to restore impoundments and proposed new green tree reservoirs to natural vegetation
- Install agridrains to create eight new green tree reservoirs, reduce management issues resulting from beaver debris, and to provide for needs of waterfowl, turtles, and amphibians through manipulation of the annual hydrological cycle.
- Identify problem areas, accessibility issues, and threatened plant communities or other threatened resources associated with impoundments. Widen vegetation buffers where necessary and reduce impervious surfaces near heavily impacted areas through natural establishment or plantings.
- For remaining impoundments:
    - Provide a mix of shallow water (less than 6 inches water depth) with 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; initiate draw down by June 21 when floating vegetation coverage of pond lily, water shield, and spatter dock exceeds 50 percent, then re-flood 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 existing green tree reservoirs (Patuxent Pond and Wildlife Viewing Area's Green Tree Reservoir), and future 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

- Ensure functionality and capacity of water control structures to drain impoundments and serve as conduit to natural streams and floodplain.
- Monitor for invasive wetland species such as phragmites, Japanese knotweed, and rusty crayfish.
- 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 or floodplain forest on targeted impoundments.

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 that 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 was 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.

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). See the discussion on impoundment management in the General Refuge Management section, or in appendix G.

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 (Haglan 2010), while at the same time they provide little contribution to waterfowl and waterbirds on a regional or landscape scale (see Appendix G, Patuxent Research Refuge Impoundment Structured Decision-Making Summary Report)

Objective 3.3 Unimpounded Emergent and Open Wetlands (Freshwater, Nontidal)
Maintain the biological integrity of approximately 55.5 acres (22.5 hectares) of unimpounded wetlands, primarily emergent, bog, depressional shrub, and open water types, to benefit priority wetland bird species of concern, such as American black duck and least bittern, and other species groups such as amphibians, and insect pollinators. They are characterized with such native plant species as sphagnum moss, sundew, 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*), hibiscus, alder, and magnolia.

Strategies

- Safeguard the water source for naturally occurring, unimpounded wetlands. These wetlands are not manipulated, may be naturally occurring or unintentionally created by a road, or some other alteration affecting flow, yet have otherwise stabilized into an established wetland over the decades.
- 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.

Monitoring Elements

- Monitor and control invasive wetland species, particularly those that are stand-replacing and have the potential to alter hydrology, such as phragmites, Japanese knotweed, and rusty crayfish.
- Monitor and address deficiencies in stream integrity leading to siltation, erosion which may affect water quality of wetlands.

Rationale

There are currently approximately 481 acres (128.6 hectares) of open wetland types (e.g., open water, depressional shrub wetland, emergent wetland) that have been delineated in GIS. However, only about 55 of those acres are unimpounded, naturally occurring, or otherwise unintentionally created by a road or some alteration affecting flow. These wetlands are scattered throughout the refuge along drainages and depressions. Other than removing beaver debris that may block culverts, they are not manipulated through water control structures as are the impoundments described in objective 3.2.

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/Early Succession Forest Habitat
Continue to provide up to 190 acres (86 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, totaling approximately 260 acres. There may also be up to 25 additional acres in scattered pockets and small fields throughout the refuge that will not be actively managed or will be transitional during the term of this document. 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.
- Identify suitable smaller fields (less than 25 acres) next to forest, where shrub management would be compatible and feasible. 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.

Monitoring Elements

- Monitor and control invasive plant species, over-dominance of vines and tall-stature trees.
- Promote conversion to relatively stable shrub habitat dominated by native shrubs and small-stature trees (such as dogwood, persimmon, holly). Include metrics that measure plant response to management, such as percent cover of native shrub or small tree species, vegetation height-density, and dominant species composition.
- Conduct landbird surveys to evaluate achievement of the objective for breeding and migrating shrub birds.
- Conduct surveys for forest edge species such as whip-poor-will, woodcock, and bats to evaluate contribution of edge habitat in supporting these species.
- Conduct lepidopteran, bee, and other insect surveys to evaluate contribution of native shrub 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 a significant population of whip-poor-will. 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/Old Fields
Reduce the 517 acres (209 hectares) currently managed as grassland and early succession habitat to 255 acres (103 hectares) and allow balance to revert to forest or shrub habitat. Of these 255 acres, approximately 205 acres (83 hectares) of selected fields will be managed as priority grassland habitat for 80 percent use by priority breeding 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.

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.
- 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.
- 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 will be allowed to revert to forest.
- Use prescribed fire, selective herbicide, selective mowing, and planting to set back succession, and to improve dominance of 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 woody encroachment.

USFWS

Juvenal's Duskywing

- 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.

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, native bees, and other pollinator species to determine species composition.

Rationale

Although significant grasslands occurred historically in northern Maryland and nearby Pennsylvania (Mayre 1920, Mayre 1955, MD DNR 2005a), and there is some evidence that grassland-dependent birds may actually be native to eastern United States (Askins 2000), it is unlikely that grasslands occurred to a great 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) or were scattered, long-interval occurances (Grumet 2000). It is unlikely that Native Americans maintained grassland on the refuge. When agriculture was still predominate in the local landscape, grasshopper sparrows, northern bobwhite quail, and other grassland obligate birds were regular breeders or visitors on refuge grasslands (Fallon, personal communication).

The refuge's current 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 6 mowed fields are greater than 25 acres (10 hectares), and 49 parcels are less than 5 acres. Twenty-five acres is the minimum size recommended for nesting obligate grassland birds, such as the grasshopper sparrow, an area- and configuration-sensitive species that requires parcels large enough to accommodate a nesting population with 2 to 4 acres per pair, well away from forest edges, and dominated by short stature bunch grasses with minimal shrubby invasion (Vickery 1996, Watts et al. 1997, Jones and Vickery 1999, Schroeder and Askerooth 1999, Vickery et al.1999, Watts 1999, Watts 2000). Many of the smaller fields on the refuge are linear in shape, greatly reducing their value to breeding obligate grasslands birds because of the increased edge-to-interior ratio, which is the length of the edge of a patch divided by the area of the patch (Helzer and Jelenski 1999, Bakker et al. 2002). Linear or small patches have higher edge to interior ratios, which makes the interior more accessible to predators, invasive plants, woody encroachment and thus diminishes its quality as a breeding habitat. Block or circular shapes, with less than 1,640 feet of edge per 2.5 acres provides more interior that is distant from edges (Maryland PIF1997, Watts 2000). An ideal patch of grassland would be ample enough to accommodate a buffer zone of approximately 300 feet (91 meters) around the edge and provide an effective interior for the target species' nesting territories. Vickery et al. (1999) recommends conserving patches of 250 acres or more to benefit more area sensitive species, and Watts et al. (1997) determined that patches less than 25 acres (10 hectares) are better suited for shrub-dependent birds. The small, linear grassland parcels also increase forest hard edge, reduce the value of adjacent forests to forest dwelling birds by fragmenting the forest. Small openings in proximity to forest are valuable for whip-poor-will, woodcock, bats, and box turtles, and for wintering or migrating birds and pollinators.

We used the above metrics for patch size, configuration, and minimal forest fragmentation as part of a decision tool to determine where to focus grassland management for the future. Other factors we took into consideration include the soil type (capacity for drainage) and the orientation of a field to sunlight.

Because agricultural land uses in the vicinity of the refuge have increasingly converted to development and related infrastructure or to forested habitats; grassland obligate species, such as grasshopper sparrow, that require large blocks of short-stature grasslands situated where agriculture predominates on a regional scale (mirroring the 'prairie' setting), have all but disappeared from refuge grasslands. The refuge's grassland habitat will benefit breeding species that are more tolerant of old field succession, such as field sparrow, 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.

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

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

- 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
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 on trails and at 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, mammals, and insects.

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.

USFWS

Birdwatching on the Refuge

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 will follow existing disturbed areas. Telegraph Trail will follow the former Telegraph Road and connect to Wildlife Drive. The Vernal Pool Trail, which has been closed since 2010, will be reestablished 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.

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.)
- Continue to offer interpreter-led tram tours from mid-March through mid-November, with increased hours of operation during the summer months.
- Continue to 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.
- Continue to utilize 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 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.
- Continue to offer periodic, guided tours to the Central Tract and the Whooping Crane Observatory.
- Increase the quality and diversity of interpretive monthly program opportunities by developing four to six new or revised interpretive programs every 2 years.
- Create and offer limited historical/interpretive guided tours on the Central and North Tracts.
- Promote more hands-on, physically active outdoor activities.

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.

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 to understand the role of Patuxent Research Refuge.

Strategies

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

- Continue to support Federal Junior Duck Stamp Program administered by the MD DNR.
- Offer a schoolyard habitat-related teacher workshop series in accordance with local and State education standards.
- Increase refuge staff/volunteer involvement by 10 percent over 15 years 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

- 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
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

- Continue to allow jogging on North and South Tracts.
- Continue to allow bicycling on the North Tract.
- Continue to allow cross-country skiing on North and South Tracts.
- Continue to allow hiking on North and South Tracts.
- Continue to allow dog walking with current 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 pursuant to Nationwide memoranda of agreement with those organizations.
- Continue to allow limited dog training in designated areas on the North Tract.
- Continue to allow horseback riding at the North Tract.
- Allow limited virtual and no-impact geocaching along designated trails 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

- 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 robust and diverse, quality hunting opportunities to hunters of all ages while promoting hunter and visitor safety and wildlife health, and accommodating other public use opportunities.

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 X on the North Tract to hunting every other week and allow wildlife observation and photography on Forest Trail at those times.
- 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.

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 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. 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 annually by MNHA and refuge staff, 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

- 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.
- 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

- 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.

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.

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).
- Continue to maintain quality internship program (currently 12 to 15 interns annually).
- Continue to promote organized group participation (e.g., Scout groups) for one-time volunteer projects.
- Continue to maintain coordination between PWRC, MNHA, and the refuge.

- Continue to provide volunteer award and recognition programs/events.
- 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

- 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

Continue to 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).
- 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

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

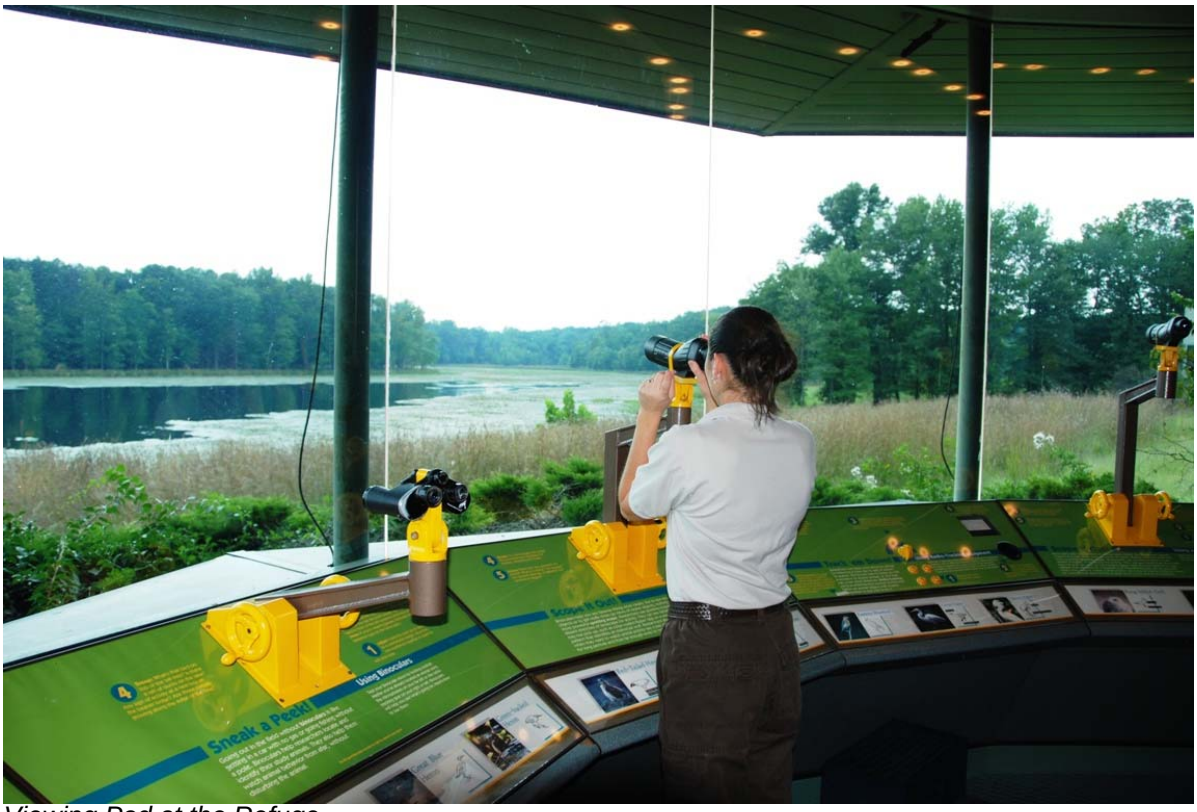
Rationale

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.

USFWS

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 CCP and how we plan to continue consulting and coordinating with others in the future. It details how we invited and encouraged 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. It also identifies who contributed in writing the plan or significantly contributed to its contents.

According to Service Policy, we must review and update our final CCP at least once every 15 years. We may update the plan sooner if we determine that we need to markedly change management direction or our Director or Regional Director deem it necessary. If so, we will once again announce our revised planning and encourage your participation.

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
January 26, 2011	Land protection	County, State, and NGO

Date	Topic	Audience
	opportunities	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

On October 10, 2012, we published a Notice of Availability in the *Federal Register* announcing the release of the draft CCP/EA for 45 days of public review and comment. We also distributed a newsletter and sent out a press release announcing the public comment period. The *Federal Register* notice, newsletter, press release, and our planning Web site also announced the two public meetings in October 2012. At the meetings we gave a short overview of the refuge and the CCP planning process, and recorded all the comments and suggestions provided at the meeting. After the end of the comment period, we compiled and considered all the public comments we received and drafted a response to each substantive comment. The responses to these comments can be found in appendix I. Based on these comments, we reviewed and revised the CCP.

We compiled the final CCP for the Regional Supervisor, Regional Chief, and Regional Solicitor's Office before submitting it to the Regional Director for review and approval. The Regional Director determined that a FONSI was appropriate, and approved the final CCP. In May 2013, we published another *Federal Register* Notice of Availability to announce the availability of the final CCP. The notice completes 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) 437-5582

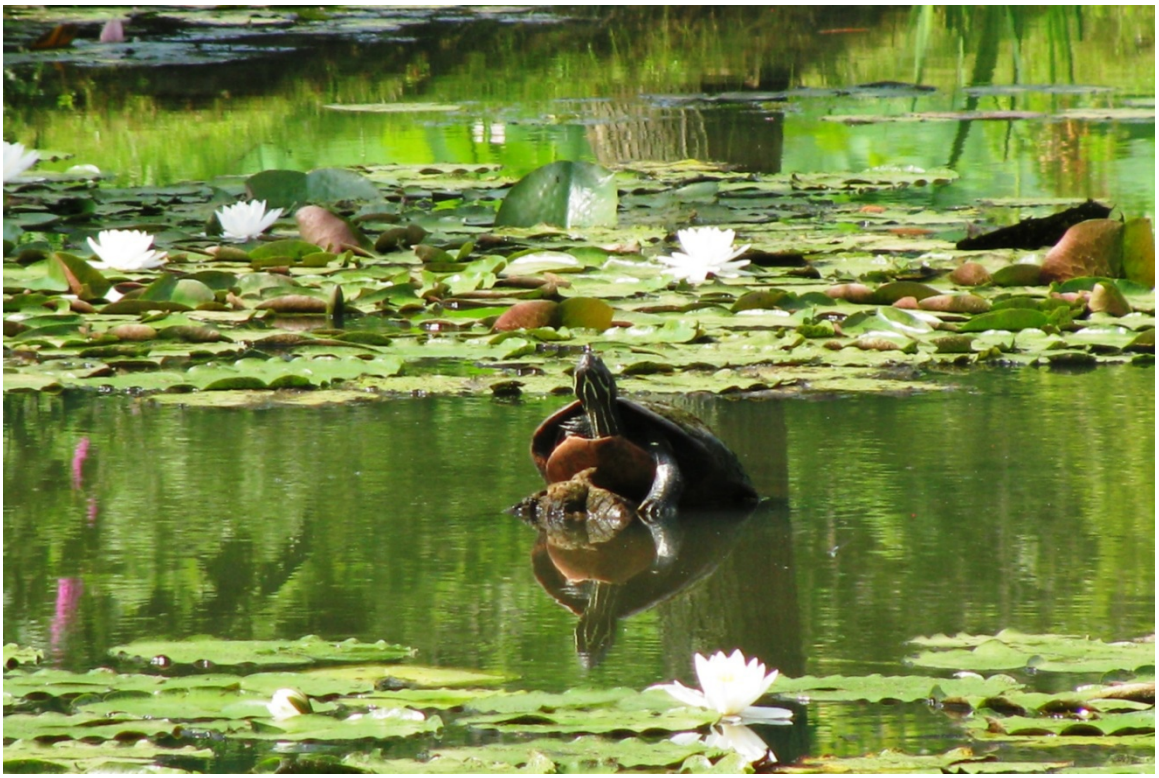
5.4 Members of the Core Planning Team

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 Walter, Engineer, Patuxent Research Refuge, USFWS
Jennifer Casey, Biologist, USFWS

Bibliography



USFWS

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.

Askins, R.A. 2000. Restoring North America's birds. Yale University Press, New Haven, CT. 332pp.

Bakker, K.K., D.E. Naugle, and K.F. Higgins. 2002. Incorporating landscape attributes into models for migratory grassland bird conservation. Conservation Biology 6: 1638-1646.

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.

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.

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.

Burk, A.O. Ph.D. University of Maryland. Personal communication. November 6, 2012.

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, VA.

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.

Davis, S.K. 2004. Area sensitivity in grassland passerines: effects of patch size, patch shape, and vegetation structure on bird abundance and occurrence in Southern Saskatchewan. The Auk 121(4): 1130-1145.

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. 598pp.

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.

Edison Electric Institute and the U.S. Fish and Wildlife Service. 2005. Avian protection plan (APP) guidelines. A joint document prepared by: Edison Electric Institute, Avian Powerline Interactive Committee, and the U.S. Fish and Wildlife Service.

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.

Fallon, J. 2011. USGS, Patuxent Wildlife Research Center. Personal communication.

Ferguson, D. 1994. Species of moths collected on the Patuxent Wildlife Research Center, season 1992. Systematic Entomology Laboratory, ARS, USDA.

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*.

Grumet, R.S. 2000. Bay, plain, and piedmont: a landscape history of the Chesapeake Heartland from 1.3 billion years ago to 2000. U.S. Dept of Interior, National Park Service, The Chesapeake Bay Heritage Context Project, Annapolis, MD. 183pp.

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*.

Helzer C.J. and Jelenski, D.E. 1999. The relative importance of patch area and perimeter-area ratio to grassland breeding birds. Ecological Applications 9:1448-1458.

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. 26pp.

James, F.C. 1971. Ordination of habitat relationships among breeding birds. Wilson Bulletin 83(3): 215-236.

Jones, A.L. and P.D. Vickery. 1999. Managing small grasslands including conservation lands, corporation headquarters, recreation fields, and small landfills for grassland birds. Grassland Conservation Program, Center for Biological Conservation. Massachusetts Audubon Society.

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., C.R. Gilbert, C.H. Hocutte, R.E. Jenkins, D.E. McAllister, and J.R. Stauffer, Jr., eds), 708pp. 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. 639pp.

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. 83pp.

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 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). 1999. Timber harvest plan guidelines. FIDS/Forestry Task Force, Chesapeake Bay Critical Area.

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 Division.

Maryland Geological Survey (MGS). 2007. Physiographic provinces of Maryland. Department of Natural Resources, Resource Assessment Service, Annapolis, MD.

Maryland Partners in Flight (MD PIF). 1997. Habitat Management Guidelines for the benefit of landbirds in Maryland. MD PIF Management Committee.

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.

McGilvrey, 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. Unpublished memo. USFWS.

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. 47pp.

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.

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. 57pp.

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. 8pp.

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. 458pp.

Richard Grubb and Associates, Inc. 2011. Archaeological 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*.

Riordan, R. 2006. Rare forest habitat discovered near Anacostia River in suburban Maryland. NatureServe article June 15, 2006. *www.natureserve.org.*

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.

Sauer, J.R., B.G. Peterjohn, S. Schwartz, and J.E. Hines. 1995. The grassland bird homepage. Version 95.0. Patuxent Wildlife Research Center, Laurel, MD. Accessed March 2013 at: *http://www.mbr-pwrc.usgs.gov/bbs/grass/grass.htm.*

Scherer, G. 2001. Backcountry visitor impacts: we have met the enemy, and he is us. American Hiker.

Schroeder, R.L. and K. Askerooth. 1999. A habitat-based approach to management of tallgrass prairies at the Tewaukon National Wildlife Refuge. Information and Technology Report USGS/BRD/ITR—2000-0001.

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. In: Management of North Central and Northeastern Forests for Nongame Birds (DeGraaf, R.M. and K.E. Evans, compilers) pp.132-153. 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. 51pp.

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.

Vickery, P.D. 1996. Grasshopper sparrow (*Ammodramus savannarum*). In: The Birds of North America, No. 239 (Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA and the American Ornithological Union, Washington, DC.

Vickery, P.D, J.R. Herkert, F.L. Knopf, J. Ruth, and C.E. Keller. 1999. Grassland birds: an overview of threats and recommended management strategies. In: Strategies for Bird Conservation: The Partners in Flight Planning Process (R. Bonney, D.N. Pashely, R. Cooiper, and L. Niles, eds.). Cornell Lab of Ornithology.

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. 31pp. Accessed August 2012 at: *http://www.aacounty.org/DPW/Watershed/PRR%20Biological%20Condtions%20Summary_final.pdf*.

Vilchek, L. 2011, 2012. USFWS. Personal communication.

Virginia Department of Game and Inland Fisheries (VDGIF). 2005. Virginia's comprehensive wildlife conservation strategy 2005. Virginia Department of Game and Inland Fisheries, Richmond, VA

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, AK. 193pp.

Watts, B.D., M.D. Wilson, and D.S. Bradshaw. 1997. Habitat requirements of early successional bird communities: management implications for Mid-Atlantic region. Center for Conservation Biology Technical Report, CCBTR-97-03. College of William and Mary, Williamsburg, VA. 62pp.

Watts, B.D. 1999. Partners in Flight Bird conservation plan for the Mid-Atlantic Coastal Plain (Physiographic Area 44), Version 1.0. American Bird Conservancy, College of William and Mary, Williamsburg, VA. 81pp.

Watts, B.D. 2000. Management of park fields to enhance natural resource value and biodiversity of Colonial National Historic Park. Center for Conservation Biology, College of William and Mary, Williamsburg, VA. 23pp.

Watts, B.D., M.D. Wilson, and D. Bradshaw. 1997. Habitat requirements of early succcessional bird communities: management implications for mid-Atlantic region. Center for Conservation Biology Technical Report, CCBTR-97-03. College of William and Mary, Williamsburg, VA. 62pp.

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 Wildlife 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*				
Silver-haired Bat	*Lasionycteris noctivagans*				

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 Flying Squirrel	*Glaucomys v. volans*				
Star-nosed Mole	*Condylura cristata nigra*				
Striped Skunk	*Mephitis mephitis nigra*				
Tri-colored 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*	G5	S3	T	
Gizzard Shad	*Dorosoma cepedianum*				
Hickory Shad	*Alosa mediocris*				
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*				

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 Hogsucker	*Hypentelium nigricans*				
River Chub	*Nocomis micropogon*				
Rosyside Dace	*Clinostomus funduloides*	G5	S5		
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*	G5	S2		
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*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Redbreast Sunfish	*Lepomis auritus*				
Shield Darter	*Percina peltata*	G5	S3		
Stripeback Darter	*Percina notogramma*	G4	S1	E	
Tessellated Darter	*Etheostoma olmstedi*				
Warmouth	*Chaenobryttus gulosus*	G5	S3?		
Yellow Perch	*Perca flavescens*				
BUTTERFLIES and MOTHS					
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 philodice₃*				
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 calanus₃*				
Brown Elfin	*Callophrys augustinus*				
Coral Hairstreak	*Satyrium titus₃*				
Eastern Pine Elfin	*Callophrys niphon*				
Eastern Tailed-Blue	*Cupido comyntas comyntas*				
Gray Hairstreak	*Strymon melinus*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Harvester	*Feniseca tarquinius*				
Henry's Elfin	*Callophrys henrici*				
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 Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Common Checkered-Skipper	*Pyrgus communis*				
Common Roadside-Skipper	*Amblyscirtes vialis*				
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*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Zabulon Skipper	*Poanes zabulon*				
Sphingidae (sphinx moths)					
Walnut Sphinx	*Amorpha juglandis*				
Pine Sphinx Moth	*Lapara coniferarum*				
Huckleberry Sphinx	*Panonis astylus*				
Small-eyed Sphinx Moth	*Paonis myops*				
Twin-spotted Sphinx Moth	*Smerinthis jamaicensis*				
Saturniidae (giant silkworm and royal moths)					
Luna Moth	*Actias luna*				
Spiny Oakworm Moth	*Anisota stigma*				
Pink-striped Oakworm Moth	*Anisota virginensis*				
Polyphemus Moth	*Antheraea polyphemus*				
Io Moth	*Automeris io*				
Rosy Maple Moth	*Dryocampa rubicunda*				
Imperial Moth	*Eacles imperialis*				
Cossidae (carpenter and leopard moths)					
Little Carpenterworm Moth	*Prionoxystus macmurtrei*				
Carpenterworm Moth	*Prionoxystus robinae*				
Amphisbatidae					
Gold-striped Leaftier	*Machimia tentoriferella*				
Black-fringed Psilocorsis Moth	*Psilocorsis cryptolechiella*				
Coleophorideae (casebearer moths)					
Acorn Moth	*Blastobasis glandulella*				
	Coleophora sp.				
Elachistidae (grass miner moths)					
	Antaeotricha osseella$_1$				
Schlaeger's Fruitworm Moth	*Antaeotricha schlaegeri*				
Gelechiidae					
Stripe-backed Moth	*Arogalea cristifasciella*				
	Chionodes fuscomaculella				
	Pseudoelphusa sp.				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
	Trypanisma prudnes$_1$				
Geometridae (geometrid moths)					
Straw Besma	*Besma endropiaria*				
Oak Besma	*Besma quercivoraria*				
Bent-line Carpet	*Costaconvexa centrostrigaria*				
Hollow-spotted Angle Moth	*Digrammia gnophosaria*				
Bad-Wing	*Dyspteris abortivaria*				
Deep Yellow Euchlaena Moth	*Euchlaena amoenaria*				
Least-marked Euchlaena	*Euchlaena irraria*				
Johnson's Euchlaena Moth	*Euchlaena johnsonaria*				
Obtuse Euchlaena Moth	*Euchlaena obtusaria*				
Common Eupithecia	*Eupithecia miserulata*				
Curve-toothed Geometer	*Eutrapela clemataria*				
Fine-lined Gray Moth	*Exelis pyrolaria*				
Blueberry Gray	*Glena cognataria*				
Dotted Gray Moth	*Glena cribrataria*				
	Gueneria similaria				
Common Spring Moth	*Heliomata cycladata*				
Three-spotted Fillip	*Heterophleps triguttaria*				
Pistachio Emerald	*Hethemia pistasciaria*				
Ferguson's Scallop Shell	*Hydria prunivorata*$_1$				
	Hypagyrtis esther$_1$				
	Hypagyrtis unipunctaria$_1$				
Umber Moth	*Hypomecis umbrosaria*				
Red-Bordered Wave Moth	*Idaea demissaria*				
Shiny Moth	*Idaea eremiata*				
Rippled Wave	*Idaea obfusaria*				
Large Purplish Gray Moth	*Iridopsis vellivolata*				
Yellow-headed Looper	*Lambdina pellucidaria*				
Drab Brown Wave Moth	*Lobocleta ossularia*				
Powdered Bigwing	*Lobophora nivigerata*				

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 Lytrosis	*Lytrosis unitaria*				
Common Angle	*Macaria aemulataria*				
Red-headed Inchworm	*Macaria bisignata*				
Hemlock Angle Moth	*Macaria granitata*				
Canadian Melanolophia	*Melanolophia canadaria*				
Signate Melanolophia Moth	*Melanolophia signataria*				
	Metarranthis angularia				
Purplish Metarranthis Moth	*Metarranthis homuraria*				
Common Metarranthis	*Metattanthis hypochraria*				
Horned Spanworm Moth	*Nematocampa resistaria*				
The Gem	*Orthonama obstipata*				
	Pero honestarius$_1$				
Half-Wing	*Phigalia titea*				
Hollow-spotted Plagodis Moth	*Plagodis alcoolaria*				
Alien Probole Moth	*Probole alienaria*				
Large Maple Spanworm	*Prochoerodes lineola*				
Virgin Moth	*Protitame virginalis*				
Porcelain Gray	*Protoboarmia porcelaria*				
Soft-lined Wave Moth	*Scopula inductata*				
Large Lace-border Moth	*Scopula limboundata*				
	Semiothisa bicolorata$_1$				
Wavy-lined Emerald	*Synchlora aerata*				
White Slant-Line Moth	*Tetracis cachexiata*				
Yellow Slant-Line Moth	*Tetracis crocallata*				
	Xanthotype rufaria$_1$				
Uraniidae (swallowtail moths)					
Brown Scoopwing	*Calledapteryx dryopterata*				
Bucculatricidae (ribbed cocoon-maker moths)					
Oak Skeletonizer Moth	*Bucculatrix ainsliella*				
Incurvariidae (leafcutter moths)					
Maple leaf cutter	*Paraclemenais acerifoliella*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Mimallonidae (sack-bearing moths)					
Scalloped Sack-bearer Moth	*Lacosoma chiridota*				
Erebidae					
False Underwing Moth	*Allotria elonympha*				
Velvetbean caterpillar Moth	*Anticarsia gammatalis*				
Carlotta's Tiger Moth	*Apantesis carlotta*				
Nais Tiger Moth	*Apantesis nais*				
Eyed Baileya Moth	*Baileya ophthalmica*				
Bent-winged Owlet Moth	*Bleptina caradrinalis*				
Girlfriend Underwing	*Catocala amica*				
Ilia Underwing Moth	*Catocala ilia*				
Morbid Owlet	*Chytolita morbidalis*				
Stone-winged Owlet	*Chytolita petrealis*				
Yellow-collared Scape Moth	*Cisseps fulvicollis*				
Packard's Lichen Moth	*Cisthene packardii*				
Lead-Colored Lichen Moth	*Cisthene plumbea*				
Pale Lichen Moth	*Crambidia pallida*				
	Crambidia uniformis				
Yellow-based Tuccock Moth	*Dasychira basiflava*				
Manto Tussock Moth	*Dasychira manto*				
Streaked Tussock Moth	*Dasychira obliquata*				
Spot-edged Dyspyralis Moth	*Dyspyralis puncticosta*				
	Gabara subniveosella$_1$				
	Grammia anna				
Arge Moth	*Grammia arge*				
Figured Tiger Moth	*Grammia figurata*				
Virgin Tiger Moth	*Grammia virgo*				
Banded Tussock Moth	*Halysidota tessellaris*				
Fall Webworm Moth	*Hypantria cunea*				
Flowing-line Bomolocha	*Hypena manalis*				
Green Cloverworm Moth	*Hypena scabra*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Broken-line Hypenodes	*Hypenodes fractilinea*				
	Hyperstrotia aetheria$_1$				
Yellow-spotted Graylet Moth	*Hyperstrotia fluviguttata*				
Dotted Graylet Moth	*Hyperstrotia pervertens*				
Black-patched Graylet Moth	*Hyperstrotia secta*				
White-lined Graylet Moth	*Hyperstrotia villificans*				
Painted Lichen Moth	*Hypoprepia fucosa*				
Idia julia Moth	*Idia julia*				
Rotund Idia Moth	*Idia rotundalis*				
Detracted Owlet Moth	*Lesmone detrahens*				
Gypsy Moth	*Lymantria dispar*				
Bronzy Macrochilo Moth	*Macrochilo orciferalis*				
Dark Marathyssa Moth	*Marathyssa inficita*				
Richards' Fungus Moth	*Metalectra richardsi*				
Definite Tussock Moth	*Orgyia definita*				
White-marked Tussock Moth	*Orgyia leucostigma*				
	Pagara simplex				
Decorated Owlet Moth	*Pangrapta decoralis*				
Red-lined Panopoda	*Panopoda rufimargo*				
Black-banded Owlet Moth	*Phalaenostola larentioides*				
Pink-Bordered Yellow	*Phytometra rhodarialis*				
Discolored Renia Moth	*Renia discoloralis*				
	Renia salusalis				
Orange Holomelina	*Virbia aurantiaca*				
	Virbia opella				
Green-dusted Zale	*Zale aeruginosa*				
Brown-spotted Zale	*Zale helata*				
Horrid Zale	*zale horrida*				
Lunate Zale	*Zale lunata*				
Washed-out Zale	*Zale metatoides*				
Early Zanclognatha	*Zanclognatha cruralis*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Noctuidae (owlet moths)					
Greater Red Dart	*Abagrotis alternata*				
Clear Dagger Moth	*Acronicta clarencens*				
Hesitant Dagger Moth	*Acronicta haesitata*				
Yellow-haired Dagger Moth	*Acronicta impleta*				
Raspberry Bud Dagger Moth	*Acronicta increta*				
Medium Dagger Moth	*Acronicta modica*				
Smeared Dagger Moth	*Acronicta oblinita*				
Ovate Dagger	*Actonicta ovata*				
	Acronita tristis$_1$				
Triton Dagger Moth	*Acronicta tritona*				
Ipsilon Dart	*Agrotis ipsilon*				
Copper Underwing	*Amphipyra pryamidoides*				
Snowy Dart Moth	*Anicla illapsa*				
Green Cutworm Moth	*Anicla infecta*				
Obtuse Yellow Moth	*Azenia obtusa*				
White-blotched Balsa Moth	*Balsa labecula*				
Silver-spotted Fern Moth	*Callopistria cordata*				
Pink-Shaded Fern Moth	*Callopistria mollissima*				
Silky Sallow	*Chaetaglaea sericea*				
The Laugher Moth	*Charadra deridens*				
Formosa Looper	*Chrysanympha formosa*				
Cloaked Marvel Moth	*Chytonix palliatricula*				
Yellowhorn	*Colocasia flavicornis*				
White-dotted Groundling Moth	*Condica videns*				
Bog Deltote	*Deltote bellicula*				
Festive Midget Moth	*Elaphria festivoides*				
Grateful Midget	*Elaphria grata*				
Beautiful Wood-nymph Moth	*Eudryas grata*				
Pearly Wood-Nymph	*Eudryas unio*				
	Heliothis turbatus				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Linda Wainscot	*Leucania linda*				
Bethune's Pinion	*Lithophane bethunei*				
Dashed Gray Pinion	*Lithophane disposita*				
Ashen Pinion	*Lithophane unimoda*				
Black-bordered Lemon Moth	*Marimatha nigrofimbria*				
Black-dotted Maliattha	*Maliattha synochitis*				
	Metaxaglaea viatica				
Confused Woodgrain	*Morrisonia confusa*				
Ruby Quaker	*Orthosia rubescens*				
Spotted Phosphila	*Phosphila miselioides*				
Turbulent Phosphila Moth	*Phosphila turbulenta*				
Large Mossy "Lithacodia"	*Protodeltote muscosula*				
Miranda Moth	*Proxenus miranda*				
The Brother	*Raphia frater*				
Three-lined Flower Moth	*Schinia trifascia*				
Variable Sallow	*Sericaglaea signata*				
Otter Spiramater	*Spiramater lutra*				
Yellow-striped Armyworm Moth	*Spodoptera ornithogalli*				
Bicolored Sallow	*Sunira bicolorago*				
Striped Garden Caterpillar Moth	*Trichordestra legitima*				
	Xestia adela$_1$				
Nolidae (nolid moths)					
Coastal Plain Meganola Moth	*Meganola phylla*				
Ashy Meganola	*Meganola spodia*				
Sorghum Webworm Moth	*Nola cereella*				
Sweet Pepperbush Nola Moth	*Nola clethrae*				
Frigid Owlet	*Nycteola frigidana*				
Notodontidae (prominent moths)					
Sigmoid Prominent Moth	*Clostera albosigma*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Angle-lined Prominent	*Clostera inclusa*				
Black-spotted Prominent Moth	*Dasylophia anguina*				
Gray-patched Prominent Moth	*Dasylophia thyatiroides*				
Drexel's Datana Moth	*Datana drexelii*				
Yellow-necked Caterpillar Moth	*Datana ministra*				
Common Gluphisia Moth	*Gluphisia septentrionis*				
Wavy-Lined Heterocampa Moth	*Heterocampa biundata*				
Saddled Prominent Moth	*Heterocampa guttivitta*				
White-blotched Heterocampa Moth	*Heterocampa umbrata*				
Variable Oakleaf Caterpillar Moth	*Lochmaeus manteo*				
Mottled Prominent Moth	*Macrurocampa marthesia*				
White-dotted Prominent Moth	*Nadata gibbosa*				
White-streaked Prominent	*Oligocentria lignicolor*				
Angulose Prominent	*Peridea angulosa*				
Chocloate Prominent Moth	*Peridea furruginea*				
Morning-glory Prominent	*Schizura ipomoeae*				
White-headed Prominent Moth	*Symmerista albifrons*				
Crambidae (crambid snout moths)					
	Chrysendeton imitabilis				
Forked Grass-veneer	*Crambus bidens*				
Eastern Grass-veneer	*Crambus laqueatellus*				
Common Grass-veneer	*Crambus praefectellus*				
Sawtoothed Crocidophora	*Crocidophora serratissimilalis*				
Paler Diacme Moth	*Diacme elealis*				
	Donacaula aquilella,				
Crambid Snout Moth	*Donacaula sordidella*				
Wainscot Grass-veneer	*Eoreuma densella*				
Changeable Grass-veneer	*Fissicrambus mutabilis*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Peppered Haimbachia	*Haimbachia placidella*				
	Haimbachia squamulella				
Bold-feathered Grass Moth	*Herpetogramma pertextalis*				
Pondside Pyralid Moth	*Munroessa icciusalis*				
Black Grass-veneer	*Neodactria caliginosellus*				
Crambine Snout Moth	*Neodactria zeellus*				
Lucerne Moth	*Nomophila nearctica*				
Bluegrass Webworm Moth	*Parapediasia teterella*				
Double-striped Scoparia Moth	*Scoparia biplagialis*				
Waterlily Leafcutter Moth	*Synclita obliteralis*				
Pyralidae (pyralid moths)					
Posturing Arta Moth	*Arta statlis*				
Trumpet Vine Moth	*Clydonopteron tecomae*				
American Plum Borer	*Euzophera semifuneralis*				
	Glyptocera consobrinella				
	Homoeosoma deceptorium				
	Nephopteryx subcaesiella				
Orange-tufted Oneida Moth	*Oneida lunulalis*				
	Peoria bipartitella				
	Peoria gemmatella$_1$				
Aspen Webworm Moth	*Pococera aplastella*				
Double-humped Pococera Moth	*Pococera expandens*				
White-aproned Pococera Moth	*Pococera scortealis*				
Engel's Salebriaria	*Salebriaria engeli*				
Tortricidae (tortricid moths)					
Oblique-banded Leafroller Moth	*Choristoneura rosaceana*				
Three-lined Leafroller Moth	*Pandemis limitata*				
Limacodidae (slug caterpillar moth)					
Saddleback Caterpillar	*Acharia stimulea*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Purple-crested Slug Moth	*Adoneta spinuloides*				
common name not found BG/ITIS	*Apoda biguttata*				
Inverted Y Slug Moth	*Apoda y-inversum*				
Spiny Oak-Slug Moth	*Euclea delphinii*				
inverted Y Slug Moth	*Isa textula*				
Spun Glass Slug Moth	*Isochaetes beutenmuelleri*				
Yellow-shouldered Slug Moth	*Lithacodes fasciola*				
Nason's Slug	*Natada nasoni*				
Jeweled Tailed Slug	*Packardia geminata*				
Smaller Parasa Moth	*Parasa chloris*				
Skiff Moth	*Prolimacodes badia*				
	Tortricidea testacea				
Megalopygidae (flannel moths)					
Black-waved Flannel Moth	*Megalopyge crispata*				
HOPLONEMERTEA					
Tetrastemmatidae (ribbon worm)					
	Prostoma sp.				
MOLLUSCS					
Freshwater Snails					
Freshwater limpet	*Ferrissia sp.*				
Pond snail	*Lymnaea sp.*				
Tadpole snail	*Physa spp.*				
Ram's horn snail	*Helisoma sp.*				
	Menetus sp.				
Neotaenioglossa					
Hydrobiidae (aquatic prosobranch snails)					
	unknown genus$_2$				
Slugs					
Dusky arion	*Arion subfuscus*				
Hedgehog arion	*Arion intermedius*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Carolina mantleslug	*Philomycus carolinianus*				
Changeable mantleslug	*Megapallifera mutabilis*				
Clams					
	Corbicula sp.				
	Pisidium sp.				
	Sphaerium sp.				
ANELIDA					
Lumbricullida					
	unknown genus$_2$				
HAPLOTAXIDA					
Enchytraeidae (earthworm)					
	unknown genus$_2$				
Lumbricidae (earthworm)					
	unknown genus$_2$				
Naididae (earthworm)					
	Chaetogaster sp.				
	Dero sp.				
	Nais spp.				
Tubificidae (earthworm)					
	Aulodrilus sp.				
	Limnodrilus sp.				
	Tubifex sp.				
ARACHNIDS					
Spiders					
Marbled orbweaver	*Araneus marmoreus*				
	Ceraticelus sp.				
	Mermessus bryantae$_1$				
	Mermessus maculata$_1$				
	Mermessus tridentatus				
	Erigone autumnalis$_1$				
	Souessoula parva$_1$				
	Walckenaeria pallida				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
	Bathyphantes pallidus				
	Centromerus cornupalpis				
Bowl and doily weaver	*Frontinella communis*				
	Tenuiphantes sabulosus				
	Meioneta sp.				
	Neriene clathrata				
Filmy dome spider	*Neriene radiata*				
	Neriene variabilis				
Wolf spider	*Schizocosa ocreata*				
Six-spotted fishing spider	*Dolomedes triton*				
Southern black widow	*Latrodectus mactans*				
Actinedida					
Chigger	*Trombicula alfreddugesi*				
	Neumania sp.				
Ticks					
Black legged tick	*Ixodes scapularis*				
Lone star tick	*Amblyomma americanum*				
MAYFLIES					
Small minnow mayflies					
	Baetis sp.				
	Centroptilum sp.				
	Labiobaetis sp.				
	Plauditis sp.				
Spiny crawler mayfly					
	Eurylophella sp.				
Stream mayflies					
	Maccaffertium sp.				
STONEFLIES					
Capniidae (small winter stoneflies)					
	unknown genus₂				
Nemouridae					
	Nemoura sp.				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Capniidae/Leuctridae (small winter stoneflies/rolled-wing stoneflies)					
	unknown genus₂				
Nemouridae (spring stoneflies)					
	Amphinemura sp.				
Perlidae (common stoneflies)					
	Perlesta sp.				
Leuctridae (rolled-wing caddisflies)					
	Leuctra sp.				
MANTIDS					
European Mantis	*Mantis religiosa*				
Carolina Mantis	*Stagmomantis californica*				
TRUE BUGS, CICADAS, HOPPERS, APHIDS, AND ALLIES					
Cicadidae (cicadas)					
	unknown genus₂				
Gerridae (water striders)					
	unknown genus₂				
Hydrometridae (water measurers)					
	Hydrometra sp.				
Veliidae (broad-shouldered water striders, ripple bugs, small water striders)					
	Rhagovelia sp.				
Corixidae (water boatmen)					
	Hesperocorixa sp.				
Nepidae (waterscorpions)					
	Ranatra sp.				
Notonectidae (backswimmers)					
	Notonecta sp.				
Pentatomidae (stink bugs)					
	Euschistus sp.				
ALDERFLIES, DOBSONFLIES, AND FISHFLIES					
Sialidae (alderflies)					
	Sialis sp.				
Corydalidae (dobsonflies, fish flies, hellgrammites)					

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
	Chauliodes sp.				
	Nigronia sp.				
ANTLIONS, LACEWINGS, AND ALLIES					
Sisyridae (spongillaflies)					
	Climacia sp.				
BEETLES					
Carabidae (ground beetles)					
	Acupalpus sp.				
	Agonum darlingtoni				
	Agonum sp.				
	Amara anthobia				
	Amara avida				
	Amara discors				
	Amara musculis				
	Amara pennsylvanica				
	Anisodactylus laetus				
	Anisodactylus sp.				
	Ardistomis viridis				
	Bembidion affine				
	Bembidion confusum				
	Bembidion fugax				
	Bembidion inaequale				
	Bembidion sp.				
	Calleida punctata				
European Ground Beetle	*Carabus nemoralis*				
	Carabus sylvosus				
	Chlaenius aestivus				
	Chlaenius impunctifrons				
Punctured Tiger Beetle	*Cicindela punctulata*				
Bronzed Tiger Beetle	*Cicindela repanda*				
Six-spotted Tiger Beetle	*Cicindela sexguttata*				
	Clivina americana				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
	Clivina bipustulata				
	Clivina ferrea				
	Clivina fossor				
	Clivina striatopunctata				
	Dyschirus pallipennis				
	Dyschirus sp.				
	Harpalus erythropus				
	Harpalus pensylvanicus				
	Harpalus sp.				
	Lebia analis				
	Lebia solea				
	Lebia viridis				
	Lebia vittata				
	Leptotrachelus dorsalis				
	Notiobia nitidipennis				
	Omophron labiatum				
	Oodes amaroides				
	Phloeoxena signata				
	Platynus parmarginatus				
	Scarites subterraneus				
	Schizogenius lineolatus				
	Stenolophus comma				
	Stenolophus conjunctus				
	Stenolophus fuliginosus				
Seedcorn Beetle	*Stenolophus lecontei*				
	Stenolophus ochropezus				
	Tachys sp.				
	unknown genus$_2$				
Gyrinidae (whirligig beetles)					
	Dineutes discolor				
	Dineutes emarginatus				
Haliplidae (crawling water beetles)					

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
	Haliplus fasciatus				
	Haliplus triopsis				
	Peltodytes duodecimpuntatus				
	Peltodytes edentulus				
	Peltodytes sexmaculatus				
	Peltodytes shermani				
Noteridae (burrowing water beetles)					
	Hydrocanthus iricolor				
Dytiscidae (predaceous diving beetles)					
	Acilius fraternus				
	Agabetes acuductus				
	Agabus aeruginosus				
	Agabus anthracinus				
	Agabus gagtes				
	Agabus sp.				
	Bidessonotus inconspicuus				
	Copelatus chevrolati chevrolati				
	Copelatus glyphicus				
	Coptotomus interrogatus interrogatus				
	Cybister sp.				
	Hoperius planatus				
	Hydrocolus oblitus				
	Hydroporus niger				
	Hydroporus pulcher				
	Hydrovatus sp.				
	Hygrotus sayi				
	Laccophilus maculosus maculosus				
	Lioporeus sp.				
	Matus bicarinatus				
	Matus sp.				
	Neoporus clypealis				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
	Neoporus undulatus				
Hydrophilidae (water scavenger beetles)					
	Berosus exiguus				
	Berosus fraternus				
	Berosus peregrinus				
	Berosus sayi				
	Berosus striatus				
	Cymbiodyta chamberlaini				
	Cymbiodyta semistriata				
	Enochrus cinctus				
	Enochrus consors				
	Enochrus consortus				
	Enochrus fimbriatus				
	Enochrus ochraceus				
	Enochrus pygmaeus nebulosus				
	Helochares maculicollis				
	Hydrobius sp.				
	Hydrochara obtusata				
	Hydrochus squamifer				
	Paracymus nanus				
	Paracymus subcupreus				
	Sperchopsis sp.				
	Tropisternus blatchleyi blatchleyi				
	Tropisternus collaris striolatus				
Silphidae (carrion beetles)					
	Nicrophorus pustulatus				
Tomentose Burying Beetle	*Nicrophorus tomentosus*				
Lucanidae (stag beetles)					
	Ceruchus piceus				
	Dorcus parallelus				
Passalidae (bess beetles)					
Horned Passalus	*Odontotaenius disjunctus*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Hybosoridae (scavenger scarab bettles)					
	Cloeotus globosus$_1$				
Scarabaeidae (scarab beetles)					
	Ataenius alternatus				
	Ataenius cylindrus				
	Ataenius gracilis				
	Aphodius leopardus				
	Aphodius ruricola$_1$				
	Aphodius silvanicus$_1$				
	Aphodius stercorosus				
	Dialytes striatulus				
	Dialytes truncatus				
	Diplotaxis bidentata				
	Diplotaxis liberta				
	Diplotaxis sordida				
Rice Beetle	*Dyscinetus morator*				
	Eucanthus lazarus				
Asiatic Garden Beetle	*Maladera castanea*				
	Onthophagus pennsylvanicus				
Grapevine Beetle	*Pelidnota punctata*				
	Phyllophaga balia				
	Phyllophaga crenulata				
	Phyllophaga drakii				
	Phyllophaga fraterna				
	Phyllophaga ilicis				
	Phyllophaga luctuosa				
	Phyllophaga micans				
	Pleurophorus caesus				
Japanese Beetle	*Popillia japonica*				
	Serica atraepella$_1$				
	Serica atracapilla$_1$				
	Serica loxia$_1$				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
	Serica mystaca				
	Serica peregrina,				
	Serica sericea				
Carrot Beetle	*Tomarus gibbosus*				
	Tomarus relictus				
	Trichiotinus piger				
	Trox aequalis				
	Trox hamatus				
	Trox striatus				
Scirtidae (marsh beetles)					
	Cyphon sp.				
	Prionocyphon sp.				
Elmidae (riffle beetles)					
	Ancyronyx sp.				
	Dubiraphia sp.				
	Macronychus sp.				
	Microcylloepus sp.				
	Stenelmis sp.				
Dryopidae (long-toe water beetles)					
	Helichus sp.				
Coccinellidae (lady beetles)					
	unknown genus				
Tenebrionidae (fungus, bark, darkling and blister Beetles)					
	Adelina pallida				
	Alobates morio				
	Alobates pennsylvanica				
	Alphitobius diaperinus				
	Anaedus brunneus				
	Androchirus femoralis				
	Blapstinus moestus				
	Bolitophagus comutus				
	Bolitophagus corticola				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
	Bothrotes canaliculatus				
	Capnochroa fuliginosa				
	Centronopus calcaratus				
	Corticeus parallelus				
	Corticeus thoracicus				
	Diaperis maculata				
	Dioedus punctatus				
	Gnatocerus guatemalensis				
	Haplandrus ater				
	Haplandrus fulvipes				
	Helops aereus				
	Hymenochara rufipes				
	Hymenorus communis				
	Hymenorus dicretus				
	Hymenorus niger				
	Hymenorus obesus				
	Hymenorus perforatus				
	Hymenorus pilosus				
	Hymenorus sobrinus				
	Idiobates castaneus				
	Isomira pulla				
	Isomira sericea				
	Meracantha contracta				
	Mycetochara binotata				
	Mycetochara fratema				
	Mycetochara haldemani				
	Neatus tenebrioides				
	Neomida bicomis				
	Opatrinus minimus				
	Paratenetus fuscus				
	Paratenetus punctatus				
	Pentaphyllus pallidus				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
	Platydema ellipticum				
	Platydema erythrocerum				
	Platydema excavatum				
	Platydema flavipes				
	Platydema laevipes				
	Platydema micans				
	Platydema picilabrum				
	Platydema ruficome				
	Platydema subcostatum				
	Platydema teleops				
	Polypleurus perforatus				
	Rhipidandrus paradoxus				
	Statira gagatina				
	Strongylium tenuicolle				
	Strongylium terminatum				
	Tarpela mincans				
	Tarpela venusta				
	Terpela americana				
	Uloma imberbis				
	Uloma impressa				
	Uloma mentalis				
	Uloma punctulata				
	Xylopinus aenescens				
	Xylopinus saperdoides				
Cerambycinae (longhorned beetles)					
	Dryobius sexnotatus				
Chrysomelidae (leaf beetles)					
	Altica kalmiae				
	Altica litigata				
	Anomoea laticlavia				
	Anomoea laticlavia laticlavia				
	Baliosus nervosus				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
	Blepharida rhois				
	Calligrapha bidenticola bidenticola				
	Calligrapha californica coreopsivora				
	Calligrapha philadelphica				
	Capraita circumdata				
	Capraita obsidiana obsidiana				
	Capraita scalaris				
	Capraita subvittata				
	Capraita thyamoidea				
	Cerotoma trifurcata				
	Chaetocnema aenigmatica,				
	Chaetocnema confinis				
	Chaetocnema denticulata				
	Chaetocnema fuscata				
	Chaetocnema pulicaria				
	Chalepus bicolor				
	Charidotella bicolor				
	Charidotella purpurata				
	Chlamisus foveolatus				
	Chrysochus auratus				
	Colaspis brunnea				
	Colaspis costipennis				
	Coleothorpa dominicana dominicana				
	Crepidodera nana				
	Crepidodera vilacea				
	Cryptocephalus guttalatus				
	Cryptocephalus leucomelas leucomelas				
	Cryptocephalus notatus quadrimaculatus				
	Cryptocephalus quadruplex				
	Cryptocephalus venustus venustus				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
	Deloyala guttata				
	Diabrotica undecimpunctata howardi				
	Diabrotica virgifera virgifera				
	Disonycha caroliniana				
	Disonycha glabrata				
	Disonycha pennsylvanica				
	Disonycha procera				
	Disonycha xanthomelas				
	Distigmoptera impennata				
	Distigmoptera pilosa				
	Donacia assimilis				
	Donacia biimpressa				
	Donacia caerulea				
	Donacia liebecki				
	Donacia piscatrix				
	Donacia subtilis				
	Donacia texana				
	Donacia tuberculata				
	Epitrix brevis,				
	Epitrix cucumeris				
	Epitrix fuscula				
	Exema byersi				
	Exema canadensis				
	Fidia viticida				
	Galerucella nymphaeae				
	Glyphuroplata pluto				
	Labidomera clivicollis				
	Lexiphanes saponatus				
	Longitarsus testaceus				
	Mantura chrysanthemi				
	Metachroma laevicolle				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
	Microrhopala vittata				
	Neochlamisus bebbianae				
	Neochlamisus comptoniae				
	Neochlamisus eubati				
	Neochlamisus gibbosus				
	Neochlamisus platani				
	Odontota dorsalis				
	Odontota scapularis				
	Ophraella communa				
	Ophraella conferta				
	Ophraella cribrata				
	Ophraella notata				
	Oulema melanopus				
	Oulema palustris				
	Pachybrachis confusus				
	Pachybrachis m-nigrum				
	Pachybrachis pectoralis				
	Pachybrachis spumarius				
	Paria fragariae fragariae				
	Paria quadriguttata				
	Paria quadrinotata				
	Paria scutellaris				
	Paria sellata				
	Paria thoracica				
	Phyllobrotica limbata				
	Phyllotreta undulata				
	Plagiodera versicolor				
	Plagiometriona clavata				
	Psylliodes napi				
	Rhabdopterus picipes				
	Saxinis omogera omogera				
	Saxinis saucia				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
	Stenispa metallica				
	Strabala rufa rufa				
	Sumitrosis inaequalis				
	Sumitrosis rosea				
Palestriped Flea Beetle	*Systena blanda*				
	Systena hudsonias				
	Systena marginalis				
	Zygogramma suturalis				
Curculionidae (snout beetles, weevils)					
Asiatic Oak Weevil	*Cyrtepistomus castaneus*				
ANTS, BEES, WASPS, AND SAWFLIES					
Andrenidae (mining bees)					
	Andrena asteroides				
	Andrena barbara				
	Andrena bradleyi				
	Andrena brevipalpis				
	Andrena carlini				
	Andrena carolina				
	Andrena cressonii				
	Andrena erigeniae				
	Andrena fenningeri				
	Andrena forbesii				
	Andrena hilaris				
	Andrena hippotes				
	Andrena ilicis				
	Andrena imitatrix				
	Andrena macoupinensis				
	Andrena miserabilis				
	Andrena morrisonella				
	Andrena nasonii				
	Andrena nida				
	Andrena nigrae				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
	Andrena nuda				
	Andrena perplexa				
	Andrena personata				
	Andrena placata				
	Andrena platyparia				
	Andrena pruni				
	Andrena robertsonii				
	Andrena rugosa				
	Andrena simplex				
	Andrena spiraeana				
	Andrena tridens				
	Andrena vicina				
	Andrena violae				
	Andrena ziziaeformis				
	Calliopsis andreniformis				
	Panurginus atramontensis				
Apidae (cuckoo, carpenter, digger, bumble, and honey bees)					
	Anthophora abrupta				
	Anthophora plumipes				
Honey Bee	*Apis mellifera*				
	Bombus auricomus				
	Bombus bimaculatus				
	Bombus citrinus				
	Bombus fervidus				
	Bombus griseocollis				
	Bombus impatiens				
	Bombus perplexus				
	Ceratina calcarata				
	Ceratina dupla				
	Ceratina strenua				
	Habropoda laboriosa				
	Holcopasites calliopsidis				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
	Melissodes denticulata				
	Melissodes desponsa				
	Nomada affabilis				
	Nomada armatella				
	Nomada articulata				
	Nomada composita				
	Nomada cressonii				
	Nomada dentariae				
	Nomada denticulata				
	Nomada depressa				
	Nomada imbricata				
	Nomada lehighensis				
	Nomada luteoloides				
	Nomada maculata				
	Nomada parva				
	Nomada perplexa				
	Nomada pygmaea				
	Nomada sayi/ illinoensis				
	Nomada sulphurata				
	Peponapis pruinosa				
	Ptilothrix bombiformis				
	Triepeolus cressoni				
	Xylocopa virginica				
Colletidae (plasterer and yellow-faced bees)					
	Colletes inaequalis				
	Colletes thoracicus				
	Colletes validus				
	Hylaeus affinis				
	Hylaeus mesillae				
	Hylaeus modestus				
	Hylaeus ornatus				
	Panurginus potentillae				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Halictidae (sweet bees)					
	Agapostemon sericeus				
	Agapostemon splendens				
	Agapostemon texanus				
	Agapostemon virescens				
	Augochlora pura				
	Augochlorella aurata				
	Augochloropsis metallica				
	Halictus confusus				
	Halictus ligatus				
	Halictus parallelus				
	Halictus rubicundus				
	Lasioglossum bruneri				
	Lasioglossum callidum				
	Lasioglossum coeruleum				
	Lasioglossum coriaceum				
	Lasioglossum cressonii				
	Lasioglossum ephialtum				
	Lasioglossum foxii				
	Lasioglossum fuscipenne				
	Lasioglossum gotham				
	Lasioglossum illinoense				
	Lasioglossum imitatum				
	Lasioglossum laevissimum				
	Lasioglossum macoupinense				
	Lasioglossum mitchelli				
	Lasioglossum nelumbonis				
	Lasioglossum nigroviride				
	Lasioglossum nymphaerum				
	Lasioglossum oblongum				
	Lasioglossum pectorale				
	Lasioglossum pilosum				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
	Lasioglossum quebecense				
	Lasioglossum rozeni				
	Lasioglossum sopinci				
	Lasioglossum subviridatum				
	Lasioglossum taylorae				
	Lasioglossum tegulare				
	Lasioglossum versatum				
	Lasioglossum vierecki				
	Lasioglossum zephyrum				
	Sphecodes atlantis				
	Sphecodes heraclei				
Megachilidae (leaf-cutter bees, mason bees, and allies)					
	Anthidiellum notatum				
	Anthidium manicatum				
	Anthidium oblongatum				
	Coelioxys sayi				
	Heriades carinatus				
	Hoplitis pilosifrons				
	Hoplitis producta				
	Hoplitis simplex				
	Hoplitis spoliata				
	Megachila georgica				
	Megachile addenda				
	Megachile brevis				
	Megachile campanulae				
	Megachile gemula				
	Megachile inimica				
	Megachile mendica				
	Megachile montivaga				
	Megachile rotundata				
	Megachile sculpturalis				
	Osmia atriventris				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
	Osmia bucephala				
	Osmia collinsiae				
	Osmia cornifrons				
	Osmia distincta				
	Osmia georgica				
	Osmia lignaria				
	Osmia pumila				
	Osmia taurus				
	Osmia virga				
	Stelis lateralis				
	Stelis louisae				
Braconidae (braconid wasps)					
Stigmata munny-wasp	*Aleiodes stigmator*				
Sphecidae (thread-waisted wasps)					
	Ammophila pictipennis				
	Ammophila urnaria				
	Entomognathus lenapeorum$_1$				
Crabronidae					
	Lestica producticollis				
	Liris argentatus				
	Plenoculus davisi atlanticus$_1$				
	Plenoculus pruinosa$_1$				
	Tachysphex mundus$_1$				
	Tachysphex similis				
	Tachysphex terminatus$_1$				
	Trypoxylon frigidum$_1$				
Chrysididae (cuckoo wasps and allies)					
	Caenochrysis doriae				
	Chrysis cembricola$_1$				
	Chrysis montana$_1$				
	Chrysis scitala$_1$				
	Chrysura kyrae/pacifica$_1$				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
	Hedychridium dimidiatum				
	Hedychrum confusum/ violaceum				
	Hedychrum parvum				
Vespidae (ants, stinging wasps, and hornets)					
	Ancistrocerus campestris				
	Leptochilus republicanus				
	Parancistrocerus perennis				
CADDISFLIES					
Philopotamidae (finger-net caddisflies)					
	Wormaldia sp.				
Dipseudopsidae					
	Phylocentropus sp.				
Hydropsychidae (net-spinning caddisflies)					
	Ceratopsyche sp.				
	Ceratopsyche/Hydropsyche sp.				
	Cheumatopsyche sp.				
	Hydropsyche sp.				
	Leptonema sp.				
Polycentropodidae (tube maker caddisflies)					
	Cernotina sp.				
	Polycentropus sp.				
Leptoceroidae (long-horn caddisflies)					
	Oecetis sp.				
Phyrganeoidae (large caddisflies)					
	Ptilostomis sp.				
Hydroptilidae (micro-caddisflies)					
	Hydroptila sp.				
Limnephilidae (northern caddisflies)					
	Ironoquia sp.				
	Pycnopsyche sp.				
FLIES					
Cecidomyiidae (gall midges, gall gnats)					

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
	unknown genus₂				
Ceratopogonidae (biting midges)					
	Alluaudomyia sp.				
	Bezzia sp.				
	Bezzia/Palpomyia sp.				
	Ceratopogon sp.				
	Ceratopogoninae sp.				
	Culicoides sp.				
Dixidae (dixid midges)					
	Dixella sp.				
Chironomidae (midges)					
	Ablabesmyia sp.				
	Alotanypus sp.				
	Apsectrotanypus sp.				
	Brillia sp.				
	Chaetocladius sp.				
	Chironomus sp.				
	Cladotanytarsus sp.				
	Clinotanypus sp.				
	Conchapelopia sp.				
	Corynoneura sp.				
	Cricotopus sp.				
	Cryptochironomus sp.				
	Cryptotendipes sp.				
	Dicrotendipes sp.				
	Diplocladius sp.				
	Eukiefferiella sp.				
	Guttipelopia guttipennis				
	Gymnometriocnemus sp.				
	Heterotrissocladius sp.				
	Hydrobaenus sp.				
	Larsia sp.				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
	Limnophyes sp.				
	Micropsectra sp.				
	Microtendipes sp.				
	Nanocladius sp.				
	Natarsia sp.				
	Nilotanypus sp.				
	Omisus sp.				
	Orthocladius/Cricotopus sp.				
	Parachaetocladius sp.				
	Parakiefferiella sp.				
	Paramerina sp.				
	Parametriocnemus sp.				
	Paraphaenocladius sp.				
	Paratanytarsus sp.				
	Paratendipes sp.				
	Phaenopsectra sp.				
	Polypedilum sp.				
	Procladius sp.				
	Psectrocladius sp.				
	Pseudorthocladius sp.				
	Pseudosmittia sp.				
	Radotanypus sp.				
	Rheocricotopus sp.				
	Rheosmittia sp.				
	Rheotanytarsus sp.				
	Stempellinella sp.				
	Stenochironomus sp.				
	Sublettea sp.				
	Tanypodinae sp.				
	Tanytarsus sp.				
	Thienemanniella sp.				
	Thienemannimyia sp.				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
	Tribelos sp.				
	Tvetenia sp.				
	Xylotopus sp.				
	Zavrelia sp.				
	Zavrelimyia sp.				
Simuliidae (black flies, buffalo gnats)					
	Cnephia sp.				
	Prosimulium sp.				
	Simulium decorum				
	Simulium sp.				
	Simulium vittatum				
	Stegopterna sp.				
Culicidae (mosquitoes)					
	Anopheles sp.				
	Culex sp.				
Psychodidae (moth flies, sandflies)					
	Lutzomyia shannoni				
Tipulidae (crane flies)					
	Antocha sp.				
	Gonomyia sp.				
	Tipula sp.				
	Cryptolabis sp.				
	Hexatoma sp.				
	Limnophila sp.				
	Ormosia sp.				
	Pseudolimnophila sp.				
Tabanidae (horse flies, deer flies)					
	Chrysops sp.				
Empididae (balloon flies, dance flies)					
	Hemerodromia sp.				
CRABS, CRAYFISH, LOBSTER, PRAWNS, AND SHRIMP					
Cambaridae (crayfish)					

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
	unknown genus$_2$				
AMPHIPODS					
Crangonyctidae					
	Crangonyx sp.				
	Stygobromus sp.				
Gammaridae (scuds)					
	Gammarus sp.				
	Synurella sp.				
ISOPODS					
	Caecidotea sp.				
DAMSELFLIES and DRAGONFLIES					
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*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
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					
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*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
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*				
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		

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
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		
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*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
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.

Table A-3. Suspected or Known Plant 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]
LYCOPDIALES					
Lycopodiaceae (club mosses, club-moss family)					
Christmas green	*Diphasiastrum complanatum*				
Common club moss	*Lycopodium clavatum*				
Deeproot clubmoss	*Diphasiastrum tristachyum*	G5	S3		
Rare clubmoss	*Dendrolycopodium obscurum*				
Inundated clubmoss	*Lycopodiella inundata*	G5	S2		
Huperziaceae					
Shining clubmoss	*Huperzia lucidula*				
SELAGINELLALES					
Selaginellaceae (selaginella)					
Meadow spike-moss	*Selaginella apoda*				
ISOËTALES					
Isoëtaceae (quillworts)					
Appalachian quillwort	*Isoëtes engelmannii*	G4	S3		
OPHIOGLOSSALES					
Ophioglossaceae (adder's tongue)					
Southern adder's-tongue	*Ophioglossum vulgatum*				
Bortychiaceae					
Cut-leaf grape fern	*Botrychium dissectum*				
Rattlesnake fern	*Botrypus virginianus*				
EQUISETALES					
Equisetaceae (horsetails)					
Field horsetail	*Equisetum arvense*				
OSMUNDALES					
Osmundaceae (royal fern)					
Cinnamon fern	*Osmundastrum cinnamomeum*				
Interrupted fern	*Osmunda claytoniana*				
Royal fern	*Osmunda regalis*				
SCHIZAEALES					
Lygodiaceae (curly grass)					

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Climbing fern	*Lygodium palmatum*	G4	S2	T	
POLYPODIALES					
Polypodiaceae (common ferns, licorice ferns)					
Rock polypody	*Polypodium virginianum*				
Silvery-spleenwort	*Athyrium thelypteroides*				
Dryopteridaceae (wood fern)					
Christmas fern	*Polystichum acrostichoides*				
Crested wood fern	*Dryopteris cristara*				
Intermediate woodfern	*Dryopteris intermedia*				
Marginal wood fern	*Dryopteris marginalis*				
Spinulose woodfern	*Dryopteris carthusiana*				
Dennstaedtiaceae (bracken)					
Braken	*Pteridium aquilinum*				
Braken fern	*Pteridium aquilinum var. latiusculum*				
Eastern hayscented fern	*Dennstaedtia punctilobula*				
Adiantaceae					
Maidenhair fern	*Adiantum pedatum*				
BLECHNALES					
Blechnaceae (deer-fern)					
Netted chainfern	*Woodwardia areolata*				
Virginia chainfern	*Woodwardia virginica*				
Aspleniaceae (spleenwort)					
Ebony spleenwort	*Asplenium platyneuron*				
Athyriaceae					
Lady Fern	*Athyrium filix-femina*				
Onocleaceae					
Sensitive fern	*Onoclea sensibilis*				
Thelypteridaceae					
Bog fern	*Thelypteris simulata*				
Broad beech fern	*Phegopteris hexagonoptera*				
Eastern marsh fern	*Thelypteris 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]
New York fern	*Thelypteris noveboracensis*				
PINALES (CONIFERS)					
Pinaceae (pines)					
Eastern white pine	*Pinus strobus*				
Eastern-hemlock	*Tsuga canadensis*				
Loblolly pine	*Pinus taeda*				
Pitch pine	*Pinus rigida*				
Virginia pine	*Pinus virginiana*				
Cupressaceae (cypress, redwood)					
Bald cypress	*Taxodium distichum*				
Eastern red-cedar	*Juniperus virginiana*				
Northern white cedar	*Thuja occidentalis*	G5	S1	T	
NYMPHAEALES					
Cabombaceae (water-shield)					
Water-shield	*Brasenia schreberi*				
Nymphaeaceae (water lilies)					
European waterlily	*Nymphaea alba*				
White waterlily	*Nymphaea odorata*				
Yellow pond-lily	*Nuphar lutea spp. advena*				
PIPERALES					
Aristolochiaceae (birthworts)					
Canadian wild-ginger	*Asarum canadense*				
Saururaceae (lizard tails)					
Lizard tail	*Saururus cernuus*				
LAURALES					
Lauraceae (laurels)					
Sassafras	*Sassafras albidum*				
Spicebush	*Lindera benzoin*				
MAGNOLIALES					
Annonaceae (custard apples)					
Pawpaw	*Asimina triloba*				
Magnoliaceae (magnolias)					

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Sweetbay	*Magnolia virginiana*				
Tuliptree	*Liriodendron tulipfera*				
ACORALES					
Acoraceae					
Sweetflag	*Acorus calamus*				
ALISMATALES					
Alismataceae (arrowhead, water-plantain)					
Alisma subcorde	*Alisma subcordatum*				
Awl-leaf arrowhead	*Sagittaria subulata*	G5	S1	E	
Broadlear arrowhead	*Sagittaria latifoilia*				
Grass-Leaved arrowhead	*Sagittaria graminea var. weatherbiana*	G5	SU		
Araceae (arums)					
Brazilian watermeal	*Wolffia brasiliensis*				
Goldenclub	*Orontium aquaticum*				
Green arrow arum	*Peltandra virginica*				
Jack-in-the-pulpit	*Arisaema triphyllum*				
Lesser duckweed	*Lemna minor*				
Skunk cabbage	*Symplocarpus foetidus*				
Valdivia duckweed	*Lemna valdiviana*				
Hydrocharitaceae (frog's bit, tape-grass, waternymphs)					
American eelgrass	*Vallisneria americana*				
Broad waterweed	*Elodea canadensis*				
Potamogetonaceae (pond weed, pondweed, Pondweed family)					
Broadleaf pondweed	*Potamogenton natans*				
Heartleaf pondweed	*Potamogenton pulcher*				
Ribbonleaf pondweed	*Potamogeton epihydrus*				
Slender naiad	*Najas gracillima*	G5?	SU	X	
Small pondweed	*Potamogeton pusillus*	G5	S1		
Southern naiad	*Najas guadalupensis*	G5	S3		
Waterthread	*Potamogeton diversifolius*				
DIOSCOREALES					

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Dioscoreaceae (yams)					
Chinese yam	*Dioscorea polystachya*				
Wild yam	*Dioscorea villosa*				
Nartheciaceae					
White colicroot	*Aletris farinosa*				
LILIALES					
Colchicaceae					
Perfoliate bellwort	*Uvularia perfoliata*				
Sessileleaf bellwort	*Uvularia sessilifolia*				
Liliaceae					
Dogtooth violet	*Erythronium americanum*				
Indian cucumber	*Medeola virginiana*				
Star-of-Bethlehem	*Ornithogalum umbellatum*				
Turks-cap lily	*Lilium superbum*				
Melanthiaceae					
Eastern featherbells	*Stenanthium gramineum*	G4 G5	S1	T	
Smilacaceae					
Cat greenbrier	*Smilax glauca*				
Herbaceous greenbriar	*Smilax herbacea*				
ASPARAGALES					
Amaryllidaceae					
Adam's needle	*Yucca filamentosa* *				
Canada garlic	*Allium canadense*				
Summer snowflake	*Leucojum aestivum*				
Wild garlic	*Allium vineale*				
Asparagaceae					
Asparagus	*Asparagus officinalis*				
False lily-of-the-valley	*Maianthemum canadense*				
False solomons-seal	*Maianthemum racemosa racemosa*				
Smooth solomons-seal	*Polygonatum biflorum*				
Hypoxidaceae					

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 goldstar	*Hypoxis hirsuta*				
Daffodil	*Narcissus pseudonarcissus*				
Iridaceae					
Blue-eyed grass	*Sisyrinchium angustifolium*				
Eastern blue-eyed grass	*Sisyrinchium atlanticum*				
Harlequin blueflag	*Iris versicolor*				
Paleyellow iris	*Iris pseudacorus*				
Orchidaceae (orchids)					
Autumn coralroot	*Corallorrhiza odontorhiza*				
Crippled cranefly	*Tipularia discolor*				
Downy rattlesnake-plantain	*Goodyera pubescens*				
Green fringe-orchid	*Platanthera lacera*				
Green woodland orchid	*Platanthera clavellata*				
Nodding ladies-tresses	*Spiranthes cernua*				
Northern slender ladies-tresses	*Spiranthes lacera var. gracilis*				
Palegreen orchid	*Platanthera flava*	G4	S2		
Pink lady-slipper	*Cypripedium acaule*				
Purple fiveleaf orchid	*Isotria verticillata*				
Showy orchid	*Galearis spectabilis*				
Upland ladies-tresses	*Spiranthes vernalis*				
Yellow fringe-orchid	*Plantanthera ciliaris*				
Xanthorrhoeaceae					
Orange daylily	*Hemerocallis fulva*				
COMMELINALES					
Commelinaceae (spiderworts)					
Common dayflower	*Commelina communis*				
Virginia dayflower	*Commelina virginica*				
Pontederiaceae					
Kidneyleaf mudplantain	*Heteranthera reniformis*				
Pickerel-weed	*Pontederia cordata*				
POALES					
Cyperaceae (foins coupants, laîches, rouches, rouchettes, sedges)					

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Amphibious sedge	*Carex amphibola*				
Awlfruit sedge	*Carex stipata*				
Bland sedge	*Carex blanda*				
Blue sedge	*Carex complanata*				
Blunt broom sedge	*Carex tribuloides*				
Broad looseflower sedge	*Carex laxiflora*				
Brook flatsedge	*Cyperus bipartitus*				
Broom sedge	*Carex scoparia*				
Brownish beakrush	*Rhynchospora capitellata*				
Bur-reed sedge	*Carex sparganioides*	G5	S1 S2		
Button sedge	*Carex bullata*	G5			
Carolina sedge	*Carex caroliniana*				
Cattail sedge	*Carex typhina*				
Chufa flatsedge	*Cyperus esculentus*				
Common fox sedge	*Carex vulpinoidea*				
Common threesquare	*Schoenoplectus pungens*				
Creeping spikerush	*Eleocharis palustris*				
Cyperuslike sedge	*Carex pseudocyperus*				
Darkgreen sedge	*Carex venusta*	G4	S2	T	
Densetuft hairsedge	*Bulbostylis capillaris*				
Eastern straw sedge	*Carex straminea*	G5	S1 S2		
Fescue sedge	*Carex festucacea*				
Fewflower nutrush	*Scleria pauciflora*	G5	S3		
Flase hop sedge	*Carex lupuliformis*	G4	S2		
Fragrant flatsedge	*Cyperus odoratus*				
Frank's sedge	*Carex frankii*				
Globe beakrush	*Rhynchospora globularis*	G5?	S1	E	
Globe flatsedge	*Cyperus echinatus*				
Gray's sedge	*Carex grayi*				
Great Plains flatsedge	*Cyperus lupulinus*				
Greater bladder sedge	*Carex intumescens*				
Green bulrush	*Scirpus atrovirens*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Hairy sedge	*Carex lacustris*	G5	S2		
Hardstem bulrush	*Scirpus acutus*				
Hop sedge	*Carex lupulina*				
Leafy bulrush	*Scirpus polyphyllus*				
Leavensworth's sedge	*Carex leavenworthii*				
Long's sedge	*Carex longii*				
Louisiana sedge	*Carex louisianica*	G5			
Low spikesedge	*Kyllinga pumila*	G5	S1	E	
Marsh flatsedge	*Cyperus pseudovegetus*				
Needle spikerush	*Eleocharis acicularis*				
Netted nutrush	*Scleria reticularis*	G4	S2 S3		
Northern long sedge	*Carex folliculata*				
Oval-leaf sedge	*Carex cephalophora*				
Ovate spikerush	*Eleocharis ovata*				
Parasol sedge	*Carex umbellata*				
Pennsylvania sedge	*Carex pensylvanica*				
Pine barren flatsedge	*Cyperus retrorsus*				
Prickly bog sedge	*Carex atlantica*				
Redroot flatsedge	*Cyperus erythrorhizos*				
Ribbed sedge	*Carex virescens*				
River blurush	*Scirpus fluviatilis*				
Rosy sedge	*Carex rosea*				
Shallow sedge	*Carex lurida*				
Shortbristle horned beaksedge	*Rhynchospora corniculata*				
Silver sedge	*Carex canescens*				
Slender firmbry	*Fimbristylis autumnalis*				
Slender spikerush	*Eleocharis tenuis*				
Slender wood sedge	*Carex digitalis*				
Smith's bulrush	*Schoenoplectus smithii*	G5?	SU	X	
Smooth sawgrass	*Cladium marisocoides*				
Smoothsheath sedge	*Carex laevivaginata*				
Softstem bulrush	*Schoenoplectus tabernaemontani*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Spreading sedge	*Carex laxiculmis*				
Squarestem spikerush	*Eleocharis quadrangulata*				
Squarrose sedge	*Carex squarrosa*				
Stawcolored flatsedge	*Cyperus strigosus*				
Swan's sedge	*Carex swanii*				
Tawny cottongrass	*Eriophorum virginicum*	G5	S3		
Texan flatsedge	*Cyperus polystachyos var. texensis*				
Thicket sedge	*Carex abscondita*				
Thinfruit sedge	*Carex flaccosperma*				
Threeway sedge	*Dulichium arundinaceum*				
Upright sedge	*Carex stricta*				
Variable flatsedge	*Cyperus difformis*				
Velvet sedge	*Carex vestita*				
Weak stellate sedge	*Carex seorsa*				
White edge sedge	*Carex debilis*				
Whitetinge sedge	*Carex albicans*				
Willenow's sedge	*Carex willdenovii*				
Wool-grass	*Scirpus cyperinus*				
Yellow flatsedge	*Cyperus flavescens*				
Yellow spikerush	*Eleocharis flavescens*				
Juncaceae (jons, rushes)					
Canadian rush	*Juncus canadensis*				
Common rush	*Juncus effusus*				
Field rush	*Juncus tenuis*				
Field woodrush	*Luzula campestris*				
Lopsided rush	*Juncus secundus*				
Needlepod rush	*Juncus scirpoides*				
Sharp-fruit rush	*Juncus acuminatus*				
Toad rush	*Juncus bufonius*				
Woodland rush	*Juncus subcaudatus*				
Grassleaf rush	*Juncus marginatus*				
Poaceae (graminées, grasses)					

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Alta fescue	*Festuca arundinacea*				
Annual ryegrass	*Lolium multiflorum*				
Annual wildrice	*Zizania aquatica*				
Arrowfeather threeawn	*Aristida purpurascens*				
Atlantic mannagrass	*Glyceria obtusa*				
Autumn bentgrass	*Agrostis perennans*				
Autumn bluegrass	*Poa autumnalis*				
Barnyard grass	*Echinochloa crus-galli*				
Beaked panicgrass	*Panicum anceps* *				
Bearded shorthusk	*Brachyelytrum erectum*				
Bermudagrass	*Cynodon dactylon*				
Blackseed needlegrass	*Piptochaetium avenaceum*				
Bluejoint reedgrass	*Calamagrostis canadensis*				
Bosc's panicgrass	*Dichanthelium boscii*				
Broomsedge	*Andropogon virginicus*				
Burgrass	*Cenchrus longispinus*				
Canada bluegrass	*Poa compressa*				
Carpet bentgrass	*Agrostis stolonifera*				
Chinese foxtail	*Setaria faberi*				
Chinese silvergrass	*Miscanthus sinensis*				
Churchmouse threeawn	*Aristida dichotoma*				
Common reed	*Phragmites australis*				
Common timothy	*Phleum pratense*				
Common witchgrass	*Panicum capillare*				
Cypress panicgrass	*Dichanthelium dichotomum*				
Dallis grass	*Paspalum dilatatum*				
Deertongue	*Dichanthelium clandestinum*				
Dixie signalgrass	*Urochloa ramosa*				
Downy brome	*Bromus tectorum*				
Eastern bottle-brush grass	*Elymus hystrix*				
Elliott bluestem	*Andropogon gyrans*				
Fall panicum	*Panicum dichotomiflorum*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Field paspalum	*Paspalum laeve*				
Floating mannagrass	*Glyceria septentrionalis*				
Florida paspalum	*Paspalum floridanum*				
Forest muhly	*Muhlenbergia sylvatica*	G5	S3		
Fowl mannagrass	*Glyceria striata*				
Fringeleaf paspalum	*Paspalum setaceum*				
Golden bamboo	*Phyllostachys aurea*				
Goose grass	*Eleusine indica*				
Green foxtail	*Setaria viridis*				
Hairy chess	*Bromus commutatus*				
Hairy crabgrass	*Digitaria sanguinalis*				
Hairy jointgrass	*Arthraxon hispidus*				
Heller's rosette grass	*Dichanthelium oligosanthes*	G5	S2 S3		
Hotsprings panicum	*Dichanthelium acuminatum*				
Indian crabgrass	*Digitaria longiflora*				
Indiangrass	*Sorghastrum nutans*				
Johnson grass	*Sorghum halepense*				
Kentucky bluegrass	*Poa pratensis*				
Knotgrass	*Paspalum distichum*				
Knotroot bristlegrass	*Setaria parviflora*				
Korean lawngrass	*Zoysia japonica*				
Lace grass	*Eragrostis capillaris*				
Little bluestem	*Schizachyrium scoparium*				
Manchurian wild-rice	*Zizania latifolia*				
Meadow fescue	*Festuca elatior*				
Mudbank crowngrass	*Paspalum dissectum*	G4?	S2	T	
Nimblewill	*Muhlenbergia schreberi*				
Nodding fescue	*Festuca subverticillata*				
Old switch panicgrass	*Panicum virgatum*				
Orchard grass	*Dactylis glomerata*				
Pale false mannagrass	*Torreyochloa pallida*				
Parairie threeawn	*Aristida oligantha*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Pearl millet	*Pennisetum glaucum*				
Perennial rye grass	*Lolium perenne*				
Petticoat-climber	*Eragrostis spectabilis*				
Philadelphia panicgrass	*Panicum philadelphicum*	G5	SU		
Poverty dropseed	*Sporobolus vaginiflorus*				
Poverty oatgrass	*Danthonia spicata*				
Prairie wedgegrass	*Sphenopholis obtusata*				
Purple love grass	*Eragrostis pectinacea*				
Purpletop	*Tridens flavus*				
Quackgrass	*Elymus repens*				
Rat-tail fescue	*Vulpia myuros*				
Rattlesnake bluegrass	*Glyceria canadensis*				
Red fescue	*Festuca rubra*				
Reed canarygrass	*Phalaris arundinacea*				
Rice cut-grass	*Leersia oryzoides*				
Rosette grass	*Dichanthelium polyanthes*				
Rough bluegrass	*Poa trivialis*				
Roundseed panicgrass	*Dichanthelium sphaerocarpon*				
Silver hairgrass	*Aira caryoplyllea*				
Six-weeks fescue	*Vulpia octoflora*				
Slender crabgrass	*Digitaria filiformis*				
Slender wedgegrass	*Sphenopholis intermedia*				
Slender wild-rye	*Elymus villosus*				
Slender woodoats	*Chasmanthium laxum*				
Slimspike threeawn	*Aristida longespica*				
Small crabgrass	*Digitaria ischaemum*				
Smooth brome	*Bromus inermis*				
Smooth crabgrass	*Digitaria ischaemum*				
Soft chess	*Bromus hordiaceus*				
Soreng	*Coleataenia longifolia*				
Soreng	*Coleataenia anceps*				
Soreng	*Coleataenia longifolia*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Starved panicgrass	*Dichanthelium depauperatum*				
Stink grass	*Eragrostis cilianensis*				
Stout woodreed	*Cinna arundinacea*				
Sugarcane plumegrass	*Saccharum giganteum*				
Sweet vernalgrass	*Anthoxanthum odoratum*				
Tall oatgrass	*Arrhenatherum elatius*				
Tapered rosette grass	*Dichanthelium acuminatum*				
Teal love grass	*Eragrostis hypnoides*				
Variable panicgrass	*Dichanthelium commutatum*				
Velvet grass	*Holcus lanatus*				
Velvet panicum	*Dichanthelium scoparium*				
Virginia wildrye	*Elymus virginucus*				
Warty panicgrass	*Panicum verrucosum*				
Water bentgrass	*Agrostis gigantea*				
Wavy hairgrass	*Avenella flexuosa*				
White grass	*Leersia virginica*				
Winter bentgrass	*Agrostis hyemalis*				
Wirestem muhly	*Muhlenbergia frondosa*				
Woodland bluegrass	*Poa sylvestris*				
Yellow foxtail	*Pennisetum glaucum*				
Typhaceae					
Common cattail	*Typha latifoila*				
Bur-reed	*Sparganium americanum*				
Xyridaceae (yellow-eyed-grasses)					
Carolina yellow-eyed grass	*Xyris caroliniana*				
Slender yellow-eyed grass	*Xyris torta*				
RANUNCULALES					
Berberidaceae (bayberries)					
Japanese barberry	*Berberis thunbergii*				
May apple	*Podophyllum peltatum*				
Papaveraceae (poppies; including Fumariaceae)					
Blindeyes	*Papaver dubium*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Bloodroot	*Sanguinaria canadensis*				
Celandine	*Chelidonium majus*				
Dutchman's breeches	*Dicentra cucullaria*				
Pale corydalis	*Corydalis flavula*				
Ranunculaceae (buttercups)					
Bulbous buttercup	*Ranunculus bulbosus*				
Common buttercup	*Ranunculus acris*				
Creeping buttercup	*Ranunculus repens*				
Hairy buttercup	*Ranunculus hispidus*				
Hooked buttercup	*Ranunculus recurvatus*				
Low spearwort	*Ranunculus pusillus*	G5	SU		
Rue-anemone	*Anemonella thalictroides*				
Small-flowered buttercup	*Ranunculus abortivus*				
Tall meadow-rue	*Thalictrum pubescens*				
Tall spearwort	*Ranunculus ambiqens*	G4	SH	X	
Virgins-bower	*Clematis virginiana*				
Wood anemone	*Anemone quinquefolia*				
PROTEALES					
Platanaceae (plane trees)					
Sycamore	*Platanus occidentalis*				
SAXIFRAGALES					
Crassulaceae (orpins, stonecrops)					
Ditch-stonecrop	*Penthorum sedoides*				
Grossulariaceae (gooseberries)					
Virginia sweetspire	*Itea virginica*				
Haloragaceae (water milfoil)					
Marsh mermaidweed	*Proserpinaca palustris*				
Parrot feather	*Myriophyllum aquaticum*				
Hamamelidaceae (witch hazel)					
Witch-hazel	*Hamamelis virginiana*				
Sweetgum	*Liquidambar styraciflua*				
Saxifragaceae (saxifragacées, saxifrages)					

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Alumroot	*Heuchera americana*				
SANTALALES					
Santalaceae (sandalwoods)					
American mistletoe	*Phoradendron leucarpum*				
Bastard toadflax	*Comandra umbellata*				
CARYOPHYLLALES					
Amaranthaceae (amaranthes, pigweeds)					
Green pigweed	*Amaranthus hybridus*				
Lambs-quarters	*Chenopodium album*				
Mexican-tea	*Dysphania ambrosioides*				
Pigweed	*Amaranthus spinosus*				
Redroot pigweed	*Amaranthus retroflexus*				
Caryophyllaceae (cariophyllacees, pinks)					
Bladder campion	*Silene latifolia*				
Bouncing Bet	*Saponaria officinalis*				
Clusterstem nailwort	*Paronychia fastigiata*				
Cockle	*Agrostemma githago*				
Common chickweed	*Stellaria media*				
Common mouse-ear chickweed	*Cerastium fontanum spp. vulgare*				
Deptford pink	*Dianthus armeria*				
Grass-leaf starwort	*Stellaria graminea*				
Knawel	*Scleranthus annuus*				
Longleaf stitchwort	*Stellaria longifolia*				
Sleepy catchfly	*Silene antirrhina*				
Star chickweed	*Stellaria pubera*				
Sticky chickweed	*Cerastium glomeratum*				
Thyme-leaf sandwort	*Arenaria serpyllifolia*				
Whorled catchfly	*Silene stellata*				
Molluginaceae (carpetweeds)					
Carpetweed	*Mollugo verticillata*				
Phytolaccaceae (pokeweeds)					
Pokeweed	*Phytolacca americana*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Polygonaceae (smartweed)					
Arrow-leaf tear-thumb	*Persicaria sagittatum*				
Bitter dock	*Rumex obtusifolius*				
Black bindweed	*Fallopia convolvulus*				
Climbing false buckweat	*Fallopia scandens*				
Curlytop knotweed	*Persicaria lapathifolia*				
Denseflower knotweed	*Persicaria glabra*				
Dotted smartweed	*Persicaria punctata*				
Erect knotweed	*Polygonum erectum*				
Halberd-leaf tear-thumb	*Persicaria arifolia*				
Jumpseed	*Persicaria virginiana*				
Kiss me over the garden gate	*Persicaria orientalis*				
Marshpepper knotweed	*Persicaria hydropiper*				
Oriental lady's thumb	*Persicaria posumbu*				
Pennsylvania smartweed	*Persicaria pensylvanica*				
Pleatleaf knotweed	*Polygonum tenue*				
Prostrate knotweed	*Polygonum aviculare*				
Sheep-sorrel	*Rumex acetosella*				
Spotted ladysthumb	*Persicaria maculosa*				
Swamp smartweed	*Persicaria hydropiperoides*				
Yellow dock	*Rumex crispus*				
Portulacaceae (pourpiers, purslanes)					
Common purslane	*Portulaca oleracea*				
Spring-beauty	*Claytonia virginica*				
VITALES					
Vitaceae (grapes)					
Fox grape	*Vitis labrusca*				
Frost grape	*Vitis vulpina*				
Summer grape	*Vitis aestivalis*				
Virginia creeper	*Parthenocissus quinquefolia*				
Wild grape	*Ampelopsis brevipedunculata*				
CELASTRALES					

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Celastraceae (bittersweet)					
American bittersweet	*Celastrus scandens*				
Strawberry bush	*Euonymus americanus*				
OXALIDALES					
Oxalidaceae (oxalis)					
Common yellow wood-sorrel	*Oxalis stricta*				
Violet wood-sorrel	*Oxalis violacea*				
MALPIGHIALES					
Euphorbiaceae (euphorbes, spurge)					
American ipecac	*Euphorbia ipecacuanhae*				
Cypress spurge	*Euphorbia cyparissias*				
Flowering spurge	*Euphorbia corollata*				
Madwoman's milk	*Euphorbia helioscopia*				
Slender copperleaf	*Acalypha gracilens*				
Spotted spurge	*Chamaesyce maculata*				
Virginia threeseed mercury	*Acalypha rhomboidea*				
Hypericaceae					
Common St. Johnswort	*Hypericum perforatum*				
Coppery St. Johnswort	*Hypericum denticulatum*	G5	S2	T	
Dwarf St. Johnswort	*Hypericum mutilum*				
Lesser Canadian St. Johnswort	*Hypericum canadense*				
Lesser marsh St. Johnswort	*Triadenum tubulosum*	G4?	S1		
Marsh St. Johnswort	*Triadenum virginicum*				
Pineweed St. Johnswort	*Hypericum gentianoides*				
Spotted St. Johnswort	*Hypericum punctatum*				
St. Andrew's cross	*Hypericum hypericoides*				
Linaceae (flax)					
Florida yellow flax	*Linum floridanum*	G5?	SH	X	
Ridged yellow flax	*Linum striatum*				
Woodland flax	*Linum virginianum*				
Passifloraceae (passion-flowers)					
Yellow passionflower	*Passiflora lutea*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Podostemaceae					
Hornleaf riverweed	*Podostemum ceratophyllum*	G5	S3		
Salicaceae (saules, willows)					
Big-toothed aspen	*Populus grandidentata*				
Black willow	*Salix nigra*				
Cottonwood	*Populus deltoides*				
European aspen	*Populus tremula*				
Prairie willow	*Salix humilis*				
Purpleosier willow	*Salix purpurea*				
Weeping willow	*Salix X sepulcralis*				
White poplar	*Populus alba*				
White willow	*Salix alba*				
Violaceae (violets, violettes)					
Arrow-leaved violet	*Viola sagittata*				
Birdfoot violet	*Viola pedata*				
Common blue violet	*Viola sororia*				
Downy yellow violet	*Viola pubescens*				
Early blue violet	*Viola palmata*				
Field violet	*Viola arvensis*				
Lanceleaf violet	*Viola lanceolata*				
Marsh blue violet	*Viola cucullata*				
Primrose violet	*Viola primulifolia*				
CUCURBITALES					
Cucurbitaceae (squashes)					
Burr Cucumber	*Sicyos angulatus*				
FABALES					
Fabaceae (legumes, peas)					
Alfalfa	*Medicago sativa*				
Alsike clover	*Trifolium hybridum*				
American senna	*Senna hebecarpa*				
Arrowhead rattlebox	*Crotalaria sagittalis*				
Barestem tickclover	*Desmodium nudiflorum*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Big hop clover	*Trifolium campestre*				
Bird's-foot trefoil	*Lotus corniculatus*				
Black locust	*Robinia pseudoacacia*				
Black medic	*Medicago lupulina*				
Chinese wisteria	*Wisteria sinensis*				
Creeping lespedeza	*Lespedeza repens*				
Crownvetch	*Securigera varia*				
Dillenius' ticktrefoil	*Desmodium glabellum*				
Eastern redbud	*Cercis canadensis*				
Endbeak pencilflower	*Stylosanthes biflora*				
Golden clover	*Trifolium aureum*				
Groundnut	*Apios americana*				
Hairy lespedeza	*Lespedeza hirta*				
Hairy vetch	*Vicia villosa*				
Hog-peanut	*Amphicarpa bracteata*				
Hop clover	*Trifolium dubium*				
Japanese clover	*Kummerowia striata*				
Korean lespedeza	*Kummerowia stipulacea*				
Kudzu vine	*Pueraria montana*				
Largebract ticktrefoil	*Desmodium cuspidatum*	G5	S1		
Littleleaf tickclover	*Desmodium cilliare*				
Maryland tickclover	*Desmodium marilandicum*				
Mimosa	*Albizia julibrissin*				
Narrowleaf vetch	*Vicia sativa*				
Nuttall's lespedeza	*Lespedeza nuttallii*				
Panicledleaf ticktrefoil	*Desmodium paniculatum*				
Partridge pea	*Chamaecrista fasciculata*				
Perennial wildbean	*Strophostyles umbellata*				
Prostate ticktrefoil	*Desmodium rotundifolium*				
Rabbitfoot clover	*Trifolium arvense*				
Red clover	*Trifolium pratense*				
Redbud	*Cercis Canadensis*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Roundhead lespedeza	*Lespedeza capitata*				
Sensitive partridge pea	*Chamaecrista nictitans*				
Sericea lespedeza	*Lespedeza cuneata*				
Shrub lespedeza	*Lespedeza bicolor*				
Sicklepod	*Senna obtusifolia*				
Slender lespedeza	*Lespedeza virginica*				
Smooth tick trefoil	*Desmodium laevigatum*	G5	S3 S4		
Sparrow vetch	*Vicia tetrasperma*				
Stiff ticktrefoil	*Desmodium obtusum*				
Stuve's lespedeza	*Lespedeza stuevei*	G4?	S3		
Tephrosia virginiana	*Tephrosia virginiana*				
Trailing lespedeza	*Lespedeza procumbens*				
Velvetleaf tickclover	*Desmodium viridiflorum*	G5?	S3 S4		
Violet lespedeza	*Lespedeza violacea*				
White clover	*Trifolium repens*				
White sweet-clover	*Melilotus alba*				
Yellow sweet-clover	*Melilotus officinalis*				
Yellow wild indigo	*Baptisia tinctoria*				
Polygalaceae (milkworts)					
Blood milkwort	*Polygala sanquinea*				
Curtiss' milkwort	*Polygala curtissii*				
Maryland milkwort	*Polygala mariana*				
Whorled milkwort	*Polygala verticillata*				
FAGALES					
Betulaceae (alders, birches)					
American hazelnut	*Corylus americana*				
American hornbeam	*Carpinus caroliniana*				
River birch	*Betula nigra*				
Smooth alder	*Alnus serrulata*				
Speckled alder	*Alnus incana*				
Fagaceae					
American beech	*Fagus grandifolia*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
American chestnut	*Castanea dentata*	G4	S2 S3		
Bear oak	*Quercus ilicifolia*				
Black oak	*Quercus velutina*				
Blackjack oak	*Quercus marilandica*				
Chestnut oak	*Quercus prinus*				
Chinquapin	*Castanea pumila*				
Northern red oak	*Quercus rubra*				
Overcup oak	*Quercus lyrata*				
Pin oak	*Quercus palustris*				
Post oak	*Quercus stellata*				
Scarlet oak	*Quercus coccinea*				
Shingle oak	*Quercus imbricaria*				
Southern red oak	*Quercus falcata*				
Swamp chestnut oak	*Quercus michauxii*				
Swamp white oak	*Quercus bicolor*				
White oak	*Quercus alba*				
Willow oak	*Quercus phellos*				
Juglandaceae (walnuts)					
Butternut	*Juglans cinerea*	G4	S2 S3		
Black walnut	*Juglans nigra*				
Bitternut hickory	*Carya cordiformis*				
Pignut hickory	*Carya glabra*				
Red hickory	*Carya ovalis*				
Mockernut hickory	*Carya alba*				
Sand hickory	*Carya pallida*				
Shagbark hickory	*Carya ovata*				
Myricaceae (sweet gales)					
Northern bayberry	*Morella pensylvanica*				
Wax myrtle	*Morella cerifera*				
ROSALES					
Cannabaceae (indian hemps)					
Hops	*Humulus lupulus*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Elaeagnaceae (oleasters)					
Autumn olive	*Elaeagnus umbellata*				
Russian olive	*Elaeagnus angustifolia*				
Moraceae (mulberries)					
Osage orange	*Maclura pomifera*				
Paper-mulberry	*Broussonetia Papyrifera*				
Red mulberry	*Morus rubra*				
White mulberry	*Morus alba*				
Rhamnaceae (buckthorns, nerpruns)					
New Jersey tea	*Ceanothus americanus*				
Rosaceae (roses)					
Common serviceberry	*Amelanchier arborea*				
American plum	*Prunus americana*				
Black cherry	*Prunus serotina*				
Black chokeberry	*Photinia melanocarpa*				
Black raspberry	*Rubus occidentalis*				
Bowman's root	*Porteranthus trifoliatus*				
Boynton hawthorn	*Crataegus boyntoni*				
Bristly dewberry	*Rubus hispidus*				
Callery Pear	*Pyrus calleryana*				
Canadian burnet	*Sanguisorba canadensis*	G5	S2	T	
Canadian serviceberry	*Amelanchier canadensis*				
Carolina rose	*Rosa Carolina*				
Common cinquefoil	*Potentilla simplex*				
Dewberry	*Rubus pubescens*				
Dwarf cinquefoil	*Potentilla canadensis*				
European crabapple	*Malus sylvestris*				
Fire cherry	*Prunus pensylvanica*				
Flowering quince	*Chaenomeles lagenaria*				
Harvestlice	*Agrimona parviflora*				
Highbush blackberry	*Rubus ostryifolius*				
India mockstrawberry	*Duchesnea indica*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Link's blackberry	*Rubus linkianus*				
Multiflora rose	*Rosa multiflora*				
Northern dewberry	*Rubus flagellaris*				
Norwegian cinquefoil	*Potentilla norvegica*				
Peach	*Prunus persica*				
Pear	*Pyrus communis*				
Pennsylvania blackberry	*Rubus laudatus*				
Purple chokeberry	*Photinia floribunda*	G4 G5 Q	S3		
Red chokeberry	*Photinia pyrifolia*				
Biltmore hawthorn	*Crataegus intricata*				
Roadside agrimony	*Agrimona pubescens*				
Sand blackberry	*Rubus cuneifolius*				
Southern crabapple	*Malus angustifolia*	G5?	S3		
Spring avens	*Geum vernum*				
Steeplebush	*Spiraea tomentosa*				
Sulfur cinquefoil	*Potentilla recta*				
Swamp rose	*Rosa palustris*				
Sweet cherry	*Prunus avium*				
Toringo crabapple	*Malus sieboldii*				
White avens	*Geum canadense*				
White meadowsweet	*Spiraea latifolia*				
Wild strawberry	*Fragaria virginiana*				
Ulmaceae (elms)					
American elm	*Ulmus americana*				
Hackberry	*Celtis occidentalis*				
Urticaceae (nettles)					
Canada clearweed	*Pilea pumila*				
Canadian wood-nettle	*Laportea canadensis*				
False-nettle	*Boehmeria cylindrica*				
Stinging nettle	*Urtica dioica*				
GERANIALES					

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Geraniaceae (geraniums)					
Carolina crane's-bill	*Geranium carolinianum*				
Redstem filaree	*Erodium cicutarium*				
Small geranium	*Geranium pusillum*				
Wild crane's-bill	*Geranium maculatum*				
MYRTALES					
Lythraceae (loosestrife)					
Blue waxweed	*Cuphea viscosissima*				
Lowland rotala	*Rotala ramosior*				
Swamp loosestrife	*Decodon verticillatus*				
Melastomataceae (melastomas)					
Common meadowbeauty	*Rhexia virginica*				
Maryland meadowbeauty	*Rhexia mariana*				
Onagraceae (evening primroses, onagres)					
Biennial Beeblossom	*Gaura biennis*				
Broadleaf enchanter's nightshade	*Circaea lutetiana*				
Common evening primrose	*Oenothera biennis*				
Cutleaf evening-primrose	*Oenothera laciniata*				
Floating primrose willow	*Ludwigia peploides*				
Globefruit primrose-willow	*Ludwigia sphaerocarpa*				
Little-evening primrose	*Oenothera perennis*				
Marsh primrose-willow	*Ludwigia palustris*				
Narrowleaf evening-primrose	*Oenothera fruticosa*				
Purple-leaf willowherb	*Epilobium coloratum*				
Seedbox	*Ludwigia alternifolia*				
CROSSOSOMATALES					
Staphyleaceae (bladdernuts)					
American bladdernut	*Staphylea trifolia*				
BRASSICALES					
Brassicaceae (crucifers, moutardes, mustards)					
Bulbous bitter-cress	*Cardamine bulbosa*				
Common yellowcress	*Rorippa 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]
Cutleaf toothwort	*Cardamine concatenata*				
Early yellowrocket	*Barbarea verna*				
Field mustard	*Brassica rapa*				
Field pepperweed	*Lepidium campestre* *				
Garden yellowrocket	*Barbarea vulgaris*				
Garlic mustard	*Alliaria petiolata*				
Hairy bittercress	*Cardamine hirsuta*				
Hedge mustard	*Sisymbrium officinale*				
Mouse-ear cress	*Arabidopsis thaliana*				
Pennsylvania bittercress	*Cardamine pensylvanica*				
Pennycress	*Thlaspi arvense*				
Radish	*Raphanus sativus*				
Shepherd's purse	*Capsella bursa-pastoris* *				
Spring whitlowgrass	*Draba verna*				
Tumble mustard	*Sisymbrium altissimum*				
Virginia pepperweed	*Lepidium virginicum* *				
MALVALES					
Cistaceae (rock roses)					
Canada frostweed	*Helianthemum canadense*				
Hoary frostweed	*Helianthemum bicknellii*	G5	S1	E	
Illinois pinweed	*Lechea racemulosa*				
Leggett's pinweed	*Lechea puchella*				
Malvaceae (mallows, mauves)					
Buttonweed	*Malva neglecta*				
Flower-of-an-hour	*Hibiscus trionum*				
Prickly sida	*Sida spinosa*				
Swamp rosemallow	*Hibiscus moscheutos*				
Velvetleaf	*Abutilon theophrasti*				
SAPINDALES					
Anacardiaceae (cashews)					
Poison ivy	*Toxicodendron radicans*				
Poison sumac	*Toxicodendron vernix*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Shining sumac	*Rhus copallina*				
Smooth sumac	*Rhus glabra*				
Staghorn sumac	*Rhus hirta*				
Sapindaceae (maples)					
Boxelder	*Acer negundo*				
Norway maple	*Acer platanoides*				
Red maple	*Acer rubrum*				
Silver maple	*Acer saccharinum*				
Simaroubaceae (quassias)					
Tree of heaven	*Ailanthus altissima*				
CORNALES					
Cornaceae (dogwoods; including Nyssaceae)					
Blackgum	*Nyssa sylvatica*				
Flowering dogwood	*Cornus florida*				
Silky dogwood	*Cornus amomum*				
Hydrangeaceae (hydrangeas)					
Wild hydrangea	*Hydrangea arborescens*				
ERICALES					
Balsaminaceae (touch-me-nots)					
Jewelweed	*Impatiens capensis*				
Clethraceae (clethras, pepperbushes)					
Sweetpepperbush	*Clethra alnifolia*				
Ebenaceae (ebony)					
Persimmon	*Diospyros virginiana*				
Ericaceae (heaths)					
American wintergreen	*Pyrola americana*				
Black huckleberry	*Gaylussacia baccata*				
Blue huckleberry	*Gaylussacia frondosa*				
Blueridge blueberry	*Vaccinium pallidum*				
Deerberry	*Vaccinium stamineum*				
Eastern teaberry	*Gaultheria procumbens*				
Green-flowered wintergreen	*Pyrola chlorantha*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Highbush blueberry	*Vaccinium corymbosum*				
Indianpipe	*Monotropa uniflora*				
Lowbush blueberry	*Vaccinium angustifolium*				
Maleberry	*Lyonia ligustrina*				
Mountain laurel	*Kalmia latifolia*				
Pinesap	*Monotropa hypopithys*				
Pink azalea	*Rhododendron periclymenoides*				
Pipsissewa	*Chimaphila umbellata*	G5	S3		
Sheep laurel	*Kalmia angustifolia*	G5	S3 S4		
Sidebells wintergreen	*Orthilia secunda*	G5	SH	X	
Spotted wintergreen	*Chimaphila maculata*				
Staggerbush	*Lyonia mariana*				
Swamp azalea	*Rhododendron viscosum*				
Swamp doghobble	*Leucothoe racemosa*				
Trailing arbutus	*Epigaea repens*				
Waxflower shinleaf	*Pyrola elliptica*				
Polemoniaceae (phlox)					
Wild sweetwilliam	*Phlox maculata*				
Primulaceae (primroses)					
Fringed loosestrife	*Lysimachia ciliata*				
Lance-leaved loosestrife	*Lysimachia lanceolata*	G5	S3		
Moneywort	*Lysimachia nummularia*				
Pimpernel	*Anagallis arvensis*				
Whorled loosestrife	*Lysimachia quadrifolia*				
Boraginaceae (bourraches)					
Bay forget-me-not	*Myosotis laxa*				
Corn gromwell	*Buglossoides arvensis*				
Shawnee salad	*Hydrophyllum virginianum*				
Strict forget-me-not	*Myosotis stricta* *				
Virginia bluebells	*Mertensia virginica*				
GENTIANALES					
Apocynaceae (dogbane)					

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 swallow-wort	*Cynanchum louiseae **				
Butterfly-weed	*Asclepias tuberosa*				
Clasping milkweed	*Asclepias amplexicaulis*				
Common milkweed	*Asclepias syriaca*				
Common periwinkle	*Vinca minor*				
Green milkweed	*Asclepias viridiflora*				
Hemp-dogbane	*Apocynum cannabinum*				
Purple milkweed	*Asclepias purpurascens*	G5?	SU		
Swamp milkweed	*Asclepias incarnata ssp. Pulchra*				
Gentianaceae (gentians)					
Bottle gentian	*Gentiana clausa*				
Rosepink	*Sabatia angularis*				
Twining screwstem	*Bartonia paniculata*	G5	S3		
Yellow bartonia	*Bartonia virginica*				
Rubiaceae (madders)					
Azure bluets	*Houstonia caerulea*				
Blunt leaved bedstraw	*Galium obtusum*				
Buttonbush	*Cephalanthus occidentalis*				
Cleavers	*Galium aparine*				
Clustered mille graines	*Oldenlandia uniflora*	G5	S3		
Dye bedstraw	*Galium tinctorium*				
Hairy bedstraw	*Galium pilosum*				
Partridgeberry	*Mitchella repens*				
Poor-Joe	*Diodia teres*				
Sweet bedstraw	*Galium triflorum*				
Venus' pride	*Houstonia purpurea var. purpurea*				
Wild-licorice	*Galium circaezans*				
LAMIALES					
Bignoniaceae (bignonias)					
Northern catalpa	*Catalpa speciosa*				
Trumpet-creeper	*Campsis radicans*				
Lamiaceae (mints)					

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
American false pennyroyal	*Hedeoma pulegioides*				
American wafer horehound	*Lycopus americanus*				
Beefsteak mint	*Perilla frutescens*				
Blue-curls	*Trichostema dichotomum*				
Clustered mountainmint	*Pycnanthemum muticum*				
Common dittany	*Cunila origanoides*				
Ground-ivy	*Glechoma hederacea*				
Hairy skullcap	*Scutellaria elliptica*				
Heal-all	*Prunella vulgaris*				
Heartleaf nettle	*Stachys corda*				
Henbit	*Lamium amplexicaule*				
Hoary mountainmint	*Pycnanthemum incanum*				
Hyssop hedge-nettle	*Stachys hyssopifolia*	G4 G5	SU		
Mad-dog skullcap	*Scutellaria lateriflora*				
Marsh hedgenettle	*Stachys palustris*				
Motherwort	*Leonurus cardiaca*				
Narrowleaf mountainmint	*Pycnanthemum flexuosum*				
Northern wafer horehound	*Lycopus uniflorus*				
Purple dead-nettle	*Lamium purpureum*				
Richweed	*Collinsonia canadensis*				
Spotted beebalm	*Monarda punctata*				
Taperleaf wafer horehound	*Lycopus rubellus*				
Virginia wafer horehound	*Lycopus virginicus*				
Whorled mountainmint	*Pycnanthemum verticillatum*	G5	S1	E	
Wild bergamot	*Monarda fistulosa*				
Wild mint	*Mentha arvensis*				
Wild-basil	*Clinopodium vulgare*				
Wood-sage	*Teucrium canadense*				
Linderniaceae					
Moistbank pimpernel	*Lindernia dubia*				
Lentibulariaceae (bladderworts)					
Common bladderwort	*Utricularia vulgaris*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Conespur bladderpod	*Utricularia gibba*				
Hidden-fruited bladderwort	*Utricularia geminiscapa*				
Lavender bladderwort	*Utricularia resupinata*	G4	S1	E	
Oleaceae (olives)					
Border privet	*Ligustrum obtusifolium*				
California privet	*Ligustrum ovalifium*				
Forsythia	*Forsythia intermedia*				
Fringe-tree	*Chionanthus virginicus*				
Green ash	*Fraxinus pennsylvanica*				
White ash	*Fraxinus americana*				
Orobanchaceae (broomrape)					
Beech-drops	*Epifaqus virginiana*				
Downy yellow false-foxglove	*Aureolaria virginica*				
Naked broom-rape	*Orobanche uniflora*				
Narrowleaf cowwheat	*Melampyrum lineare*				
Purple false foxglove	*Agalinis purpurea*				
Squawroot	*Conopholis americana*				
Swamp lousewort	*Pedicularis lanceolata*	G5	S1	E	
Tenlobe false foxglove	*Agalinis obtusifolia*	G4 G5 Q	S1	E	
Paulowniaceae					
Princess tree	*Pawlonia tomentosa*				
Phrymaceae (phrymas)					
Allegheny monkey-flower	*Mimulus ringens*				
Lopseed	*Phryma leptostachya*				
Sharpwing monkey-flower	*Mimulus alatus*				
Plantaginaceae (plantains)					
Birds-eye speedwell	*Veronica persica*				
Bottle-brush Indianwheat	*Plantago aristata*				
Clammy hedge-hyssop	*Gratiola neglecta*				
Common gypsyweed	*Veronica officinalis*				
Common plantain	*Plantago major*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Corn speedwell	*Veronica arvensis*				
Differentleaf waterstarwort	*Callitriche heterophylla*				
Field speedwell	*Veronica agrestis*				
Golden hedge-hyssop	*Gratiola aurea*				
Hairy beard-tongue	*Penstemon hirsutus*				
Narrowleaf plantain	*Plantago lanceolata*				
Pond water-starwort	*Callitriche stagnalis*				
Purslane speedwell	*Veronica peregrina*				
Roundfruit hedge-hyssop	*Gratiola virginiana*				
Rugel plantain	*Plantago rugelii*				
Shaggy hedge-hyssop	*Gratiola pilosa*				
Short's hedge-hyssop	*Gratiola viscidula*	G4 G5	S1	E	
Talus slope penstemon penstemon	*Penstemon digitalis*				
Terrestrial water-starwort	*Callitriche terrestris*				
Thyme-leaved speedwell	*Veronica serpyllifolia*				
Virginia plantain	*Plantago virginica*				
Scrophulariaceae (figworts)					
Canada toadflax	*Nuttallanthus canadensis*				
Common mullein	*Verbascum thapsus*				
Moth mullein	*Verbascum blattaria*				
White turtlehead	*Chelone glabra*				
Verbenaceae (verbenas)					
Blue vervain	*Verbena hastata*				
Narrowleaved vervain	*Verbena simplex*				
White vervain	*Verbena urticifolia*				
SOLANALES					
Convolvulaceae (morning glories)					
Bigroot morningglory	*Ipomoea pandurata*				
Common morning-glory	*Ipomoea purpurea*				
Compact dodder	*Cuscuta compacta*				
Golden dodder	*Cuscuta pentagona*				
Hedge bindweed	*Calystegia sepium*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Ivy-leaved morning-glory	*Ipomoea hederacea*				
Red morning-glory	*Ipomoea coccinea*				
Scaldweed	*Cuscuta gronovii*				
White morning-glory	*Ipomoea lacunosa*				
Solanaceae (nightshades)					
Black nightshade	*Solanum ptychanthum*				
Climbing nightshade	*Solanum dulcamara*				
Horse-nettle	*Solanum carolinense*				
Jimson-weed	*Datura stramonium*				
Longleaf ground-cherry	*Physalis longifolia*				
AQUIFOLIALES					
Aquifoliaceae (hollies)					
American Holly	*Ilex opaca*				
Common winterberry	*Ilex verticillata*				
Smooth winterberry	*Ilex laevigata*				
ASTERALES					
Asteraceae (sunflowers, tournesols)					
Allegheny hawkweed	*Hieracium paniculatum*				
American burnweed	*Erechtites hieracifolia*				
Annual fleabane	*Erigeron annuus*				
Arkansas ironweed	*Vernonia arkansana* *				
Ashy sunflower	*Helianthus mollis* *				
Awnless beggarticks	*Bidens polylepis*				
Bearded beggarticks	*Bidens aristosa*				
Black-eyed Susan	*Rudbeckia hirta*				
Black knapweed	*Centaurea nigra* *				
Blue mistflower	*Conoclinium coelestinum*				
Boneset	*Eupatoriurn perfoliatum*				
Broadleaf ironweed	*Veronia glauca*				
Bull thistle	*Cirsium vulgare*				
Calico aster	*Symphyotrichum lateriflorum*				
Camphor weed	*Pluchea camphorata*	G5	S1	E	

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Canada goldenrod	*Solidago canadensis*				
Canada lettuce	*Lactuca canadensis*				
Canada thistle	*Cirsium arvense*				
Cankerweed	*Prenanthes serpentaria*				
Carolina elephantsfoot	*Elephantopus carolinianus*				
Chicory	*Cichorium inyvbus*				
Climbing hempweed	*Mikania scandens*				
Coltsfoot	*Tussilago farfara*				
Common burdock	*Arctium minus*				
Common cocklebur	*Xanthium strumarium*				
Common dandelion	*Taraxacum officinale*				
Common ragweed	*Ambrosia artemisiifolia*				
Common sneezeweed	*Helenium autumnale*				
Corn chamomile	*Anthemis arvensis*				
Cornel-leaf whitetop	*Doellingeria infirma*	G5	S3		
Crowned beggarticks	*Bidens trichosperma*	G5	S2 S3		
Cuman ragweed	*Ambrosia psilostachya* *				
Curlycup gumweed	*Grindelia squarrosa*				
Cutleaf coneflower	*Rudbeckia laciniata*				
Devil's beggarticks	*Bidens frondosa*				
Discoid beggarticks	*Bidens discoidea*				
Downy goldenrod	*Solidago puberula*				
Early goldenrod	*Solidago juncea*				
Eastern annual saltmarsh aster	*Symphyotrichum subulatum*				
Eastern baccharis	*Baccharis halimifolia*				
Elliot's goldenrod	*Solidago latissimifolia*	G5	S3		
Falsegold groundsel	*Packera pseudaurea*				
Field pussytoes	*Antennaria neglecta*				
Field thistle	*Cirsium discolor*				
Fistulous goats beard	*Tragopogon dubius*				
Flat-top goldenrod	*Euthamia graminifolia* *				
Fragrant goldenrod	*Solidago odora*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Fringed quickweed	*Galinsoga quadriradiata*				
Georgia aster	*Symphyotrichum georgianum*				
Giant goldenrod	*Solidago gigantea*				
Giant ragweed	*Ambrosia trifida*				
Giant sunflower	*Helianthus giganteus*				
Gray goldenrod	*Solidago nemoralis*				
Groh's hawkweed	*Hieracium gronovii*				
Hairy white oldfield aster	*Symphyotrichum pilosum*				
Hawkweed	*Hieracium floribundum*				
Horseweed	*Conyza canadensis*				
Hyssopleaf thoroughwort	*Eupatorium hyssopifolium*				
Ionactis	*Ionactis linariifolia*				
Jerusalem artichoke	*Helianthus tuberosus*				
Late eupatorium	*Eupatorium serotinum*				
Lesser hawkbit	*Taraxacum officinale*				
Lesser snakeroot	*Ageratina aromatica*				
Maryland golden-aster	*Chrysopsis mariana*				
Mayweed	*Anthemis cotula*				
Mugwort	*Artemisia vulgaris*				
Musk thistle	*Carduus nutans*				
Narrowleaf silkgrass	*Pityopsis graminifolia* *				
Narrowleaf whitetop aster	*Sericocarpus linifolius*				
New England aster	*Symphyotrichum novae-angliae* *				
New York ironweed	*Veronia noveboracensis*				
Nodding beggartick	*Bidens cernua* *				
Orange hawkweed	*Hieracium aurantiacum*				
Ox-eye daisy	*Leucanthemum vulgare*				
Pale indian plantain	*Arnoglossum atriplicifolium*				
Parasol whitetop	*Doellingeria umbellata*				
Philadelphia fleabane	*Erigeron philadelphicus*				
Plains coreopsis	*Coreopsis tinctoria* *				
Plantainleaf pussytoes	*Antennaria plantaginifolia*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Prickly lettuce	*Lactuca serriola*				
Prickly sow thistle	*Sonchus asper*				
Purple sneezeweed	*Helenium flexuosum*				
Purplestem aster	*Symphyotrichum puniceum*				
Purplestem beggarticks	*Bidens connata*				
Rabbittobacco	*Pseudognaphalium obtusifolium*				
Rattlesnakeweed	*Hieracium venosum*				
Rice button aster	*Symphyotrichum dumosum*				
Rock dandelion	*Taraxacum erythrospermum*				
Rough boneset	*Eupatorium pilosum*				
Rough fleabane	*Erigeron striqosus*				
Rough hawkweed	*Hieracium scabrum*				
Roundleaf eupatorium	*Eupatorium rotundifolium*				
Shaggy blazing star	*Liatris pilosa*				
Showy goldenrod	*Solidago erecta*				
Skeletonweed	*Chondrilla juncea*				
Small's ragwort	*Packera anonyma*				
Smooth wite oldfield aster	*Symphyotrichum racemosum*				
Spanish-needles	*Bidens bipinnata*				
Spoonleaf purple everlasting	*Gamochaeta purpurea*				
Spotted catsear	*Hypochoeris radicata*				
Spotted joepyeweed	*Eutrochium maculatum*				
Spotted knapweed	*Centaurea stoebe*				
Swamp sneezeweed	*Helianthus angustifolius*				
Sweet joe-pye weed	*Eutrochium purpureum* *				
Tall beggarticks	*Bidens vulgata*				
Tall blue lettuce	*Lactuca biennis*				
Thinleaf sunflower	*Helianthus decapetalus*				
Toothed whitetop aster	*Sericocarpus asteroides*				
Virginia dwarfdandelion	*Krigia virginica*				
Waxyleaf aster	*Symphyotrichum undulatum*				
White goldenrod	*Solidago bicolor*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
White pinacle aster	*Symphyotrichum lanceolatum*				
White rattlesnakeroot	*Prenanthes alba*				
White snakeroot	*Ageratina altissima*				
White thoroughwort	*Eupatorium album*				
White wood aster	*Eurybia divaricata* *				
Whorled tickseed	*Coreopsis verticillata*	G5	S3		
Wingstem	*Verbesina alternifolia*				
Woodland lettuce	*Lactuca floridana*				
Wreath goldenrod	*Solidago caesia*				
Wrinkleleaf goldenrod	*Solidago rugosa*				
Yarrow	*Achillea millefolium*				
Yellow crownbeard	*Verbesina occidentalis*				
Yellow hawkweed	*Hieracium caespitosum*				
Yellow star-thistle	*Centaurea solstitialis*				
Yerba de tajo	*Eclipta prostrata*				
Campanulaceae (harebells)					
Cardinal-flower	*Lobelia cardinalis*				
Downy lobelia	*Lobelia puberula*				
Indian-tobacco	*Lobelia inflata*				
Palespiked lobelia	*Lobelia spicata*				
Venus looking-glass	*Triodanus perfoliata*				
DIPSACALES					
Adoxaceae (adoxas)					
Arrow-wood	*Viburnum dentatum*				
Black-haw	*Viburnum prunifolium*				
Elderberry	*Sambucus nigra ssp. canadensis*				
Maple-leaf viburnum	*Viburnum acerifolium*				
Possumhaw	*Viburnum nudum*				
White-rod	*Viburnum cassinoides*				
Caprifoliaceae (honeysuckles; including Diervillaceae, Dipsacaceae, Valerianaceae)					
Amur honeysuckle	*Lonicera maackii*				
Common teasel	*Dipsacus fullonum ssp. sylvestris*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Coralberry	*Symphoricarpos orbiculatus*				
Japanese honeysuckle	*Lonicera japonica*				
Lewiston cornsalad	*Valerianella locusta*				
Northern bush-honeysuckle	*Diervilla lonicera*				
Tartarian honeysuckle	*Lonicera tatarica*				
Trumpet honeysuckle	*Lonicera sempervirens*				
APIALES					
Apiaceae (carrot)					
Canada sanicle	*Sanicula canadensis*				
Floating marsh pennywort	*Hydrocotyle ranunculoides*				
Honewort	*Cryptotaenia canadensis*				
Meadowparsnip	*Thaspium barbinode*				
Stiff cowbane	*Oxypolis rigidior*				
Water hemlock	*Cicuta maculata*				
Wild carrot	*Daucus carota*				
Araliaceae (ginseng)					
American marshpennywort	*Hydrocotyle americana*				
Devils walkingstick	*Aralia spinosa*				
Dwarf ginseng	*Panax trifolius*				
English ivy	*Hedera helix*				
Wild sarsaparilla	*Aralia nudicaulis*				

*Identified by Patuxent Research Refuge volunteer Bill Harms through his North Tract Plant Inventory Project.

[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.

Sources:

Hotchkiss, N. and R.E. Stewart. 1979. Vegetation and vertebrates of the Patuxent Wildlife Research Center: outline of ecology and annotated lists.

Perry, M. 1979. Herbaceous and woody plants of Patuxent Research Refuge.

Taxonomic Information retrieved November 2011-January 2012, from the Integrated Taxonomic Information System online database. *http://www.itis.gov*.

The Angiosperm Phylogeny Group. 2009. Botanical Journal of the Linnean Society, 161: 105–121. "An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG III". doi: 10.1111/j.1095-8339.2009.00996.x

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.

Roadless

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.

WIA 3: South 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 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.

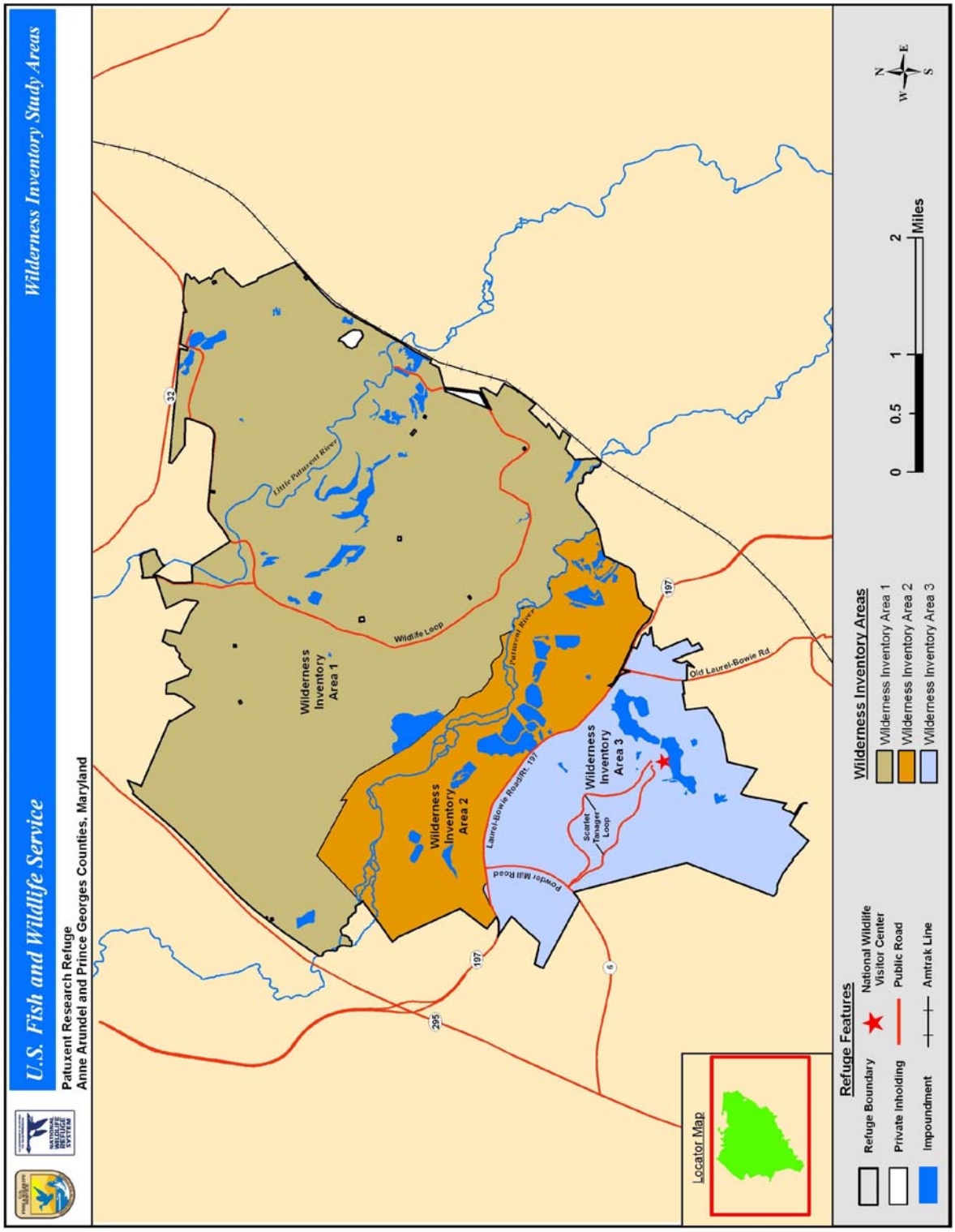
(4) *Contain ecological, geological, or other features of scientific, educational, scenic, or historical value?*

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

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 will occur; or where particular educational workshops, interpretive programs, activities, or events will 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 of times when these uses will 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 will 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 will 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 will 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 will 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 will 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, will 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 for 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 underwent extensive public review, including a comment period of 45 days following the release of the draft CCP/Environmental Assessment. We did not receive any comments specific to this compatibility determination.

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: Brad Knudson 6/11/13
(signature and date)

CONCURRENCE:

REGIONAL CHIEF: Scott B Kahan 8/19/2013
(signature and date)

MANDATORY 15-YEAR REEVALUATION DATE: 2028

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 documents any indication of disease or possible signs of wildlife overpopulation (e.g., starvation).

For all hunted species, we follow the state seasons and bag limits, which are set for sustainable harvest levels for the state. In addition, total days of hunting opportunities on the refuge for small game and waterfowl are less than the state season. Harvest levels of gray squirrels were 85 in 2012-2013, 75 in 2011-2012, and 75 in 2010-2011. Mourning dove harvest was 65 in 2012-2013, 59 in 2011-2012, and only 7 in 2010-2012. This is a fraction of the likely populations on a 12,800- acre forested refuge. We have observed large numbers of squirrels and have not observed a decrease in the population.

Similarly, waterfowl harvest levels are small, with Canada geese (mostly resident), mallards, and wood ducks being the most common waterfowl hunted. Harvest numbers for these species from 2010 – 2013 are 224 Canada geese, 87 mallards, and 205 wood ducks during the same three-year period. Waterbird surveys are conducted weekly at the refuge on certain impoundments and water bodies. Survey data for the years 1997-2011 provide total counts of waterbird species per impoundment. Per year averages for each species are 40,500 Canada geese; 3,644 mallards; and 5,060 wood ducks.

While we conduct no formal surveys on the refuge to estimate populations of small game, we do invest resources in estimating the refuge deer population, since an unmanaged deer population can have a severe ecological impact on habitats. Deer were over-hunted in Maryland in the beginning of the 20th century, which led to various efforts to increase the population throughout the 1930s and 1950s, such as creating refugia to protect deer, importing deer, or limiting the take of antlerless deer (conserves does) through a permit system. At the same time, deer habitat was improving, formerly cleared agricultural land was slowly regenerating to forest. By the mid 1980's deer populations had expanded enough to cause conflicts with growing human populations. The antlerless permit system was discontinued in the 1990's and Maryland has been promoting strategies to control the population growth.

Maryland's population reconstruction models indicate that Maryland's deer population has been reduced overall since 1998. The population increased from an estimated 246,000 deer in 1998 to a high of nearly 295,000 individuals in 2002 before declining to 229,000 in 2008. Liberal seasons and bag limits enacted for antlerless deer, as prescribed in the 1998 plan, have successfully stabilized and/or reduced deer populations in many areas. In Region B of Maryland

(Central and Southern areas), where habitat quality is considered good, the population has ranged from about 205,000 to 195,000 over a ten-year period (1998-2008)(MD White-tailed Deer Plan 2008), and at about 182,500 in 2012 (Eyler, MD DNR 2013). Maryland has 9,707 square miles of land area (figure includes unsuitable deer habitat too, such as developed areas) (http://quickfacts.census.gov/qfd/states/24000.html, accessed 16April2013). This equates to about 20 deer per square mile. The Virginia Department of Game and Inland Fisheries recommends a carrying capacity for deer at 25 deer per square mile (VDGIF 2006), while the Maryland White-tailed Deer Management Plan 2009-2018 references a maximum of 20 deer per square mile to limit habitat damage and human conflicts (MD DNR 2009). Across Pennsylvania, a deer density ranging from 10 to 40 deer per square mile is recommended to ensure adequate forest regeneration (NPS 2009).

The harvest for the North Tract in 2012-2013 season was 197 deer, and ranged from 135 to 185 per year since 2007. Obtaining good estimates upon which to pin harvest levels is difficult and has limitations. However, an acceptable formula would be buck harvest times two (assumes that ½ the bucks in the population were harvested), plus does (based on doe to buck ratio), plus fawns (1/2 of does)(Eyler, MD DNR 2013). So, for 2012-2013 on North Tract, this would be 120 bucks + 156 does + 78 fawns, or 354 deer. This total, divided by 11.785 square miles, produces 30.03 deer per square mile.

Other metrics obtained at the deer check-in station besides harvest totals may provide indirect evidence of growing, declining, or stable population, such as doe to buck ratios, fawn to doe ratios, and percent lactation. Doe to buck ratios ranged from 1.62, 1.42, and 1.42 in the past three years (2010-2013). The ratio throughout white tailed deer range is generally from 3 or 2 does to 1 buck (Eyler, MD DNR 2013). Fawn to doe ratios were 1.62, 2.15, and 1.73 for the same 3-year period, and this is an unacceptability high ratio. Throughout the white tailed deer range, this ratio should also be 1:1 for population stability. Lactation percentages among harvested does was 29, 27 and 17 for 2010-2013. Since this information is collected in the fall and winter, does are reproducing outside of the normal season. This can happen when does outnumber bucks and remain unbred. The does will continue to cycle every 30 days until bred, and this creates an increasing population. This lactation data is more reliable than the doe to buck ratio or fawn to doe ratio for estimating abundance because we impose the 15” rule on hunters, which forces a bias toward more does and fawns being harvested.

Health metrics collected from harvest data, such as beam spread, diameter, weights, suggest a fairly health herd and adequate food resources. However, the refuge habitat may be paying the price for this. That the refuge deer population is abundant is also suggested by frequent sightings of groups of deer, pervasive sign throughout the forest and other habitats, and poorly developed understory in the forests.

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 will 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 and 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. We have not seen such prominent browse lines in recent years since the hunt program was implemented on Central Tract.

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 2-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. 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 chapter 4 of 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 underwent extensive public review, including a comment period of 45 days following the release of the draft CCP/EA. We did not receive any comments specific to the compatibility determination for hunting.

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 been 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: Brad Knudsen 6/17/13
(signature and date)

CONCURRENCE:

REGIONAL CHIEF: Sam Hamilton 8/19/2013
(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.

Eyler, B. 2013. Deer Project Leader, Maryland Dept. of Natural Resources. Personal communication. 18 April 2013.

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, M. 1997. Recreation ecology: the ecological impact of outdoor recreation and ecotourism. London, United Kingdom: Chapman and Hall. 639 pp.

MD DNR 2009. Maryland Department of Natural Resources. Maryland White Tailed Deer Plan 2009-2018.

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.

NPS 2006. National Park Service. White-tailed Deer Population at Valley Forge.

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

QDMA/Quality Deer Management Association. 2010. Deer Cameras—the Science of Scouting. Lindsay Thomas, Jr., ed. Bogart. Ga. 240.pp.

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.

VDGIF 2007. Virginia Department of Game and Inland Fisheries. Virginia Deer Management Plan, 2006-2016. Wildlife Information Publication No. 07-1. June 2007.

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.

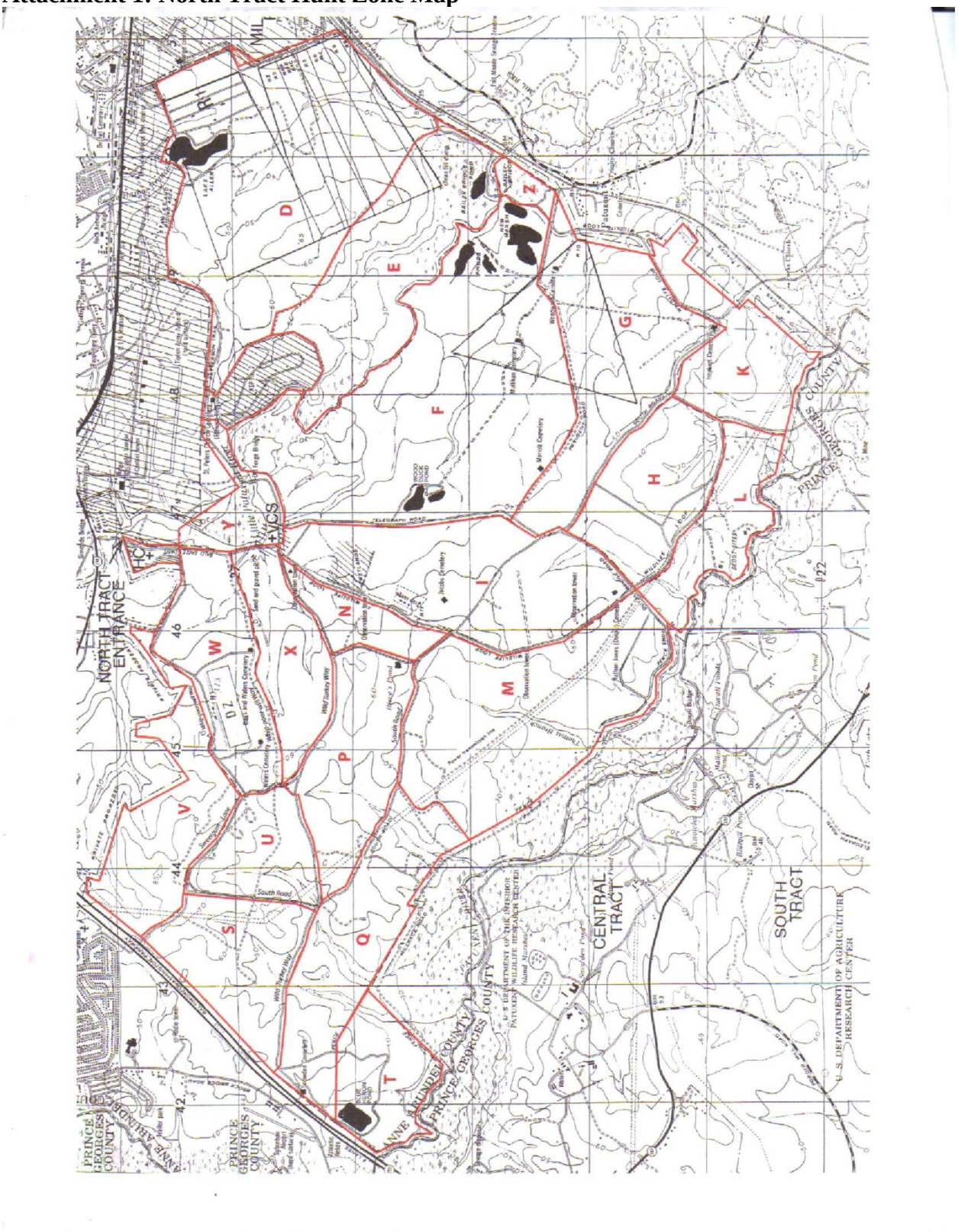
Whittaker, D. and R.L. Knight. 1998. Understanding wildlife responses to humans. Wildlife Society Bulletin 26:312–317.

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.

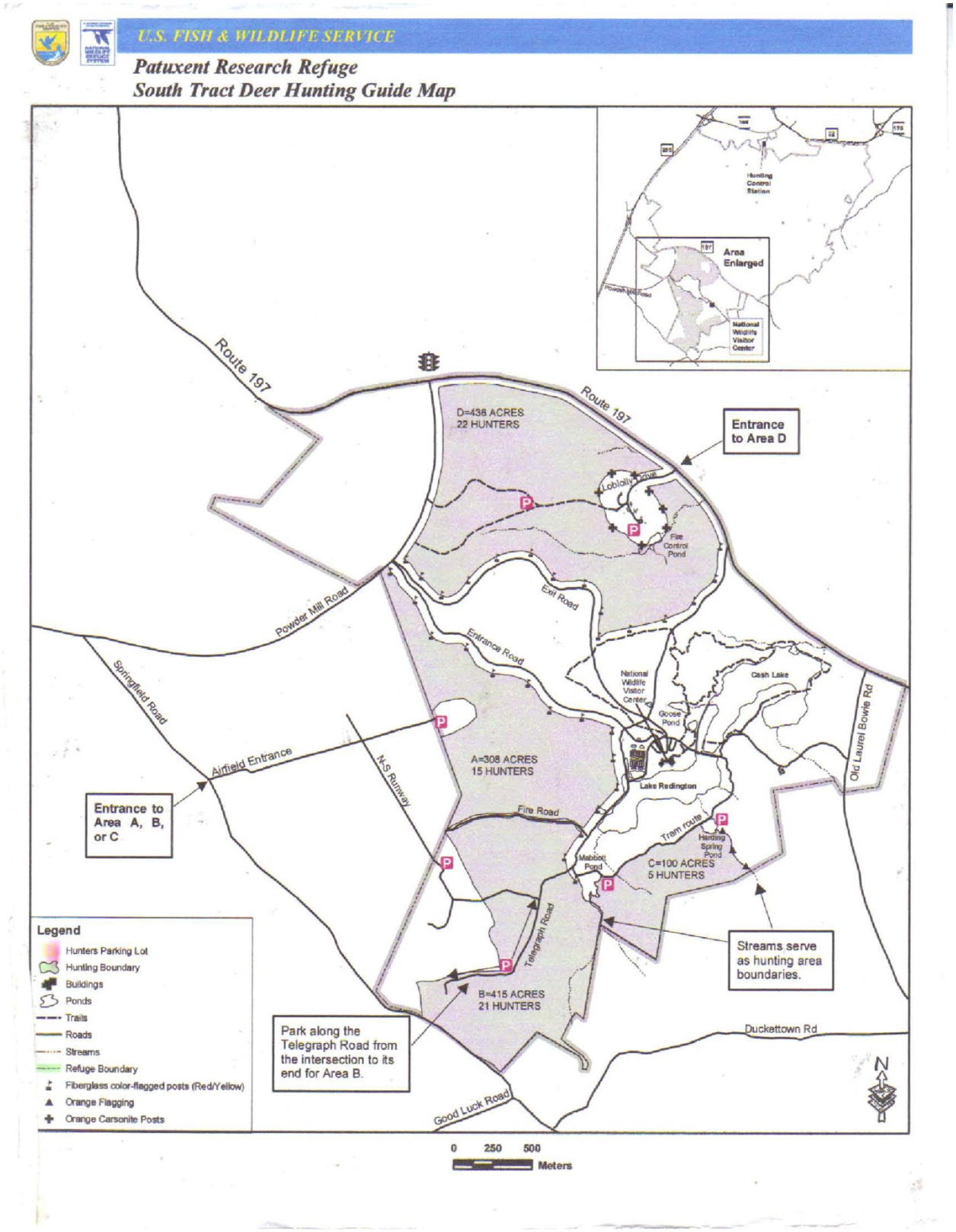
ATTACHMENTS:

Attachment 1: North Tract Hunt Zone Map
Attachment 2: South Tract Hunt Zone Map
Attachment 3: M-R and Schafer Farm Pond Hunt Map

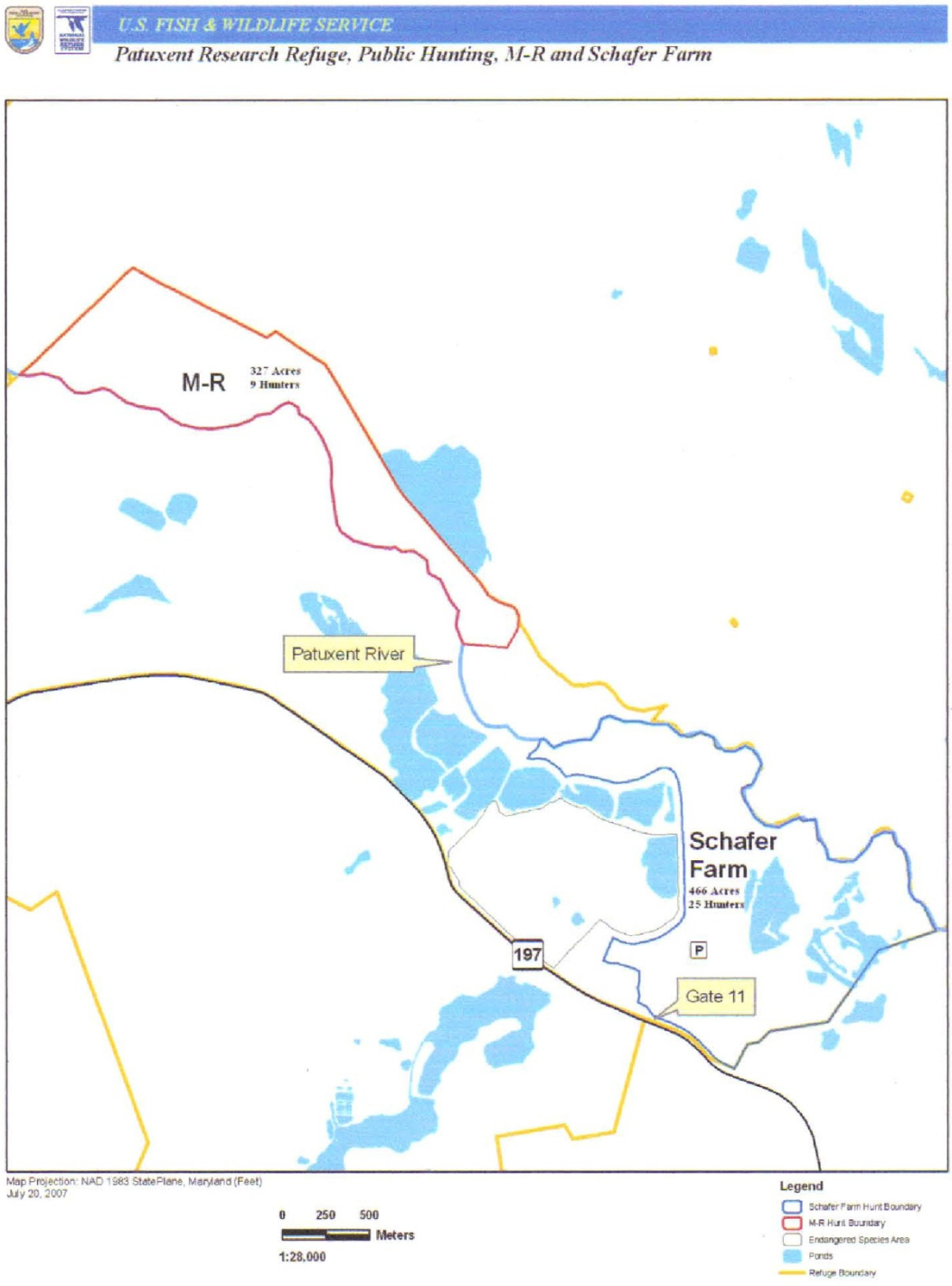
Attachment 1: North Tract Hunt Zone Map



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 will be 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).
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 underwent extensive public review, including a comment period of 45 days following the release of the draft Comprehensive Conservation Plan/Environmental Assessment. We did not receive any comments specific to this public fishing compatibility determination.

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).
    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 will 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: Brad Knudsen 6/11/13
(signature and date)

CONCURRENCE:

REGIONAL CHIEF: Sean B. Kain 8/19/2013
(signature and date)

MANDATORY 15-YEAR REEVALUATION DATE: 2028

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)

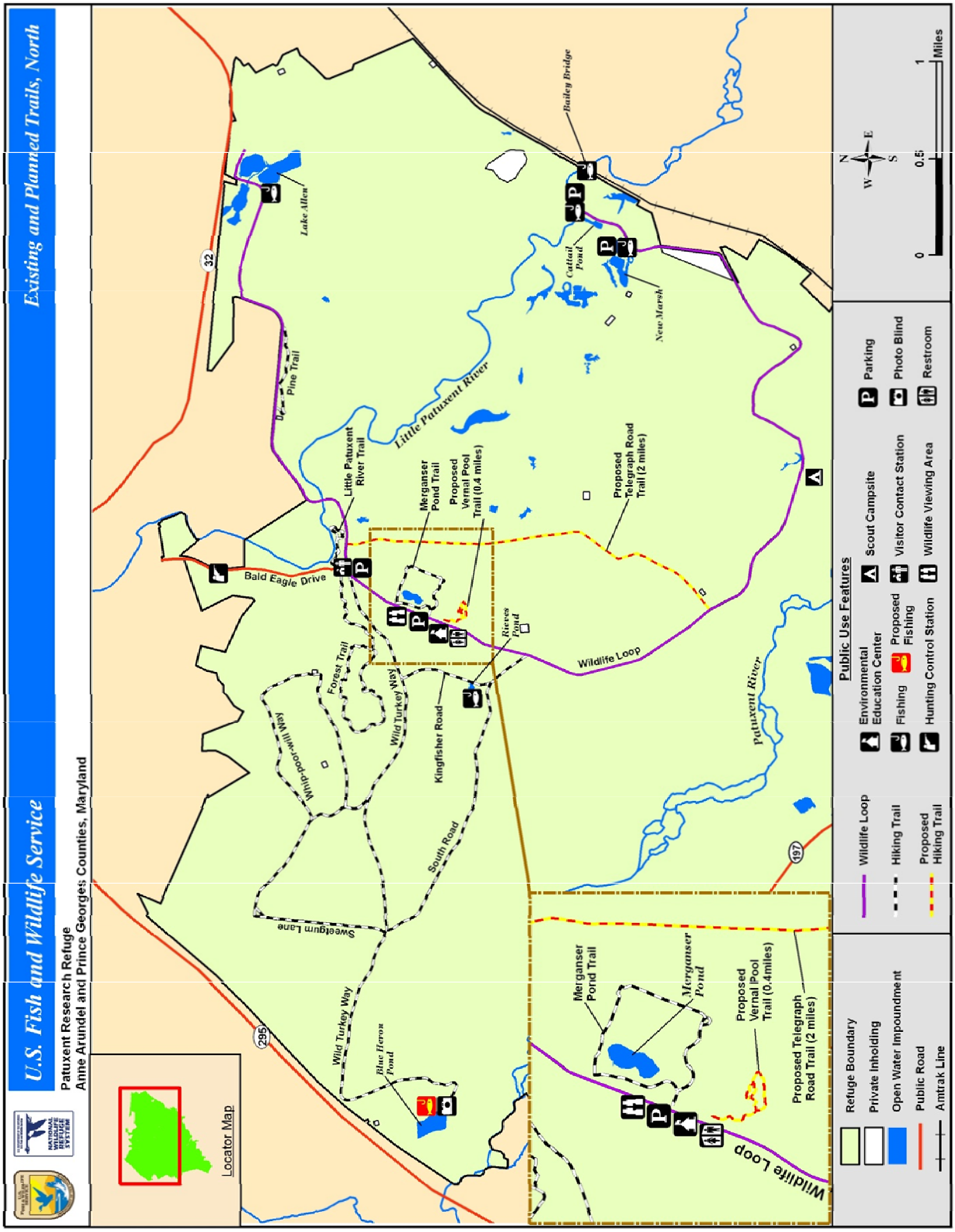
Public Law 101-519, 104 Stat. 2247

The Wildlife Society. 2009. Lead in Ammunition and Fishing Tackle. Position Statement.

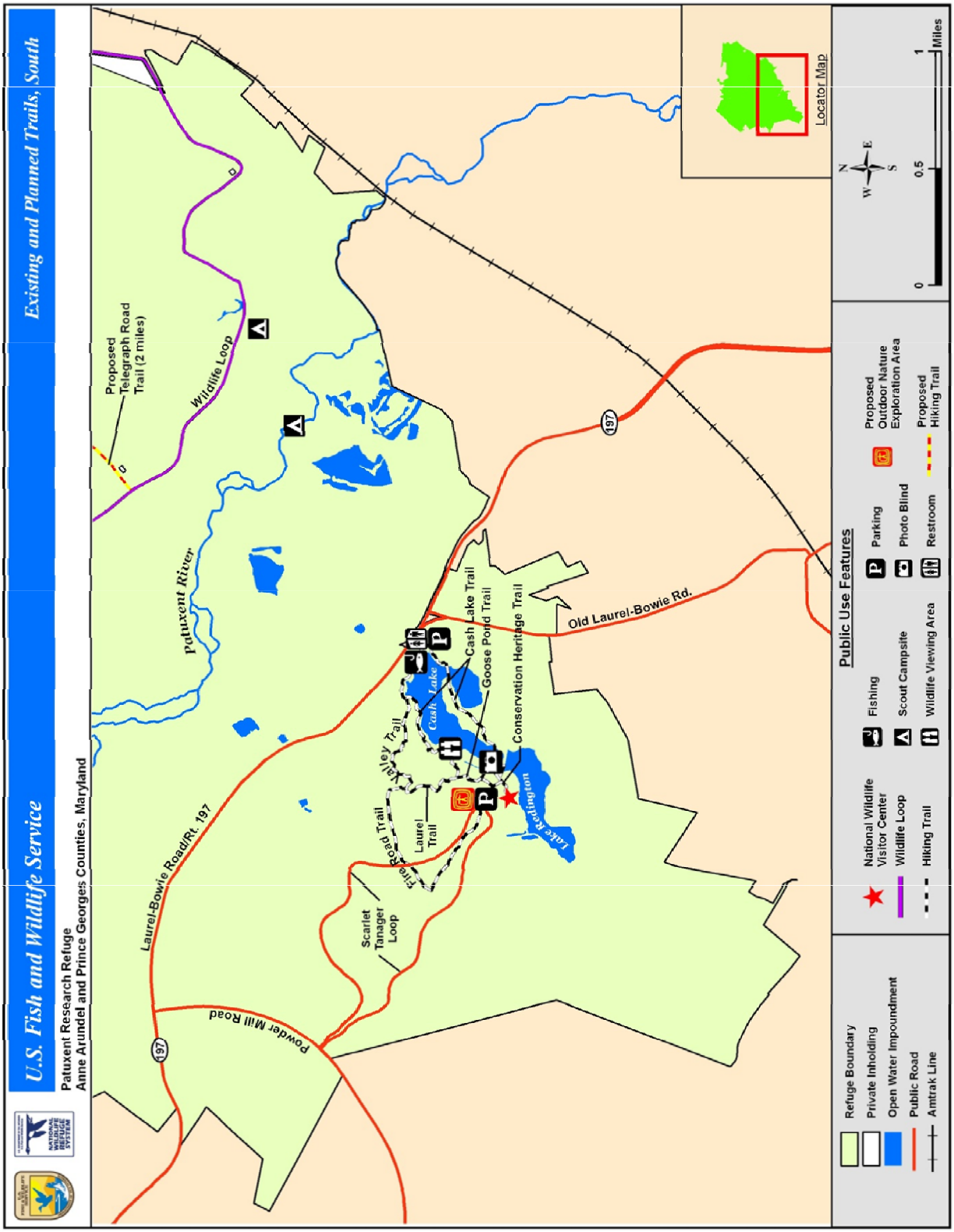
ATTACHMENTS:

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: Brad Knudsen Date: 6/11/13

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: [signature] Date: 7/5/13

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 5, 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 underwent extensive public review, including a comment period of 45 days following the release of the draft Comprehensive Conservation Plan/Environmental Assessment. We did not receive any comments specific to this compatibility determination.

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. These uses 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 actual impacts to wildlife species and habitat will be minimal, as opposed to the suite of potential impacts outlined under the impacts section. There will be adequate areas for species to retreat to that will not be impacted by these uses. In addition, the trails used for these activities do not impact core habitat or nesting 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: Brad Knudsen 6/11/13
(signature and date)

CONCURRENCE:

REGIONAL CHIEF: [signature] 8/19/2013
(signature and date)

MANDATORY 10-YEAR REEVALUATION DATE: 2023

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: Brad Knudsen Date: 6/11/13

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: [signature] Date: 7/5/13

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 2 percent of those sampled during the sampling period were participating in horseback riding (Sexton et al. 2011). 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 5 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 System 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 feetwide, 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 will 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 will 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. Riders are requested to clean up manure from staging areas, including the Visitor Contact Station, and pack out all materials.

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 will require approximately 30 staff days.

Identifier	Cost
Administration/management to facilitate activity, this includes staff/law enforcement and survey facilities	$4,600/yr
Maintenance of buildings, roadways, trails and parking areas	$14,000/yr
Supplies and support	$1,000/yr
Operating cost	$5,500/yr
Total Costs	**$25,100/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. 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 2 percent of the visitors sampled during the sampling period were participating in horseback riding (Sexton et al. 2011).

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 will ensure that 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. While this is a concern, this is only one of several contributing sources for the invasive species along roadsides and trails. Transport of weed seeds from vehicle tires or footwear are other contributors. This makes it difficult to measure the relative contributions from each source and the elimination of horses from trails would not alone resolve the issue. This concern has initiated strict requirements for weed-free hay in some national parks and forests. Also, it takes 48 hours for the food to completely pass through the horses' gastrointestinal system, so precise timing of feeding before visiting the refuge may be unrealistic. Most hay comes from carefully managed pastures where emphasis is placed on quality forage species such as orchardgrass, bluegrass, fescue,

timothy, which are heavily grazed in the pastures and seldom have an opportunity to go to seed. Japanese stiltgrass, a problem species at the refuge, is not common in managed, heavily grazed pastures, but would be found in unmanaged areas removed from the pastures and therefore not likely to be in the grazers' diet (Burk, A.O. Ph.D, University of Maryland, personal communication, November 6, 2012). Due to the relatively short timeframe for horseback riding excursions on the refuge, most users do not even bring in supplemental feed. This could potentially be a realistic control point for the refuge to minimize invasive plant introductions by requiring that, should visitors desire to bring feed along, they ensure that feeding be confined only to inside the trailer and by disallowing cleanout of trailers while onsite. However, 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.

Effects on 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, both open to horseback riding. Direct mortality from trampling is possible but considered highly improbable.

PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning process for Patuxent Research Refuge, this compatibility determination underwent extensive public review, including a comment period of 45 days following the release of the draft CCP/Environmental Assessment. We received a number of comments in writing and at the public meetings. A listing of the comments along with our responses can be found in appendix I of the CCP. We made two changes to the compatibility determination based upon the comments that we received. First, we will not require cleanup of manure along trails. We still require cleanup in parking lots and will work with riding groups to clean manure from areas within one half mile of the parking lot. Second, we will not require all riding to be done at a walk. We require that horses walk when encountering another user.

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 will 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. Continued use of existing routes is not likely to cause further wetland alteration or degradation. There is low risk that hydrology, soil stability, sensitive plant communities, riparian zones, and wildlife habitats would be adversely affected.

Free-trailing or loose-herding of horses on trails is prohibited.

Allowing horses to proceed in excess of a walk when passing in the immediate vicinity of a moving vehicle or persons on foot or bicycle is prohibited.

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.

Cleaning out of trailers while on site is prohibited. Do not shovel manure out of horse trailers in staging areas. Horse manure must be cleaned up and packed out of staging areas.

If feed is brought on site, only certified weed-free hay is permitted. Feeding must take place only inside trailer. Processed horse pellets are also allowed.

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: Brad Knudson 6/11/13
(signature and date)

CONCURRENCE:

REGIONAL CHIEF: Scott B. Cohen 8/19/2013
(signature and date)

MANDATORY 10-YEAR REEVALUATION DATE: 2023

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.

Carlson, James R., PhD. *http://www.bioone.org/doi/abs/10.1580/PR05-05.1-aff1#aff1.*

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. Biologica Conservation 18:39-51.

Ger, K. Ali. *http://www.bioone.org/doi/abs/10.1580/PR05-05.1-aff1#aff1.*

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.

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, 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: Brad Knudsen Date: 6/11/13

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: [signature] Date: 7/5/13

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, and 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 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 will 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 underwent extensive public review, including a comment period of 45 days following the release of the draft Comprehensive Conservation Plan/Environmental Assessment. We did not receive any comments specific to this filming and photography workshop compatibility determination.

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 will be restricted to public trails and roads.

These activities will require a special use permit that may include additional specific stipulations.

The size and number of photography workshops will 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 will 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 will not be 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: Brad Knudson 6/11/13
(signature and date)

CONCURRENCE:

REGIONAL CHIEF: Scott B. Flan 8/19/2013
(signature and date)

MANDATORY 10-YEAR REEVALUATION DATE: 2023

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: Brad Knudsen Date: 6/11/13

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: 7/5/13

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 wildlife research facility in the U.S. Fish and Wildlife Service (Service) with a large land base where wildlife 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.

Wildlife 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 wildlife 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 Comprehensive Conservation Plan (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. Wildlife 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 wildlife research will 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." This CD does not apply to research that is conducted by USGS staff that occurs in facilities that are covered by the MOA between the Service and USGS (2000) or the Occupancy Agreement (2008).

Where would the use be conducted?

The location of the wildlife 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 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. This compatibility determination does not include research projects that involve habitat manipulation of more than 10 acres or that would have an irreversible or long-term impact to habitat of any size unless that manipulation is included in a refuge management plan, such as the comprehensive conservation plan, habitat management plan, fire management plan, or annual habitat work plan.

The Service will encourage and support wildlife research and management studies on refuge lands that will 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 will 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 1 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 1 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.

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)
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**

Supplies/Services	Cost (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 of research (staff + supplies and services): $81,869 per year

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 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 underwent extensive public review, including a comment period of 45 days following the release of the draft Comprehensive Conservation Plan/Environmental Assessment. We did not receive any comments specific to this wildlife research compatibility determination.

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 require that proposals for research be submitted more than 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 required 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: Brad Knudsen 6/11/13
(signature and date)

CONCURRENCE:

REGIONAL CHIEF: Sam B. Hamilton 8/9/2013
(signature and date)

MANDATORY 10-YEAR REEVALUATION DATE: 2023

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: Brad Knudsen Date: 6/11/13

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: Ae Gittens Date: 7/5/13

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 3 days and 2 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 3 days and 2 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.

Task	Staff Days	Cost
Administration/management of camping activities	10	$2,589 per year
Monitoring camping activities	1	$258 per year
Maintenance of access routes and camping facilities	3	$773 per year
Totals	**14**	**$3,620 per year**

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 (staff + supplies and services): $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 3 days and 2 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 will 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 local diversity in bird species (Guth 1978). These increases of local 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 underwent extensive public review, including a comment period of 45 days following the release of the draft Comprehensive Conservation Plan/Environmental Assessment. We did not receive any comments specific to this scout and 4-H camping compatibility determination.

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 3 days and 2 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 firewood 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: Brad Knudsen 6/11/13
(signature and date)

CONCURRENCE:

REGIONAL CHIEF: 8/19/2013
(signature and date)

MANDATORY 10- YEAR REEVALUATION DATE: 2023

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: Brad Knudsen Date: 6/11/13

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: [signature] Date: 7/5/13

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 will occur from August 1 through August 31.

How would the use be conducted?
The use will 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 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 underwent extensive public review, including a comment period of 45 days following the release of the draft Comprehensive Conservation Plan/Environmental Assessment. We did not receive any comments specific to this dog training compatibility determination.

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 will occur from August 1 through 31.

The use will be 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 will 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 will be required to check in and out at the Hunting Control or Visitor Contact Station.

Retrieving dummies will be 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 will 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. Only the upland area used for dog training will be eliminated as part of this conversion to shrub-early succession habitat, while the two wetland sites, New Marsh and Cattail Pond, will continue to be open for waterfowl dog training

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: Brad Knudsen 6/11/13
(signature and date)

CONCURRENCE:

REGIONAL CHIEF: Scott B. Kahan 8/19/2013
(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: Brad Knudsen Date: 6/11/13

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: 7/5/13

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 feet 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 will 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 will 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 will 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 feet 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 will 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 underwent extensive public review, including a comment period of 45 days following the release of the draft Comprehensive Conservation Plan/Environmental Assessment. We received one comment from an individual that believes the refuge would be better off without domestic animals. The commenter stated that this would reduce one possible vector of disease transmission. We have not seen any evidence of disease transmission to date, but will reconsider this issue if we see evidence or receive additional information that would cause concern.

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, or 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: Brad Knudsen 6/11/13
(signature and date)

CONCURRENCE:

REGIONAL CHIEF: Sam B. Hamilton 8/19/2013
(signature and date)

MANDATORY 10-YEAR REEVALUATION DATE: 2023

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: Brad Knudsen Date: 6/11/13

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: [signature] Date: 7/5/13

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 will 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 will 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 will 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 will 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 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 to 4 or 5 hours in duration.

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 will 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 underwent extensive public review, including a comment period of 45 days following the release of the draft Comprehensive Conservation Plan/Environmental Assessment. We did not receive any comments specific to this search and rescue compatibility determination.

DETERMINATION (CHECK ONE BELOW):

___ Use is not compatible
_X_ Use is compatible with the following stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

- SAR exercises will 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 the refuge.

SIGNATURE:

REFUGE MANAGER: Brad Knudsen 6/11/13
(signature and date)

CONCURRENCE:

REGIONAL CHIEF: Scott B. Kahn 8/19/2013
(signature and date)

MANDATORY 10-YEAR REEVALUATION DATE: 2023

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: Brad Knudsen Date: 6/11/13

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: [signature] Date: 7/5/13

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 described as “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 will 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 will 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 will 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 will 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 will 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 2 to 3 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 underwent extensive public review, including a comment period of 45 days following the release of the draft Comprehensive Conservation Plan/Environmental Assessment. We did not receive any comments specific to this training compatibility determination.

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 described as “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: Brad Knudsen 6/11/13
(signature and date)

CONCURRENCE:

REGIONAL CHIEF: [signature] 8/19/2013
(signature and date)

MANDATORY 10-YEAR REEVALUATION DATE: 2023

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-footwide 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 powerline 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, and shrubs.

Long-term easements such as this are reevaluated 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 will coordinate with refuge staff prior to requesting access for non-emergency, planned vegetation control activities. This will 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 will 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 will 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 will 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 managed 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 will 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 will 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 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

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 underwent extensive public review, including a comment period of 45 days following the release of the draft CCP/environmental assessment. We did not receive any comment specific to this ROW compatibility determination.

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 the 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: Brad Knudsen 6/11/13
(signature and date)

CONCURRENCE:

REGIONAL CHIEF: Scott B. K 8/19/2013
(signature and date)

MANDATORY 10-YEAR REEVALUATION DATE: 2023

REFERENCES:

Droege, S., D. Bystrak (USGS), and T. Jones (USFWS). 2011. Personal communication.

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.

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 underwent extensive public review, including a comment period of

45 days following the release of the draft Comprehensive Conservation Plan/Environmental Assessment. We did not receive any comment specific to this Right-of-Way compatibility determination.

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: Brad Knudsen 6/11/13
(signature and date)

CONCURRENCE:

REGIONAL CHIEF: Sam B. Hamilton 8/19/2013
(signature and date)

MANDATORY 10-YEAR REEVALUATION DATE: 2023

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 encumbet 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 will 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 will coordinate with refuge staff prior to requesting access for non-emergency, planned vegetation control activities. Non-emergency, planned vegetation management and control activities will 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 will 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 will 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 Comprehensive Conservation Plan (CCP) 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 underwent extensive public review, including a comment period of 45 days following the release of the draft CCP/Environmental Assessment. We did not receive any comment specific to this ROW compatibility determination.

DETERMINATION (CHECK ONE BELOW):

___ Use is not compatible
_X_ Use is compatible with the following stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

The use will 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 forty-eight 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 the 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: Brad Knudsen 6/11/13
(signature and date)

CONCURRENCE:

REGIONAL CHIEF: Sam B. 16 8/19/2013
(signature and date)

MANDATORY 10-YEAR REEVALUATION DATE: 2023

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 10 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.). Law enforcement is responsible for a small portion of the estimated staff days, performing routine checks, policing parking, 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 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, 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. Conservation design recommendations regarding how far the edge effect can be 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 mowed and managed as turf grass immediately adjacent to the border of the refuge forest and as such, is 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 ball field would be 12.8 acres, more than doubling the size of the impacted habitat using the 90 meter (300 feet) distance factor. (This calculation uses only the east and south edge of the ball field 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. There is also frequent after hour trespass on the ball fields, as they are located outside the refuge access gate. This trespass is not of a serious nature in and of itself (Frisbee throwing, after hour access, etc.), but it is a violation of refuge regulations.

Research has not been conducted on the ball fields since the land was acquired in 1991 and cannot be conducted without either disruption to the operation of the ball fields or prohibitive

restrictions to the research. In addition, given its current condition as a recreational site, this parcel of land does not lend itself to wildlife research.

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 be restored 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 buffer area of 12.8 acres would become more attractive to forest interior dwelling bird species. These 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 Gaither's Run, a highly diverse tributary to the Little Patuxent River, and the Little Patuxent River itself, which is within approximately 150 yards of the ball fields. This area would be incorporated into the refuge's active habitat management plan; invasive species would be managed as needed, and where possible native species would be allowed to re-colonize through natural processes or be re-introduced. Forested buffers are some of the most effective nutrient and sediment buffers in nature. 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. In addition, forest litter and vegetation reduce sheetflow and reduce erosion from water coming from off-refuge. Currently, the softball fields are fertilized once a year, in the fall, to promote growth of the grass. Sediment from the ball fields has been observed flowing into Gaither's Run by refuge staff on multiple occasions over the years during and after heavy rain events.

The forested area that lies between the ball fields and Tipton Airport is almost completely edge habitat (using the 90 meter distance factor), and in two places the managed ball field 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 ball field be converted to forest. It would increase the effective interior of the forested area that lies east of the Little Patuxent River and is bounded by Route 198 and Bald Eagle Drive and would enhance its corridor or connectivity value. This increase in forest interior would directly benefit forest interior dwelling bird species, a focal species of the CCP. Increasing forest interior habitat and habitat connectivity is the core focus of refuge management in the CCP, and is moving forward elsewhere on the refuge where grasslands are being consolidated and impoundments reverted to increase forest habitat on the refuge. 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 storm water (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. 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. However, this use conflicts with the other refuge purposes in that it creates an unnatural environment that is used for softball games and associated parking. Continuing 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 refuge's migratory bird purposes, because these highly impacted lands, and associated buffer lands, provide little to no habitat value for migratory birds. In particular this use materially interferes with management for forest interior dwelling bird species which are identified as a focal species in the CCP. 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 conservation of wildlife and habitats.

SIGNATURE:

REFUGE MANAGER: Brad Knudson 9/10/13
(signature and date)

CONCURRENCE:

REGIONAL CHIEF: Scott B. Kahan
(signature and date)

MANDATORY 10-YEAR REEVALUATION DATE: 2023

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†
1	Maintenance worker (grounds)	-	$82,967	$82,967	1.0
2	Provide resource, facility, and visitor protection (law enforcement)	-	$150,000	$150,000	1.0
3	Enhance visitor services program in the area	-	$128,072	$128,072	1.0
4	Develop range design to restore 2,000 acres of refuge habitat	$100,000	-	$100,000	-
5	Maintenance worker (buildings)	-	$82,967	$82,967	1.0
6	Park ranger (interpretation)	-	$105,858	$105,858	1.0
7	Conduct forest health assessment and provide enhanced forest management (forester)	-	$153,506	$153,506	1.0
8	Provide enhanced habitat management (biologist)	-	$105,858	$105,858	1.0
9	Develop two cultural and historical interactive touch-screen kiosks	-	$80,000	$80,000	-
10	Global climate change and its effects on forested habitats	$250,000	$10,000	$260,000	-
11	Control invasive plant species along the floodplain	$70,000	$22,000	$130,815	1.0
12	Conduct a watershed assessment of the Patuxent Research Refuge	$200,000	-	$200,000	-
13	Restore riparian habitat	$200,000	-	$200,000	-
	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 #	Description	Cost
01111639	Remove and Replace Quarters 2	$500,000
01113586	Stabilize Historic Snowden hall	$1,631,400
01118043	Nelson Lab HVAC replacement (geothermal system)	$671,000
2006508071	Nelson Lab Communications Electric & Plumbing Repairs	$281,000
2012213807	Nelson lab Interior Finishes	$397,900
2013226786	Nelson Lab Finish 2nd floor	$179,100
2013226787	Exterior Drainage and ADA Access Upgrades	$165,400
01118069	Demolish Henshaw Lab	$150,000
04134293	Rehabilitate Merriam Laboratory P1 Structural repairs & building Envelope	$1,200,000
04134302	Rehabilitate Merriam Laboratory P2 HVAC Geothermal	$1,300,000
04134316	Rehabilitate Merriam Laboratory P3 Interior Partitions, HVAC & Plumbing	$1,100,000
2007731584	Rehabilitate Merriam Laboratory P4 Electrical and communications (child)	$1,000,000
2013227455	Rehabilitate Merriam Laboratory P5 Interior Finishes & HVAC Commissioning	$950,000
01111643	Rehabilitate Quarters 48	$144,000
2007731586	Rehabilitate Quarters 49 Windows	$94,000
2007731203	Renovate Quarters 50 (Apartment #1,2,3,4)	$400,000
01113319	Remove and Replace Quarters 51	$500,000
01111034	Rehabilitate Service Garage 52	$169,100
2013227730	Rehabilitate Service Garage 53	$53,300
2007729509	Remove and Replace Quarters 64	$500,000
01113323	Remove and Replace Quarters 65	$500,000
01111629	Rehabilitate Merriam Garage	$105,900
01113325	Rehabilitate Quarters 80	$167,000
2008859866	Rehab Service Garage #89	$92,400
2010133230	Remove and Replace Salt Shed	$164,000
2006508018	Rehabilitate Service Building	$2,357,800
02120075	Demolish Building 158	$110,000
01113327	Demolish Quarters 160	$90,000
01113328	Demolish Quarters 161	$90,000
01113329	Demolish Quarters 162	$90,000
02120078	Replace Building 165	$150,000
2013227006	Demolish Building 165	$100,000
02120079	Demolish Building 167	$100,000
2013227007	Demolish Building 171/Well #9	$20,000

Project #	Description	Cost
2007732011	Rehabilitate Dike on Hobbs Pond Impoundment E.S. Area	$53,000
2007732013	Replace Spillway and Culvert on Hance Pond I	$11,000
01111788	Replace Knowles II Water Control Structures	$68,000
2005199823	Replace Water Control Structure at Knowles III	$51,000
2007720147	Rehabilitate Route 197 ES Fencing	$845,000
2005199799	Rehabilitate Route 197 Fencing	$868,000
98109897	Rehabilitate Central Tract Paved Roads	$522,000
2012218582	Replace Millrace Culvert and Headwalls (design)	$37,600
01111684	Replace Millrace Culvert and Headwalls	$399,300
01111687	Replace Culvert at Mill Race Road by "M" Pond	$47,000
2013227048	Demolish South Tract Sewer System #615	$25,000
02121357	Replace HVAC system at North Tract Visitor Contact Station	$30,500
04134325	Replace Visitor Center Roof - Design	$61,531
04134327	Rehabilitate Visitor Center by Replacing Flat Roof	$1,485,731
2013227050	Install Solar Energy System at Visitor Center	$25,000
01110813	Remove Military Storage Buildings	$12,600
2013227690	Convert North Tract Electric Distribution to BGE Standards	$450,000
2007732130	Rehabilitate D/E Road Route 432	$100,000
99104957	Replace North Tract Refuge Boundary Fences, Signs and Path	$516,000
2013227687	Replace Viewing Tower at North Tract Wildlife Viewing Area	$250,000
01110812	Remove Military Utilities - Waterline, Telephone Poles, and Fences	$418,000
2007732009	Rehabilitate Floating Walkways	$32,745
2007732168	Rehabilitate Powder Mill Road #836	$553,100
2007732041	Replace Culverts on Rogue Harbor at North Tract	$157,500
99104944	Install Agri-drain Water Control Station on Snowden Pond	$50,000
2008857576	Remove Water Control Structure on Bluegill	$8,000
04133340	Construct Admin Building for Migratory Bird (child)	$10,338,000
	Replace Roof Coburn Area Service Garage	$25,000
	Rehabilitate Ranges 2-8	$9,000,000
Total		**$41,963,907**

Appendix E.

USFWS

Snowden Hall

Memorandum of Agreement between the U.S. Fish and Wildlife Service, the U.S. Geological Survey, 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

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

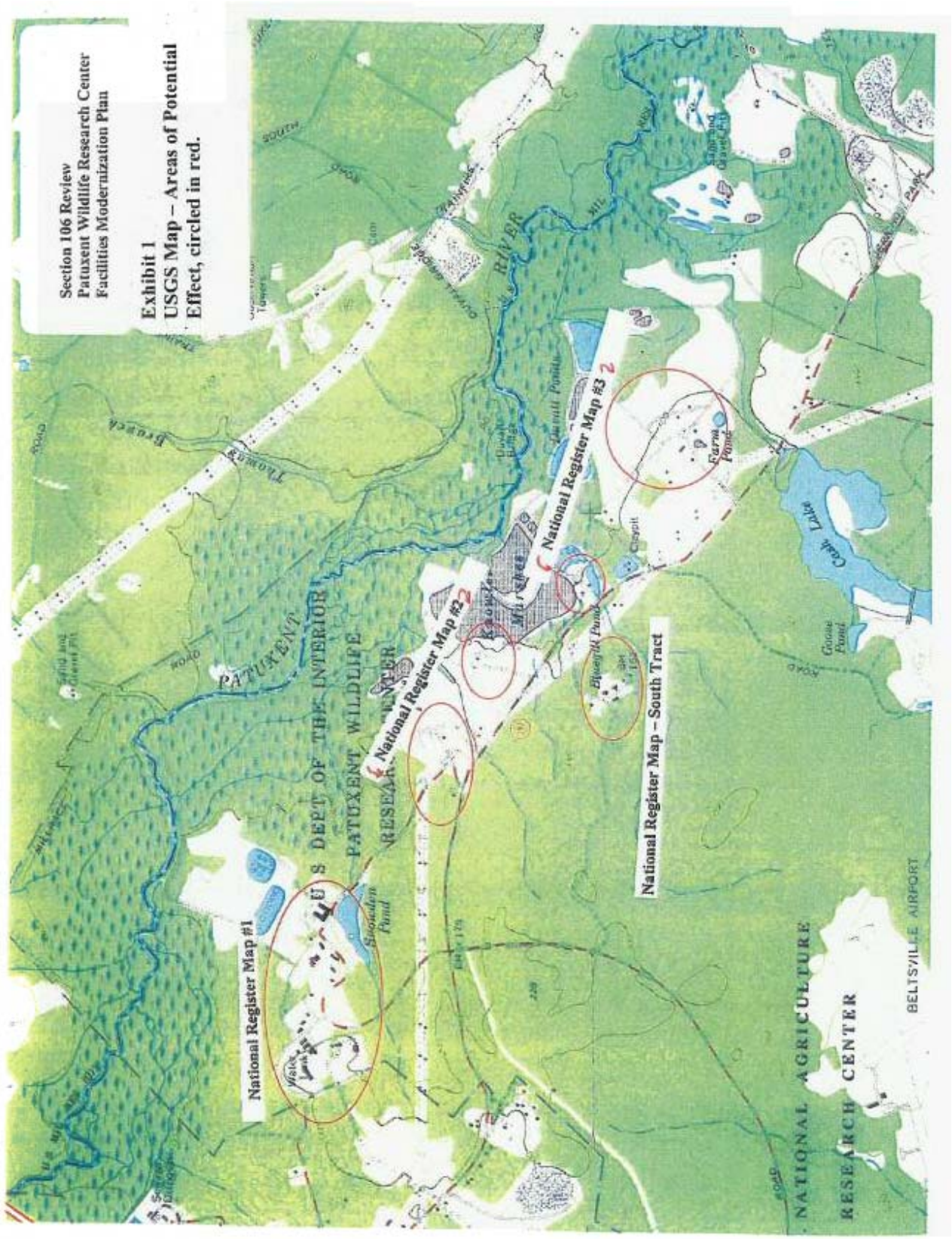

Section 106 Review
Patuxent Wildlife Research Center
Facilities Modernization Plan
Exhibit 1
USGS Map – Areas of Potential
Effect, circled in red.
National Register Map #1
National Register Map #2
National Register Map #3
National Register Map – South Tract
PATUXENT
U S DEPT OF THE INTERIOR
PATUXENT WILDLIFE
RESEARCH CENTER
NATIONAL AGRICULTURE
RESEARCH CENTER
BELTSVILLE AIRPORT

Exhibit 2
Patuxent Research Refuge Historic District – Historic Structures Slate for Demolition (1 of 3)

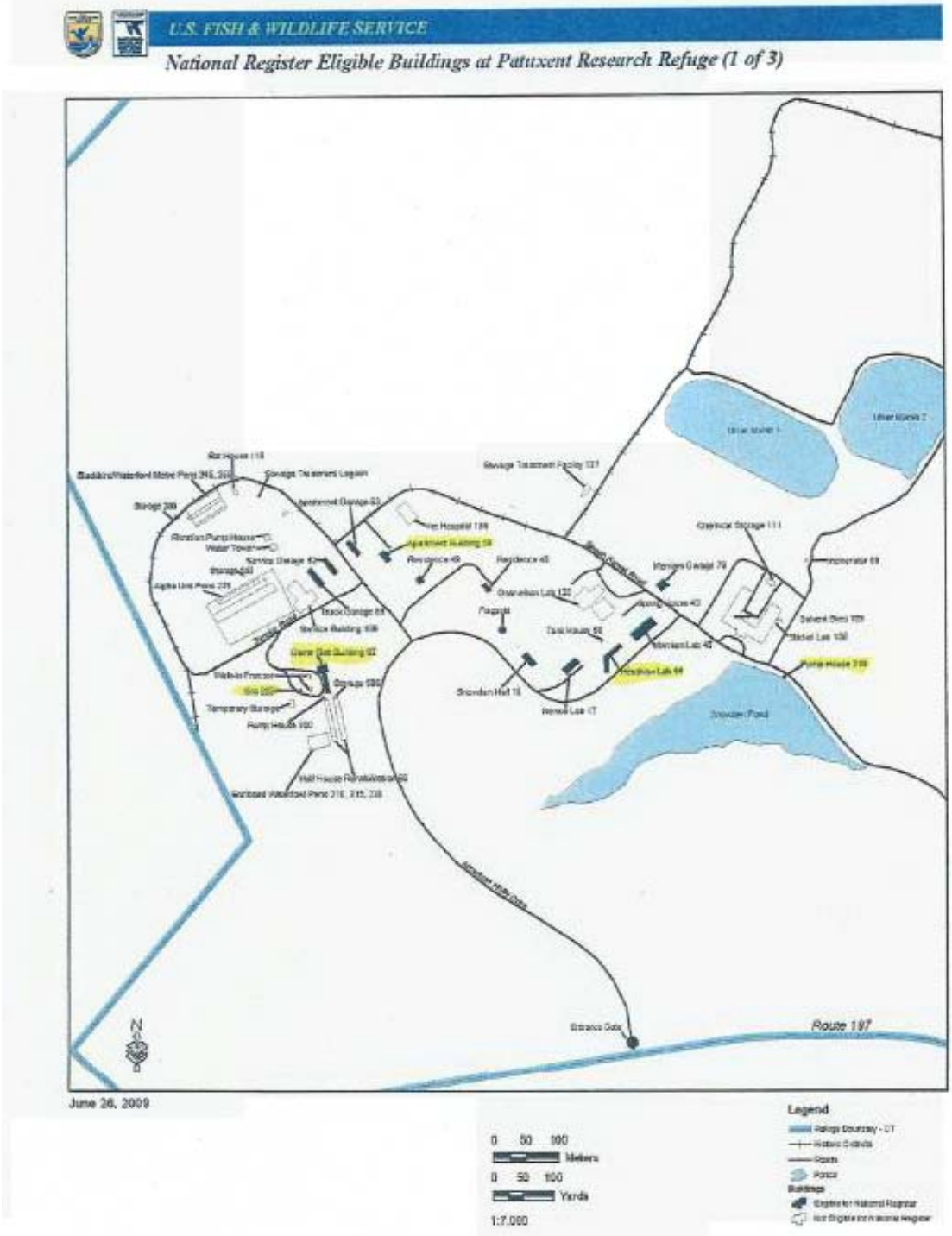


Exhibit 3
Patuxent Research Refuge Historic District – Historic Structures Slate for Demolition (2 of 3)

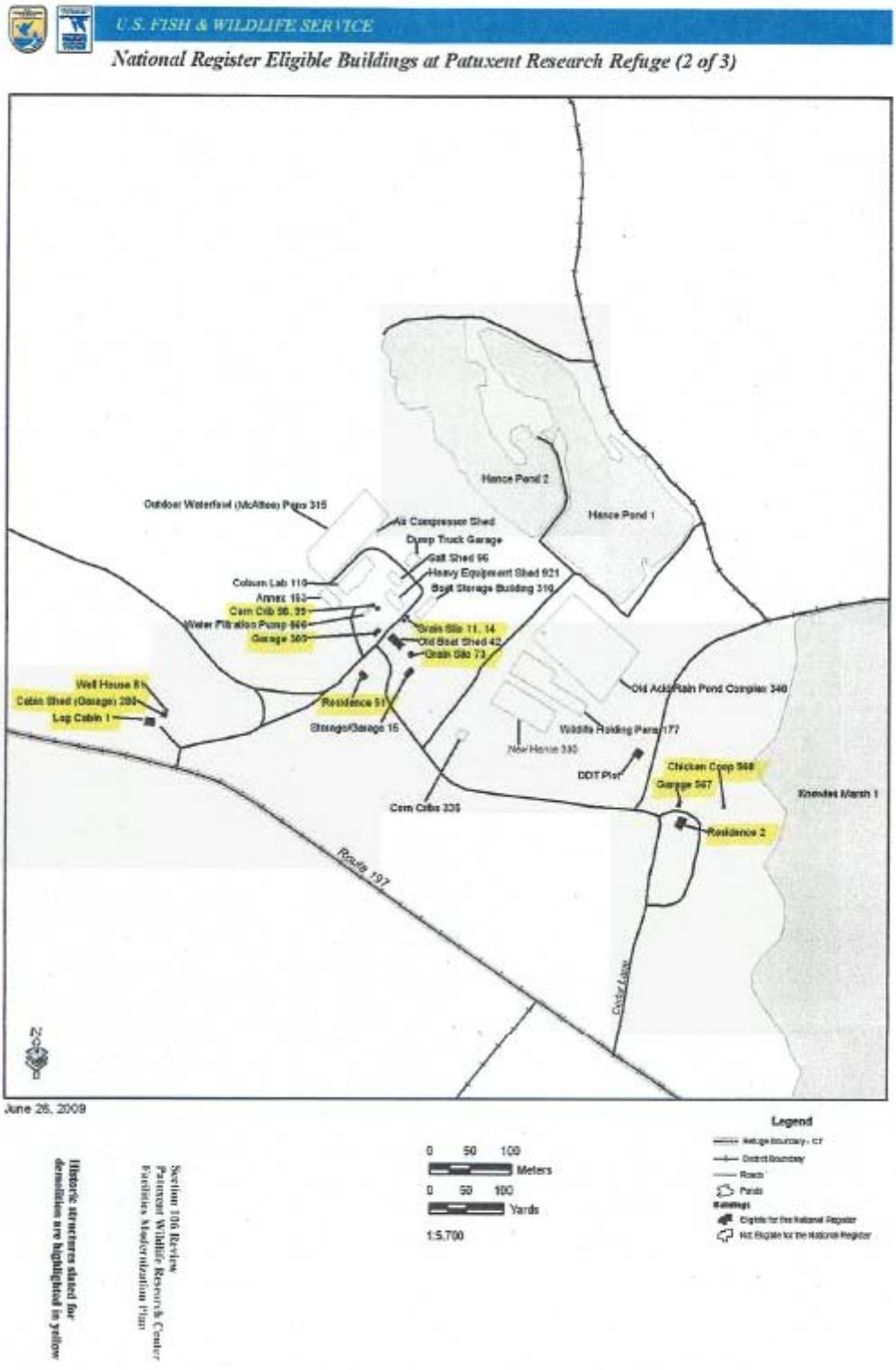
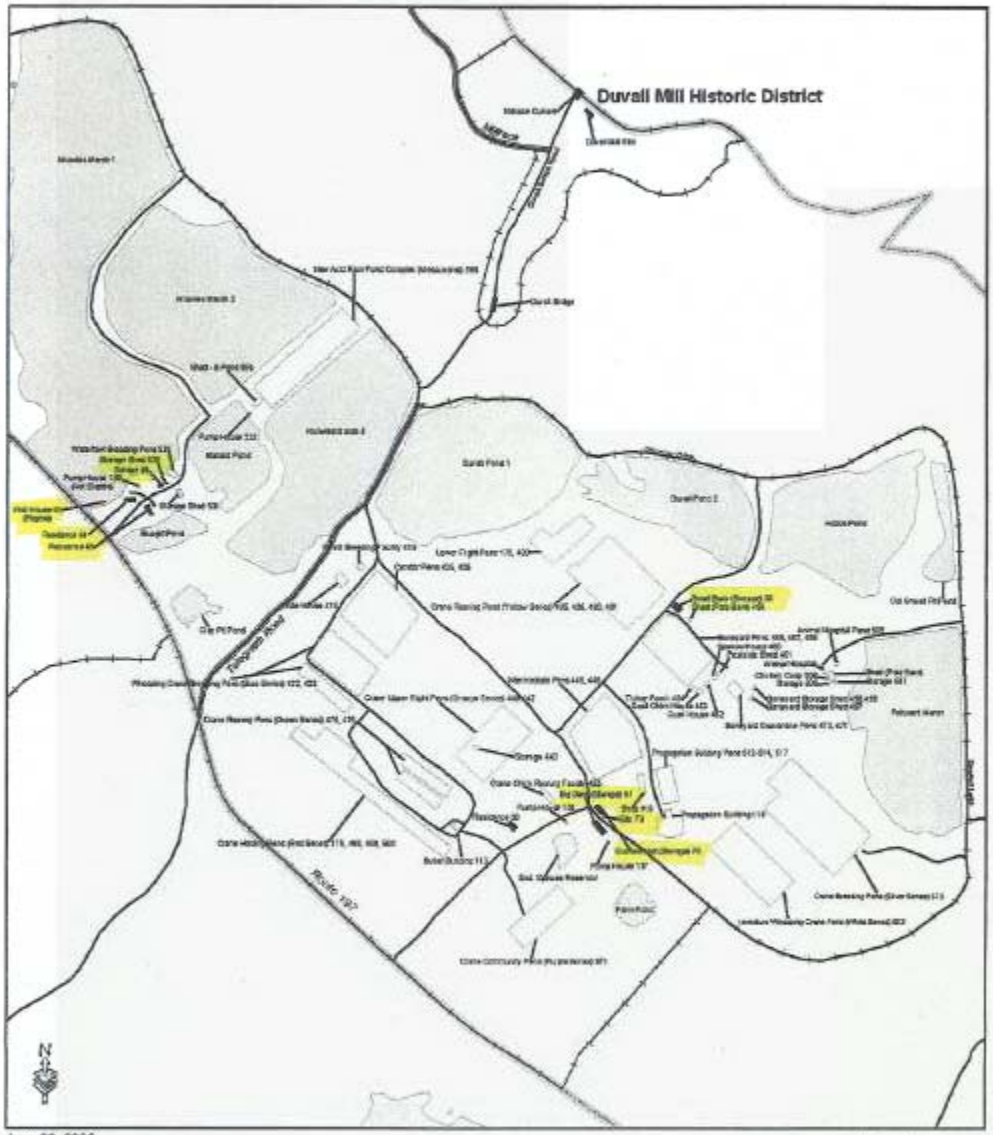


Exhibit 4
Patuxent Research Refuge
Historic District – Historic Structures Slate for Demolition (3 of 3)

U.S. FISH & WILDLIFE SERVICE

National Register Eligible Buildings at Patuxent Research Refuge (3 of 3)



June 26, 2009

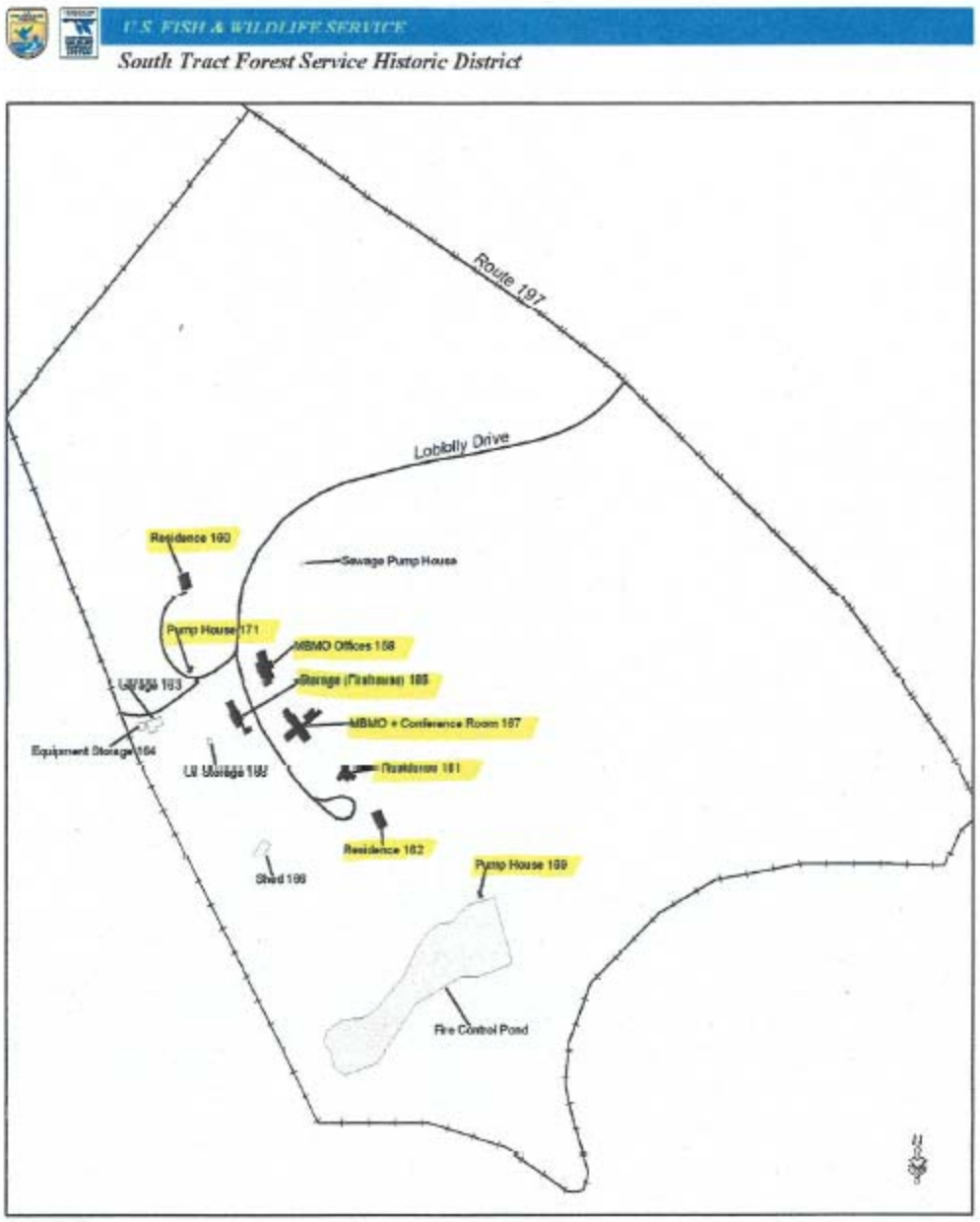
0 50 100 Meters
0 50 100 Yards
1:8,800

Legend
Refuge Boundary - CT
District Boundary
Roads
Historic Roads
Ponds
Buildings
Eligible for National Register
Not Eligible for National Register

Historic structures slated for demolition 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.

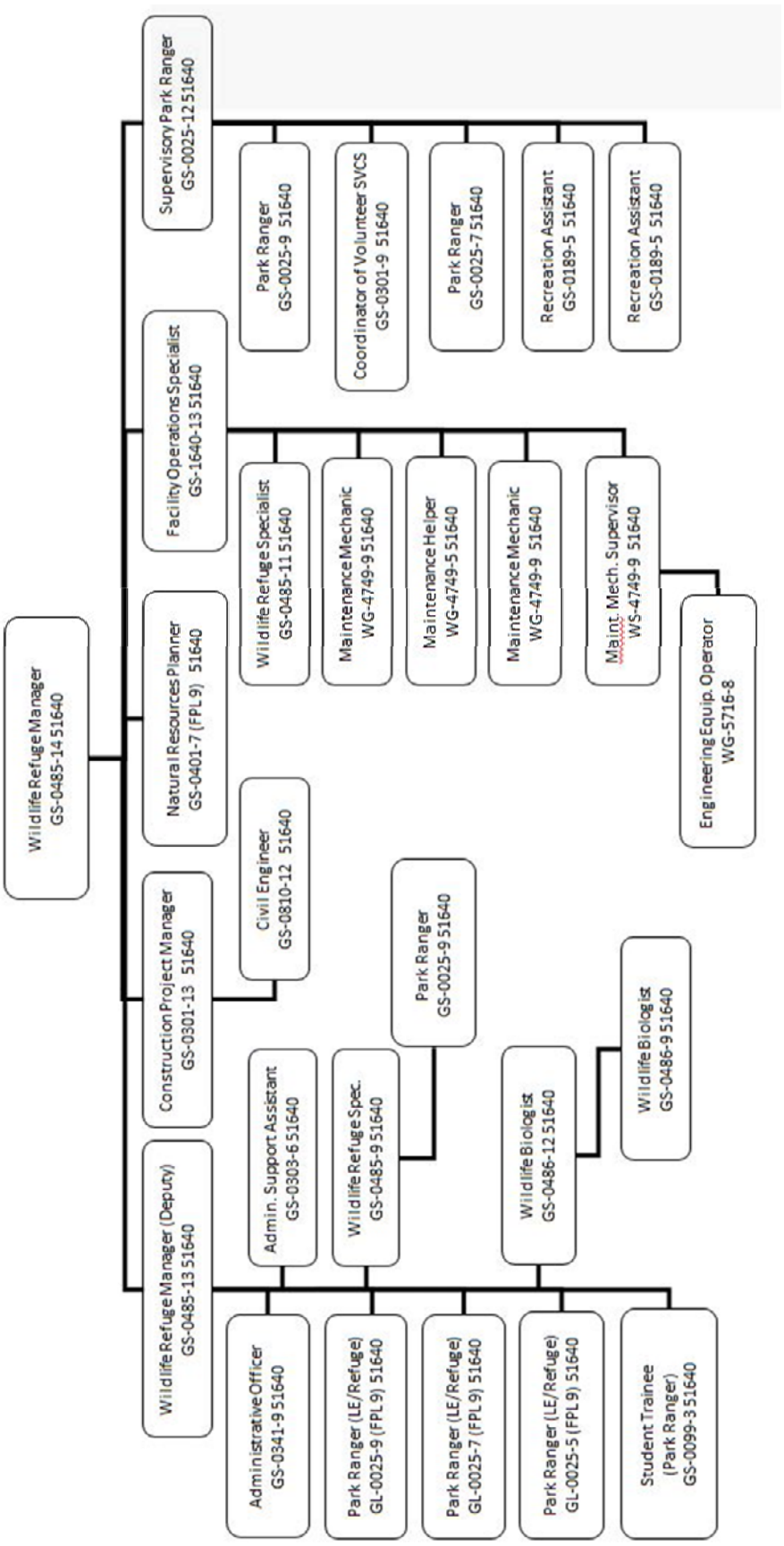
Appendix F.

USFWS

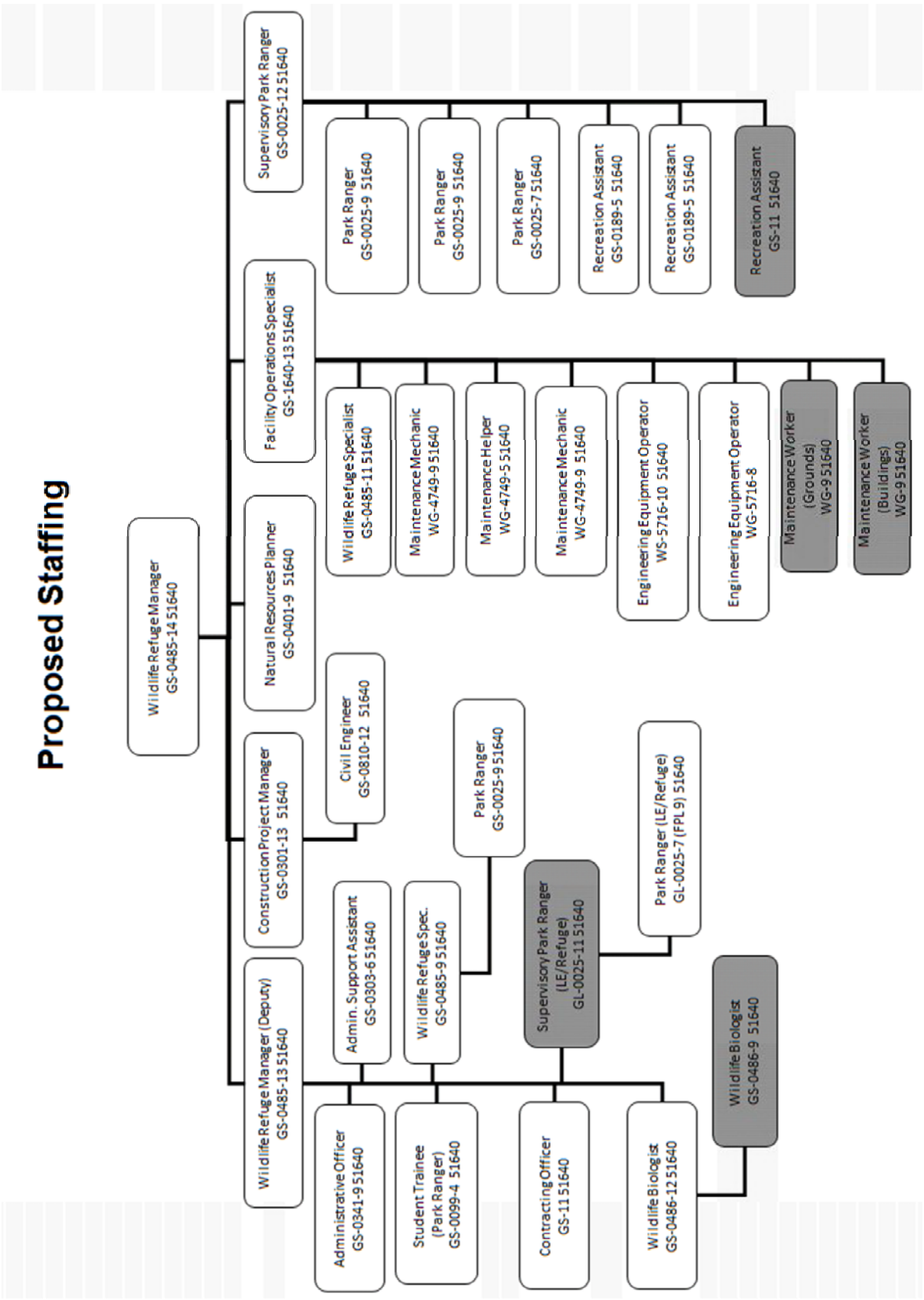
Refuge Staff with Visitor

Staffing Charts

Current Staffing Chart



Proposed Staffing



Appendix G.

Patuxent Research Refuge Impoundment Structured Decision-making Summary Report

March 30, 2012

Table of Contents

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.

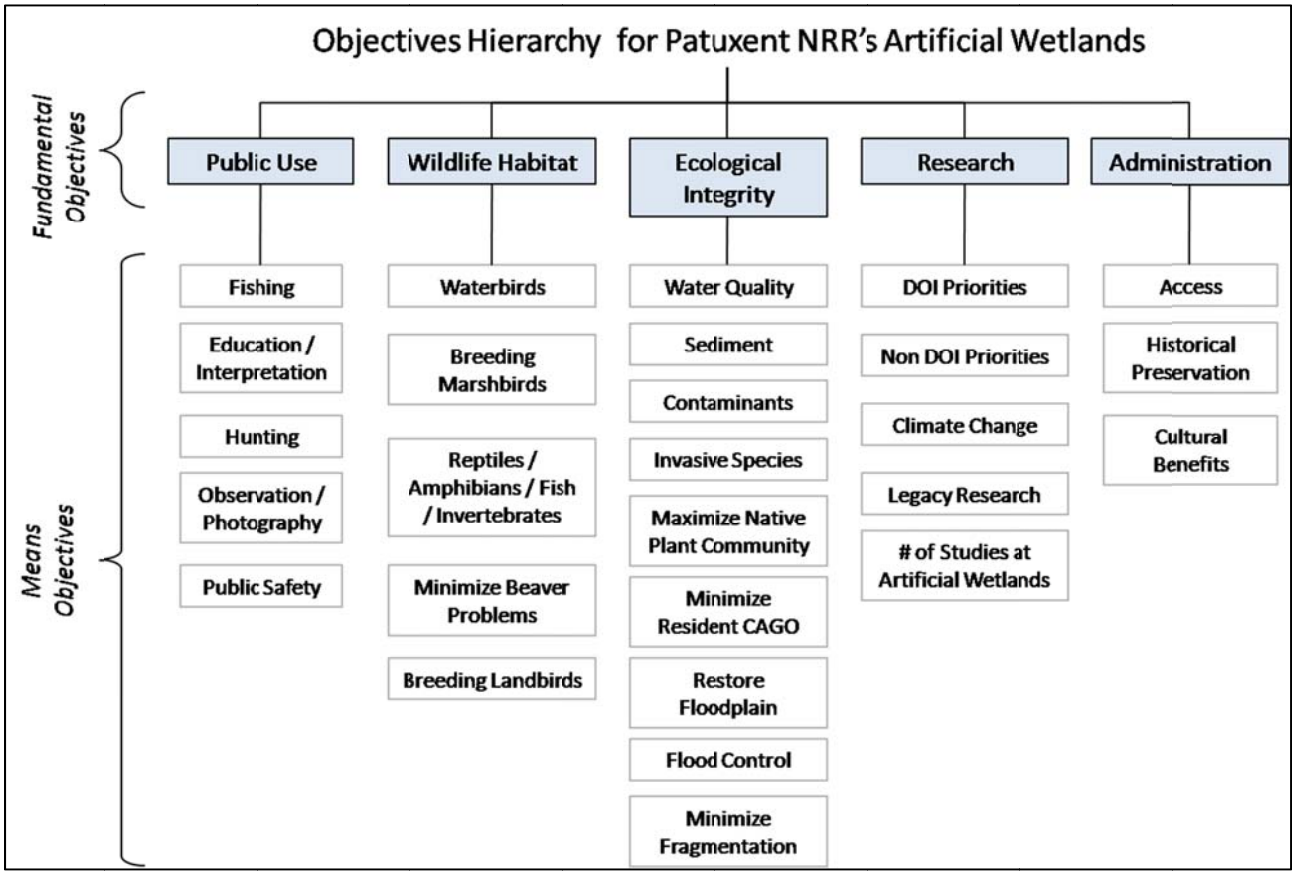
3. Objectives for the Wetland Decision Analysis

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

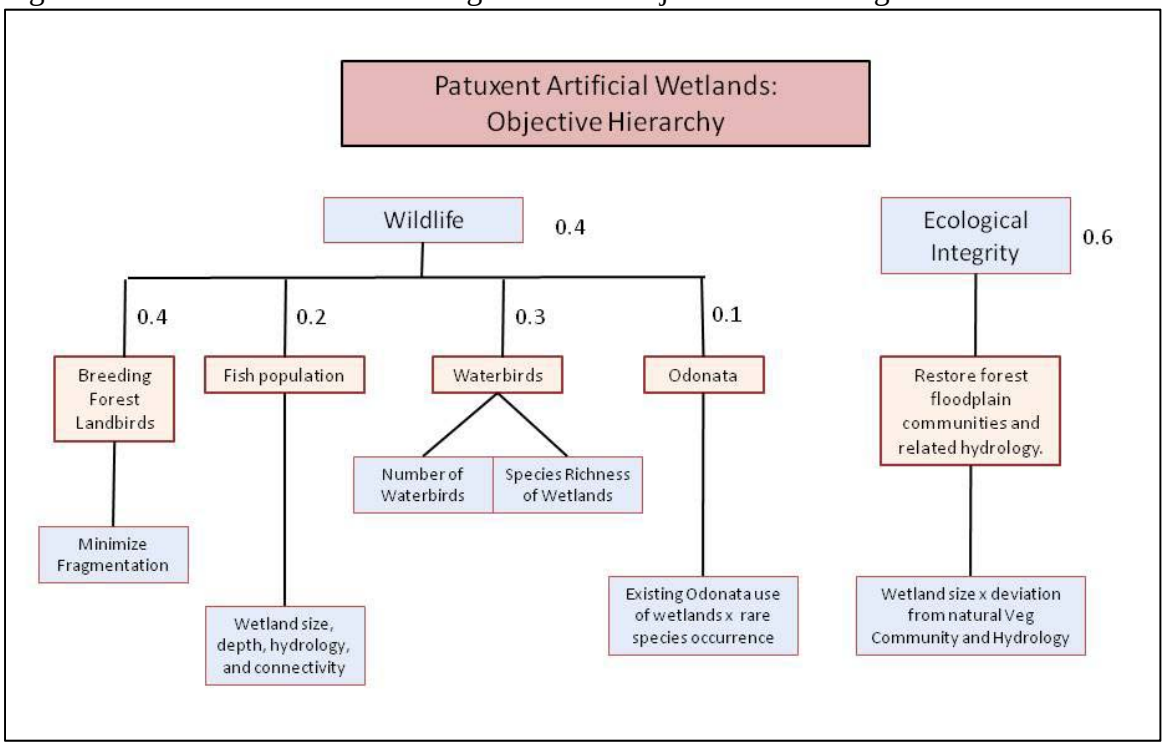
5. Ecological Integrity

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:

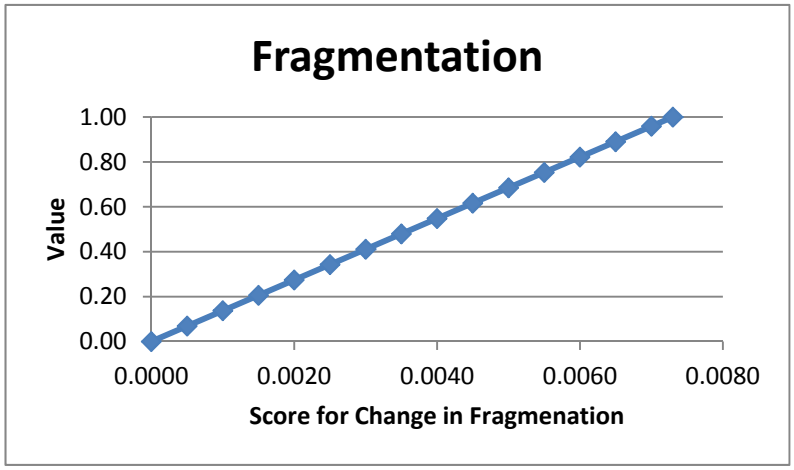
Value	Integrity Value Description
0	Wetland managed with static water regime and altered vegetation community that is not associated with the ecological system.
1	Wetland managed with modified hydrology (dynamic water levels within impoundments) and altered vegetation community that is not associated 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

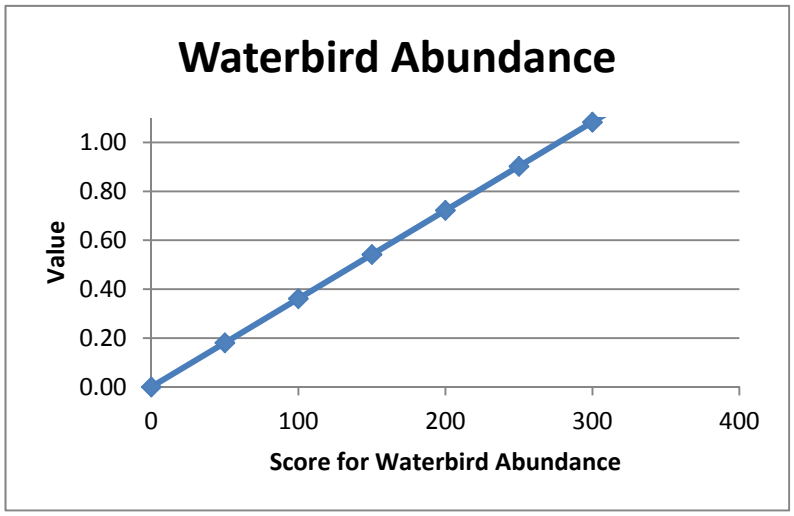
For this decision, we have five objectives we are trying to achieve for each wetland. This is therefore called a multiobjective analysis. To conduct a multiobjective analysis, is it necessary to determine a value function, which combines the evaluation measures of the five objectives into a single measure of the overall value of each of the alternatives for a wetland.

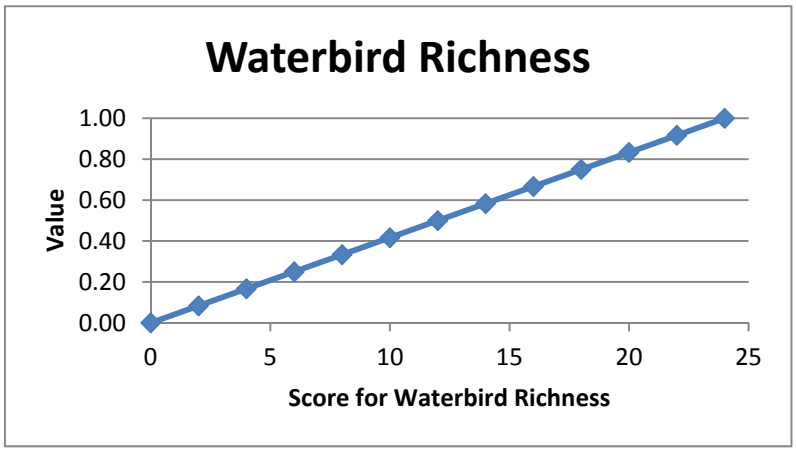
Each objective has a unique evaluation measure, a unique score. For instance, integrity is a combination of wetland size (1 to 4) and an integrity value (1 to 3), while waterbird use is the averaged maximum number of waterbirds surveyed over a 14-year period (0 to 350). The objective scores need to be 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**

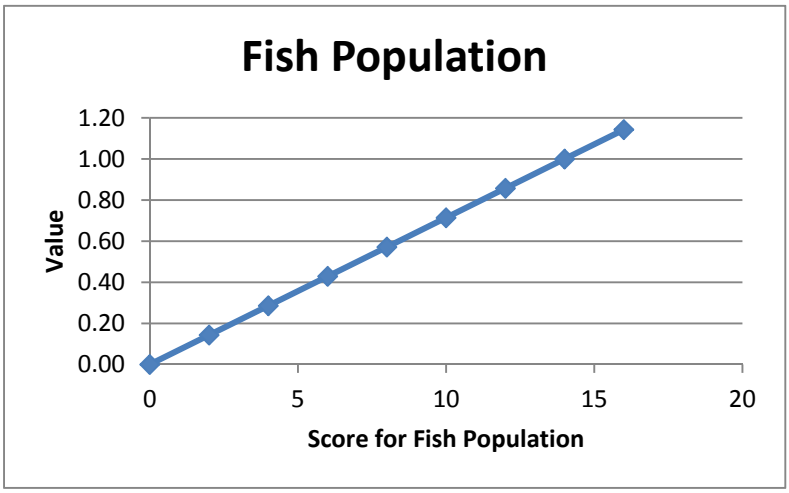


2. **Waterbirds**

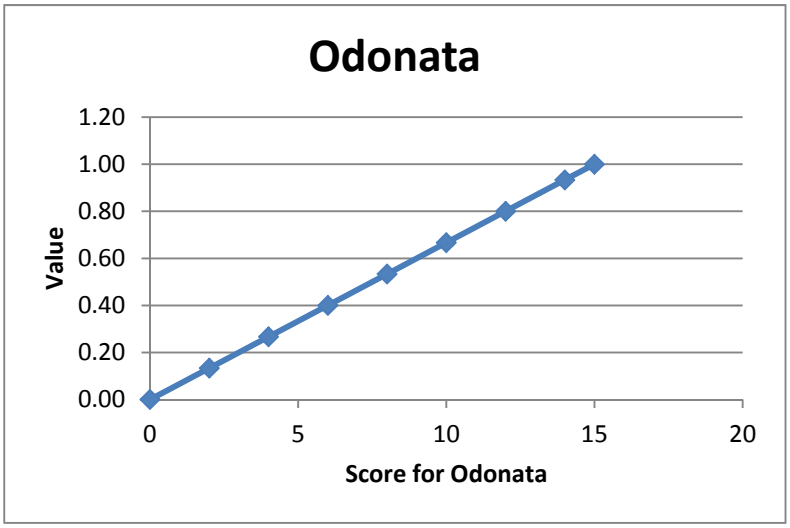




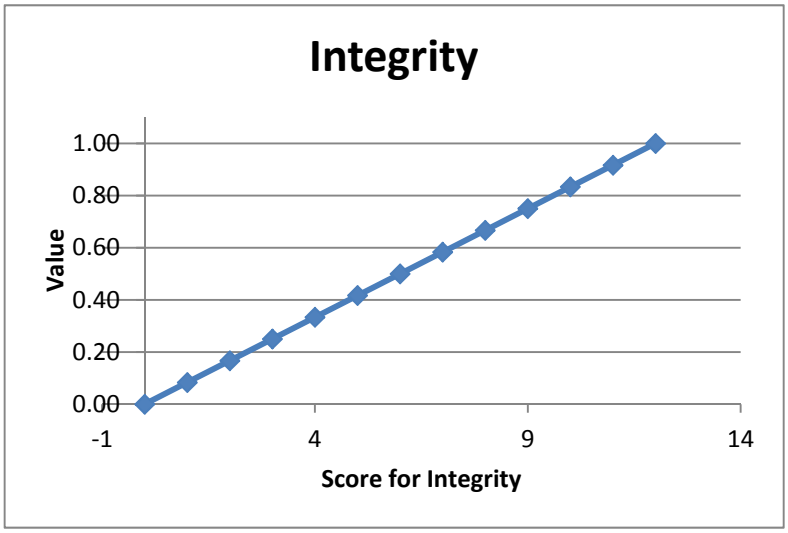
3. Fish



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

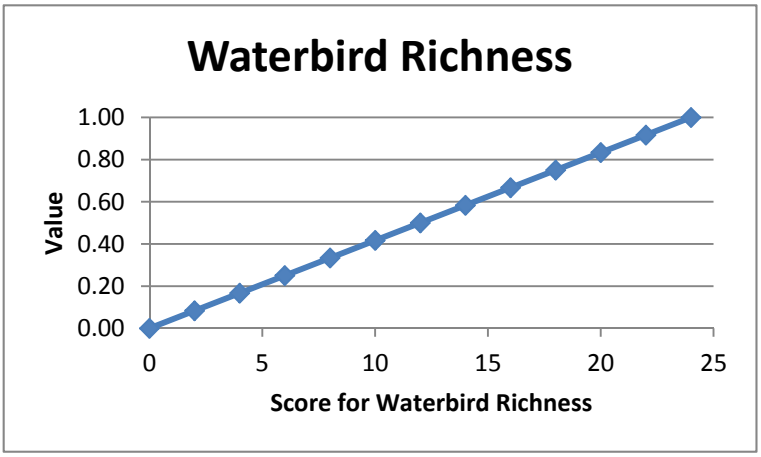
4. **Develop Evaluation Measures for the Objectives**
   As discussed in section 5:

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 culv	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)		0.002	0.013	0.003		

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)							

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

Under the management plan presented in the refuge final CCP, the refuge will 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

Appendix H.

USFWS

Fishing Day

Finding of No Significant Impact (FONSI)

Finding of No Significant Impact

In October 2012, the U.S. Fish and Wildlife Service (Service) published the Patuxent Research Refuge (RR) draft Comprehensive Conservation Plan and Environmental Assessment (CCP/EA), which is hereby incorporated by reference. Patuxent RR 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 to serve "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." Since 1936, the refuge has grown from 2,679 acres to 12,841 acres.

The Patuxent RR draft CCP/EA outlines three alternatives for managing the refuge over the next 15 years. It carefully considers their direct, indirect, and cumulative impacts on the environment and their potential contribution to the mission of the National Wildlife Refuge System (Refuge System). The draft CCP/EA restates the refuge's purposes, creates a vision for the next 15 years, and proposes seven goals to be achieved through plan implementation. Alternative B is identified as the Service-preferred alternative. Chapter 3 in the draft CCP/EA details the respective goals, objectives, and strategies for each of the three alternatives, and chapter 4 of the draft CCP/EA describes the consequences of implementing those actions under each alternative. The draft plan's appendixes provide additional information supporting the assessment and specific proposals in alternative B. A brief overview of each alternative follows:

Alternative A (Current Management)

> This alternative satisfies the National Environmental Policy Act (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. It would maintain our present levels of approved refuge staffing and the biological and visitor programs now in place. 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 provide an active visitor use program that supports environmental education and interpretation, hunting, fishing, and wildlife observation and photography.

Alternative B (Forest Restoration and Mixed Public Use)

> This alternative is the Service-preferred alternative. It combines the actions we believe would most effectively achieve the refuge's purposes, vision, and goals, and respond to the issues raised during the scoping period. It 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 of a number of impoundments and grasslands to forested areas to support forest interior-dwelling bird species and other forest-dependent species. In addition, alternative B strives to promote wildlife-dependent public uses, while allowing for nonwildlife-dependent public uses. In particular, it promotes higher quality hunting and

fishing programs; expands wildlife observation, and photography opportunities; and initiates new interpretive program and environmental education opportunities.

Alternative C (Maximize Forest Interior Restoration and Emphasize Wildlife-dependent Public Use Activities)

Alternative C would focus on 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 nonwildlife-dependent uses, particularly by expanding wildlife observation, and photography opportunities, and reducing the number of special events and interpretive programming.

We distributed the draft CCP/EA for a 45-day period of public review and comment from October 10 to November 26, 2012. We received 73 letters, calls, or emails representing individuals, organizations, and State agencies, and had approximately 30 people attend two public meetings held on October 22 and 23, 2012. Appendix I in the final CCP includes a summary of those comments and our responses to them.

After reviewing the proposed management actions, and considering all substantive public comments and our responses to them, we have determined that the analysis in the EA is sufficient to support our findings. We are selecting alternative B, as presented in the draft CCP/EA with the following changes recommended by the planning team, to implement as the final CCP. Changes we made in the final CCP include the following:

- We determined that individuals participating in horseback riding will not be required to clean up horse manure along the trails. We encourage individuals to do so if they are able, but we recognize that requiring riders to dismount could increase the possibility of injury. We will work with local riding groups to develop options for clean-up of specific areas as necessary.

- We determined that individuals participating in horseback riding will be allowed to travel at speeds other than a walk. They should take precautions when approaching other users and reduce speeds accordingly.

- We corrected all format and typographical errors that were brought to our attention.

We conclude that alternative B, with the above changes, in comparison to the other two alternatives will: (1) best fulfill the mission of the Refuge System; (2) best achieve the refuge's purpose, vision, and goals; (3) best maintain and, where appropriate, restore the refuge's ecological integrity; (4) best address the major issues identified during the planning process; and (5) be most consistent with the principles of sound fish and wildlife management. Specifically, in comparison to the other two alternatives, alternative B provides the biggest increase in the diversity, integrity, and health of high-quality habitats through enhanced habitat management. It also provides the most reasonable and effective improvements to existing public use programs that are in demand, with minimal impacts to wildlife and habitats. The plans to increase staffing

and improve and expand infrastructure are reasonable, feasible, and will result in the most efficient management of the refuge and best serve the American public.

We have reviewed the predicted beneficial and adverse impacts with alternative B that are presented in chapter 4 of the draft CCP/EA, and compared them to the other alternatives. We specifically reviewed the context and intensity of those predicted impacts over the short- and long-term, and considered the cumulative effects. The review of each of the NEPA factors to assess whether there will be significant environmental effects is summarized here (40 C.F.R. 1508.27).

(1) Beneficial and adverse effects: We expect the final CCP (alternative B) management actions to benefit both the wildlife and habitats at Patuxent RR. Important examples include changes to management of impoundments to restore natural function to the floodplain forest, efforts to reduce forest fragmentation, restoration, and management of rare pine savannah habitat, and management of a variety of other habitats on the refuge to benefit breeding and migrating songbirds, waterfowl, and raptors, as well as amphibians, reptiles, and mammals of conservation concern. Except for potentially restoring some of the impoundments, benefits will not result from any major change in management strategy; rather, they will be incremental to the effects of current management. As stated in the draft CCP/EA, we will complete any additional compliance with applicable laws before implementing any restoration of the impoundments. Therefore, we do not anticipate any significant beneficial or adverse effect on the human environment.

(2) Public health and safety: We expect the good safety record of the refuge to continue based on the protective actions provided in the stipulations of the compatibility determination for each of the authorized public uses on the refuge. There should be no significant impact on public health and safety from the implementation of the CCP.

(3) Unique characteristics of the area: The primary, unique characteristic of Patuxent RR is its large forest tracts in proximity to urban Baltimore, MD and Washington, DC. We expect the preservation and restoration measures in the CCP, such as increased efforts at forest restoration and control of nonnative invasive species, to benefit these forests, and to benefit the surrounding habitats. In addition, as the only national wildlife refuge with wildlife research as a primary purpose, refuge staff will continue to look for opportunities to conduct or allow research, especially when it provides information valuable for refuge management or Department of Interior priorities. As in (1), the benefits will be incremental to the effects of the ongoing management measures originally instituted to protect these resources. Thus, we do not expect these incremental benefits to result in a significant impact on the human environment.

(4) Highly controversial effects: The management actions in the final CCP such as invasive species control, habitat restoration, deer control, and wildlife-dependent recreational uses are time-tested measures. Their effects on the refuge are widely known from past management and monitoring. There is no scientific controversy over what these effects will be; thus, there is little risk of any unexpectedly significant effects on the environment.

(5) Highly uncertain effects or unknown risks: The management actions in the final CCP are evolutionary. They are mostly refinements of the existing management measures that we have

used for many years. We will implement a comprehensive monitoring program to reassess the effectiveness of each planned improvement. With the data available on the current management results and the system in place to adjust for any unplanned effect, we do not find a high degree of uncertainty or unknown risk that the CCP will cause any significant impact on the environment.

(6) Precedent for future actions with significant effects: The purpose of the CCP is to establish the precedent for managing the refuge for up to 15 years. The effects of that management are designed as gradual improvements over the existing conditions, not global changes. For example, strategies such as expanding environmental education and restoring floodplain forest will be completed over several years. Therefore, we do not expect this precedent to cause any significant impact on the environment.

(7) Cumulatively significant impacts: The CCP provides the programmatic, long-term management plan for the refuge. We plan to coordinate with surrounding land managers to promote common goals such as managing wildlife, habitat, and public use to minimize potential conflicts. Our management jurisdiction is limited, however, to the refuge lands, and we do not foresee any of the coordinated activities rising to the level of a significant effect on the environment. Within the term of the CCP, we intend to pursue additional projects such as constructing a boardwalk, additional trails, and expanding the refuge administrative offices. We will examine the cumulative effects of all projects under the CCP before they are approved, and we will conduct whatever level of additional NEPA review is warranted.

(8) Effects on scientific, cultural, or historical resources: Evaluation of archaeological resources presented in the draft CCP/EA showed no significant impacts on these resources from the planned management activities. Service archaeologists in the Northeast Regional Office keep an inventory of known sites and structures, and ensure that we consider them in planning new ground-disturbing or structure-altering changes to the refuge. Throughout the implementation of the CCP, we will continue to consult with the Maryland Historic Preservation Office on any ground-disturbing activities (e.g., expanding administrative offices) and other projects that might affect cultural resources.

(9) Effects on Endangered Species Act (ESA)-listed species and habitats: As detailed in the CCP, we have contacted the Service's Chesapeake Bay Ecological Services Field Office under Section 7 of the ESA. No ESA-listed species are expected to occur on the refuge. The CCP also protects the delisted bald eagle. Our management actions are designed to preserve and improve the existing habitat for this species, and there is no ESA-designated, critical habitat on the refuge. Therefore, we anticipate no effects on ESA resources.

(10) Threat of violating any environmental law: Our habitat management actions are designed to benefit the environment. They will comply with all applicable protections such as the Clean Water Act and the Clean Air Act. Pursuant to the National Wildlife Refuge System Administration Act (16 U.S.C. 668dd(e)(3), 668dd(m)), our public hunting and fishing programs under the CCP requires all participants to comply with State regulations. We do not anticipate a threat that the CCP will violate any environmental law or cause any significant impact on the environment.

Based on this review, we find that implementing alternative B will not have a significant impact on the quality of the human environment, in accordance with Section 102(2)(c) of NEPA. Therefore, we have concluded that an Environmental Impact Statement is not required, and this FONSI is appropriate and warranted.

September 30, 2013

Wendi Weber
Regional Director
U.S. Fish and Wildlife Service
Hadley, Massachusetts

Date

Appendix I.

Thomas Tetzner/USFWS

Northern Cardinal

Summary of Responses to Substantive Public Comments on the Draft Comprehensive Conservation Plan and Environmental Assessment

Introduction

In October 2012, the U.S. Fish and Wildlife Service (Service, we, our) completed the draft Comprehensive Conservation Plan and Environmental Assessment (CCP/EA) for Patuxent Research Refuge (RR, the refuge). The draft CCP/EA outlines three alternatives for managing the refuge. Alternative B is identified as the "Service-preferred alternative."

We released the draft CCP/EA for 45 days of public review and comment from October 11 to November 26, 2012. We held three public open house meetings to present the alternatives evaluated in the draft CCP/EA. We received 75 letters, calls, or emails representing individuals, organizations, and State agencies, and had approximately 30 people attend two public meetings held on October 22 and 23, 2012. We evaluated all the letters and emails sent to us during that comment period, along with comments recorded at our public meeting. This document summarizes all of the substantive comments we received and provides our responses to them.

Based on our analysis in the draft CCP/EA and our evaluation of comments received on that document, we determined that no significant modifications to the Service-preferred alternative (alternative B) as originally presented in the draft CCP/EA were necessary, and it was recommended to our Regional Director for implementation as the final CCP. We have determined that publishing a revised or amended draft CCP/EA is not warranted.

Changes we made in the final CCP include:

- We determined that individuals participating in horseback riding will not be required to clean up horse manure along the trails. We encourage individuals to do so if they are able, but we recognize that requiring riders to dismount could increase the possibility of injury. We will work with local riding groups to develop options for clean-up of specific areas as necessary.
- We determined that individuals participating in horseback riding will be allowed to travel at speeds other than a walk.
- Minor formatting and typographical errors that were brought to our attention.

We submitted the final CCP to our Regional Director for approval in May 2013. The Regional Director determined that a Finding of No Significant Impact (FONSI) was warranted (see appendix H), and that our analysis was sufficient to simultaneously issue a decision adopting this CCP for the refuge. We announced the final decision by publishing a Notice of Availability in the *Federal Register* of the final CCP.

Summary of Comments Received

After the comment period ended on November 26, 2012, we compiled all of the comments we received, including all letters, emails, and comments recorded at public meetings.

In the discussions below, we address and respond to every substantive comment we received. Substantive comments are those that suggest our analysis is flawed in a specific way. Generally

substantive comments:

- Challenge the accuracy of information presented.
- Challenge the adequacy, methodology, or assumptions of the environmental or social analysis and supporting rationale.
- Present new information relevant to the analysis.
- Present reasonable alternatives, including mitigation, other than those presented in the document.

Our discussion does not include responses to any comments we determined to be non-substantive. For example, there were people who wrote us to request copies of the draft CCP/EA.

In order to facilitate our responses, we group similar comments together and organize them by subject heading. Table I-1 at the end of this appendix lists the names of the individual, agency, or organization that submitted comments. Responses to multiple, but similar or related comments, are consolidated to reduce duplication.

In several instances, we refer to the draft CCP/EA and indicate how the final CCP was changed in response to comments. The full versions of both the draft CCP/EA and the final CCP are available online at: *http://www.fws.gov/northeast/planning/patuxent/ccphome.html*. For a CD-ROM or a print copy of either plan, please contact:

Bill Perry, Natural Resource Planner
U.S. Fish and Wildlife Service
300 Westgate Center Drive
Hadley, MA 01035
Phone: (413) 253-8688
Email: *northeastplanning@fws.gov* (put "Patuxent CCP" in the subject line)

Service Responses to Comments by Subject

Planning Process

Comment: The Patuxent Riverkeeper commented that despite their urgings, the Service did not brief the State Patuxent River Commission about the CCP. As such, the State body decided not to comment on the CCP.

> **Response:** Unfortunately, we are unable to brief individual entities during the planning process. That is why multiple public meetings are offered. We cannot control who attends these meetings, nor control whether an organization decides to provide comments or not.

Comment: The Service should involve more experts and experienced researchers in the CCP process. Questioned the lack of Patuxent Wildlife Research Center (PWRC) researchers and land management experts in the core planning team, and urged the refuge to involve more experts to ensure the objectivity of the CCP.

Response: The members of the core planning team are listed in the CCP and include representation from PWRC, along with the refuge staff members that have very specific expertise to Patuxent RR. In addition to the core planning team, we held multiple meetings with PWRC research managers and invited a number of researchers to attend our structured decision making workshops. We also included grassland bird experts in a 1-day workshop to discuss grassland management. Finally, this public comment period has included comments from a variety of interested people, including researchers.

Comment: What was the role of historic preservation and the State Historic Preservation Office (SHPO) in the CCP process? How did this impact/influence decisions regarding Snowden Pond and other impoundments?

Response: The refuge has been involved with SHPO in multiple consultations throughout the facilities modernization plan regarding eligible structures and coordination remains ongoing. We have provided multiple opportunities for SHPO to provide comments throughout the CCP process. We received a letter in response to the comment period for the CCP. The SHPO did not provide a substantive review of the CCP and looks forward to working with us on review of any projects that require SHPO review.

Comment: Patuxent RR needs to check the CCP text regarding consistency in word descriptions – particularly between alternative descriptions and the table highlight alternatives. Examples include wording on horse manure clean-up and 50-yard buffer description in hunting.

Response: We concur and have addressed this.

Law, Mandates, and Policies

Comment: It is a violation of the National Environmental Policy Act (NEPA) to do an EA when an environmental impact statement (EIS) is required. There was no broad, national public outreach per NEPA requirements in any of the meetings.

Response: Under the provisions of the NEPA, the purpose of the EA is to determine if an EIS is necessary or if a FONSI is appropriate. Based upon the analysis that was presented in the draft CCP/EA, the Regional Director has determined that the actions presented in the CCP will not lead to any significant impacts and, therefore, an EIS is not necessary. NEPA does not require broad, national public outreach. We posted information about the availability of the draft CCP/EA in the *Federal Register*, on our Web site, and in local papers.

Refuge Purposes

Comment: The draft CCP/EA deviated from the objectives on which Patuxent RR was established – to demonstrate best management practices as a wildlife experiment station that could be an example for the Nation to follow.

Response: As stated in chapter 1, the establishing purposes of the refuge are “to effectuate further the purposes of the Migratory Bird Conservation Act” and “as a wildlife experiment and research refuge.” The nature of the wildlife research that has occurred on the refuge has

changed over the past 75 years. Many of the early studies focused on farm game research and pesticide use. As habitat management changes, the nature of the experiments have also changed. There is a variety of research that occurs on the refuge and at the PWRC. Nothing in the CCP changes the purposes of the refuge or deviates from our desire to maintain its status as a top-notch wildlife experiment station.

Comment: It appears that refuge management is being dominated by a few public constituencies – in particular, local hunters, anglers, and horseback riders from outside the Baltimore-Washington area. Refuges belong to all people and Patuxent RR has a unique mission of being a research refuge. It is not, nor should it become, a park or recreation area.

Response: We disagree. The CCP provides direction for habitat management and public use for the next 15 years. The management direction presented in the CCP strives to balance habitat management with public use to support the National Wildlife Refuge System mission of wildlife conservation. We allow public uses that are found to be appropriate and compatible and do not materially interfere with or detract from the purposes of the refuge.

Refuge Administration

Comment: Institute a no smoking policy on the refuge.

Response: Smoking is not permitted in any building or government vehicle. Smoking "outposts" have been placed in certain areas to reduce littering.

Comment: Is there any mention, or should there be, of encouraging "outsiders" (e.g., offsite scientists, graduate students, etc.) to find PWRC and Patuxent RR and conduct research?

Response: The refuge has been doing this and hopes to continue this encouragement. We are open to suggestions.

Comment: Patuxent RR needs to coordinate with U.S. Geological Survey (USGS) on the need to keep Bluegill and Mallard Pond. The mesocosms are going to be revitalized and Bluegill and Mallard are needed to provide the appropriate viewshed. This may also apply to Knowles 1 and 2. The whooping crane area needs to maintain the grassland view versus having a forested view. This may affect the breeding success of the cranes in the wild by altering their nest placement.

Response: Per conversations with John French, the CCP approach to management of the impoundments you mention is appropriate. Mallard Pond will be managed in the same way that it has in the past. Bluegill and the Knowles impoundments are planned to revert to green tree reservoirs, which will still serve wetland functions. The viewshed will not appreciably change for decades. The refuge is not managing or altering those areas within the administrative and occupancy area of USGS, which includes approximately 300 acres surrounding the Endangered Species Complex.

Habitat Management

Comment: The draft CCP/EA takes a one-size-fits-all approach to habitat management, and does not consider each parcel individually and how each functions. A simple return to primitive

conditions is not called for. The current man-made alterations at Patuxent RR are 60 years old and functioning as excellent habitat.

> **Response:** We have looked at refuge habitats on a landscape scale, mapped major habitat types including rare plant communities, and considered how these habitats connect with needed corridor access, or derive from unique soil types. Although some man-made alterations may currently serve as excellent habitat, they do not serve to promote the biological integrity of the area. We are still preserving some well-functioning artificial impoundments and grasslands, such as Uhler 1 and 2 and some of the larger grassland parcels.

Comment: Patuxent RR should consider adding in a timeline to the CCP text about habitat alterations (e.g., mowing, invasive species control, etc.). Need to better address the explanation in the text about why one time is better than another for various management activities.

> **Response:** We concur that more explanation of mowing plans is important and needed. This information will be addressed in the annual habitat workplans.

Forest Transition

Comment: The Service can acquire funding to maintain the grasslands and impoundments through other means such as notifying the Maryland congressional delegation that funds are needed to maintain impoundments and meadows for research and management, get non-governmental organizations to provide management at the refuge through a special use permit, relinquish control of the impoundments to research scientists, or partner with non-profit conservation organizations to provide appropriate management under the Service's supervision.

> **Response:** Through the CCP process, we evaluated the species of greatest conservation need that occur on the refuge. In addition, we reviewed the Service's Biological Integrity, Diversity, and Environmental Health Policy. Based on these evaluations, we recommend the return of a natural floodplain forest wetland condition. We anticipate that there may be a cost savings in reduced maintenance; however, this potential cost savings is not the reason for the proposal. In addition, Federal agencies are forbidden by law from lobbying Congress for funds, from accepting funds from nonappropriated sources without specific statutory authority, and from delegating essential government function, such as management decisions for federal lands.

Comment: There is greater need for high-quality grassland and open water habitats in the region than forest. These habitats have important value for the Patuxent River and Chesapeake Bay, and the plants and animals associated with these habitats are the most strongly in decline. There are many rare species associated with open habitats, and transition to forest would result in loss of biodiversity and negative impacts to migratory and indigenous bird species.

Surrounding parks and private lands will move more toward establishing greater forest cover, so the Service should take the lead in creating and maintaining grassland and open water habitats.

Response: The emphasis of forest habitats in the CCP is based on biological integrity and where the refuge lies in the landscape. Whether to maintain a grassland area depends on the larger context of where these grasslands lie (for example, in a rural agricultural setting, or in a predominately forested or built out environment). We have included large, intact, high-quality grasslands adjacent to compatible habitat (i.e., agricultural fields), or on the edge of the refuge where it does not contribute to forest fragmentation. We continue to monitor rare species that are dependent open habitat areas.

We disagree that surrounding parks and private lands would establish greater forest cover. At this point in time large blocks of intact, native and mature forest are in severe decline.

Comment: There is questionable benefit of converting a small amount of grassland, open water, and marsh habitat to forest when the refuge is already 90 percent forest.

Response: The benefit is a combination of fragmentation reduced and management cost saved and not simply a measure of the number of acres.

Grassland Transition to Forest

Comment: Let small grasslands revert to either scrub/shrub or forest, while maintaining the larger ones in the northeast and southwest corners of the North Tract and the one on the Central Tract between Hance, the kestrel pens, and Route 197.

Response: Future management reflects the proposition suggested above.

Comment: Agree with reverting some smaller openings in the forest interior and the old firing ranges in sectors J and K. Also agree with converting meadow habitat under powerlines to scrub since they're too narrow to function as effective grasslands. However, instead of eliminating grasslands, the refuge should enlarge the grassland area between Knowles and Hance Ponds by eliminating a few hedgerows and trees and maintaining the larger ones in the northeast and southwest corners of the North Tract.

Response: With the exception of enlarging the grassland area between Knowles and Hance Ponds, future management reflects the propositions suggested. The grassland area needs to be maintained as a vegetative buffer for the whooping crane pens.

Comment: Eliminating wet meadows north of the Uhler Ponds would be a mistake because of their habitat value.

Response: Bottomland hardwood forests are also valuable habitat and this action will reduce forest fragmentation. In addition, this action will reduce carbon emissions from mowing.

Comment: Grassland is valuable habitat. Converting grassland into forest is bad for biodiversity and is inconsistent with goal 4 of the CCP – to maintain biodiversity in upland habitat sites. Grassland transition to forest would deny scarce habitat to early successional bird species and other wildlife.

Response: We are providing over 250 acres of grassland habitat in areas where they will provide the greatest contribution to grassland species.

Impoundment Transition to Forest

Comment: The refuge needs to do more research on the value of specific impoundments or marsh areas, and what the benefits or costs of conversion to forest would be for the refuge and the Patuxent River ecosystem.

The impoundments have provided opportunities for research on the refuge for decades and are an important source of biological, scientific, and ecosystem information. Keep as many of the ponds as possible to allow the option for future research.

Response: We have already conducted this type of analysis in a structured decision-making process to weigh the ecological-biological values for each impoundment and the costs of conversions. Much research has been done for decades on the contributions of wetlands and impoundments, and there will continue to be some impoundments available should a research need arise. The refuge lies outside the priority areas for the Atlantic Flyway for waterbirds, so we are not considered a priority area by the State or Service regional priorities.

A great deal of time was spent by an interdisciplinary team discussing the biological and ecological merits of each impoundment, individually and collectively (as part of a complex). The vast majority of the impoundments proposed for conversion will become bottomland hardwood forest habitat, and will provide the wetland functions along the Patuxent River they had provided prior to their conversion to cropland, and to their present-day open water/marsh habitat. We view this as an effort to return the natural hydrology along this portion of the Patuxent River. The resulting bottomland hardwood forest will also provide additional forested acres of importance to several species of forest-interior dwelling bird species, as detailed in the CCP.

There is no question that many of Patuxent's impoundments served as important areas for wildlife and habitat research for much of their history. However, these impoundments have been largely devoid of research in recent years. Discussions with upper level management of the PWRC confirmed there were essentially no plans to conduct research in these impoundments in the future. Conversions planned for these impoundments will no doubt take many years to complete; therefore, many will remain intact for the fore-seeable future, should a research need arise. In the meantime, there will be opportunities to research how such areas respond to restoration to bottomland hardwood/floodplain forest. Such restoration has not occurred very often in the Mid-Atlantic region.

Wildlife research continually evolves, and Patuxent RR's research has evolved with it. Patuxent RR started out with many studies on how agricultural practices could be modified to be more wildlife-friendly. This is an example of research that is no longer done at Patuxent RR. Two impoundments – the Uhler Marshes, where extensive research was done over the years, are being kept expressly for the purpose of having some impoundments available should a research need arise.

Comment: The loss of impoundments would negatively impact the red-bellied turtle which is declining and has a restricted range. Conversion of impoundments would result in permanent loss of red-bellied turtle habitat and reduction in its population size at the refuge. There is no other red-bellied turtle habitat nearby.

> **Response:** There will still be many wetland areas and even those impoundments that eventually get converted will still be wetland, with variable pools, braided streams, and green tree reservoirs. Red-bellied turtles are associated with coastal plain rivers and their floodplains, with which the refuge is hoping to increase connectivity. The turtles are common at Jug Bay and Lothian Park on the Patuxent.

Comment: Loss of impoundments would result in diminution of the riverine ecosystem and watershed impacts. The impoundments provide a variety of ecosystem services including biodiversity, stormwater management, and flood control, along with habitat for waterfowl.

> **Response:** Reverting impounded areas to green tree reservoirs or to forested wetland areas will not diminish the riverine ecosystem. The areas that reforest will still serve as a type of wetland, with seasonal flowage. By allowing the impounded areas to revert to a more forested state, water quality may improve as nutrient and sediment overloads are filtered more efficiently. Forested wetland areas will continue to provide a variety of ecosystem services including stormwater management and flood control, carbon sequestration, and promoting biodiversity. Conversion of these impoundments will result in reestablishing natural hydrology of the Patuxent River.

Comment: Impoundments have aesthetic value for Service and USGS employees.

> **Response:** While aesthetics are a consideration, habitat management decisions must be made based on the natural resources and species needs. Forested landscapes also provide aesthetic value.

Comment: There is concern about the impact of impoundment transition on wildlife. Impoundments contribute to habitat diversity and their conversion would result in the loss of important and locally rare habitat for migratory waterfowl, shorebirds, and other birds, including wood ducks, ring-necked ducks, and herons. This would negatively impact Statewide rare and threatened vegetation species. Conversion would exacerbate the problem of disappearing wetlands on the western shore of the Chesapeake Bay and that the loss of wetlands would devastate wetland birds at the refuge. Decreasing wetlands would be inconsistent with CCP goals 1 and 3. The impoundments have been one of reasons why the refuge maintains good wood duck populations – a researcher estimated that 800 wood ducks had come to roost in Knowles Marsh within a 1-hour period at dusk. Black ducks have also historically used impoundments in high numbers. Snowden Pond, Hance Pond, and one or more of the Knowles complex to provide wintering and migration habitat for ring-necked ducks, hooded mergansers, and other species which move amongst the impoundments.

Response: We will continue to maintain a variety of wetland habitats that are important for these rare and threatened species, including roosting wood ducks. We are changing the nature of some of the impoundments but we are not eliminating wetlands. For example, some of the impoundments will be converted to green tree reservoirs, which will provide food, cover, and nesting substrate for wood ducks and other species that depend on flooded forests. This changing of the nature of the impoundments will accommodate seasonal changes and better buffer watershed functions. These changes will continue to contribute to habitat and species diversity. In addition, throughout the refuge, many "traditional" impoundments will still remain.

Comment: If any impoundments were going to be reverted to forest they should be Snowden Pond and the gravel pits at the refuge's southeast corner. These impoundments are excessively deep and less prime as habitat, especially the gravel pits. Why is the Service preserving those over Knowles, Hance, and Uhler Ponds?

Response: Refuge impoundments underwent extensive analysis to determine which impoundments should revert to a more forested state or remain as an impounded area. With each alternative different end results were achieved for various impoundments. In regards to gravel pits, these areas do not contain a water control structure to allow for water manipulation. As a result gravel pits would have to be filled, which would require an extensive permit process, in addition to being extremely cost prohibitive.

Impoundments such as Knowles and Hance Ponds are linked through water control structures that would allow for water manipulation and eventually simulate a green tree reservoir or forested wetland regime. Managing impoundments to revert to a forested state may be costly in some aspects, but overall will provide increased habitat benefit as an end result. Snowden Pond is an example of this scenario.

Comment: The refuge should continue autumn draw-downs to benefit amphibians.

Response: Autumn draw-downs will continue to be one of our management tools.

Grassland Management

Comment: Concern about mowing grasslands in the fall, because birds use grasslands during the fall migration and for winter cover. Grassland mowing should be moved to the early spring, or if kept in the fall, mow just half of the fields, leave the other half for the birds, then reverse the mowing the following year.

Response: We agree and the above suggestion is also a consideration in our planning. This is a concern as it affects overwintering beneficial insects or may remove seed sources for the future populations of desirable plants. To the extent possible, we seek to spot mow, or "sectional mow" to leave standing vegetation in the winter. However, invasive species have taken over many fields and edges, and to be effective, a more aggressive approach is required, such as multiple treatments or late and early growing season mowing. We do not intend to make this aggressive approach a frequent practice.

Comment: Prescribed burns should continue on the R-1 firing range field and the Service should require the control of Lespidiza there.

Response: Where feasible and applicable the refuge will continue to use prescribed fire as a management tool for invasive species control, such as Lespedeza. In addition, prescribed fire is also used to promote suitable habitat for insect species such as the darkling beetle, for ground nesting birds, and as a tool to aid in the reduction of refuge-wide mowing applications.

Comment: The protocols in the Maryland Partners in Flight "Management Guidelines for the Benefit of Land Birds in Maryland" should be the starting point for recommendations for the management of grasslands on the refuge.

Response: This was one of several resources used to develop the management strategy for grasslands, particularly with respect to patch size, and area-sensitive obligate species. Some of these documents include Askins 2000, Helzer and Jelinksi 1999, Schroeder and Askerooth 1999, and Vickery et al. 1999. Full citations and additional documents consulted for grassland management can be found in the bibliography of the final CCP.

Water Resource Management

Comment: Clean up contaminated water bodies on the North Tract (e.g., lead shot, mercury in Little Patuxent). Management would need to differ based on the source and kind of contamination.

Response: There are no documented contaminated bodies of water on the North Tract. There are multiple monitoring wells on the North Tract, which are tracking the potential for groundwater contamination from former military operations when the property belonged to the Department of Defense. We also post the information provided by the State, regarding a fish consumption advisory based on mercury levels, which are a potential threat throughout the state of Maryland, and not unique to the refuge.

We continue to work with Fort Meade, the National Security Agency, and the U.S. Secret Service to minimize the amount of lead being deposited on the North Tract from activity at the shooting ranges. Capturing and recycling of expended rounds are the primary solutions being explored.

Rare Plants and Wildlife

Comment: The refuge should provide for the security of research animal colonies, especially the endangered cranes.

Response: The refuge currently provides this service to the animal colonies. Public access is highly restricted; we have law enforcement staff patrol these areas; we coordinate the access needs of various contractors with the animal colony managers, especially regarding the whooping crane pens; and we are managing adjacent fields to provide more "screening" from both external and internal observation.

Fish

Comment: Is American brook lamprey found on the refuge?

> **Response:** The American brook lamprey (*Lethenteron appendix*) has not been documented on the refuge. Currently the refuge has documented the least brook lamprey (*Lampetra aepyptera*) and the sea brook lamprey (*Petromyzon marinus*).

Reptiles and Amphibians

Comment: The refuge should conduct detailed searches for box turtles before a prescribed burn or mowing. Box turtles are found across the refuge – in some areas they are declining and in other areas are transient and passing through the refuge. The draft CCP/EA says that mowing would be postponed until August 15th; however, this is when box turtles are moving about. Spotted turtles and snapping turtles have also been found along mowed areas.

> **Response:** We are aware of the potential impact of mowing and prescribed burn to box turtles and other wildlife. We try to mitigate the impacts of mowing and burning by scouting ahead of time when practical.

Diseases

Comment: There is a lack of attention to ranavirus in the draft CCP/EA. Ranavirus is a disease that is of increasing concern, and protocols for preventing and minimizing the carryover of ranavirus from one location to another, or from one species to another are being developed. Once these protocols are created, they should be available as part of education packages for refuge visitors, particularly hunters and fishers.

> **Response:** Although it is not referenced in the CCP/EA, we do have a ranavirus protocol in place for researchers, biological staff, and visitor services programs. This protocol was drafted with the assistance of E. Grant, and R. Siegel, both experts in the disease and its treatment. We will continue to educate other users of this concern. A study on the distribution of the disease throughout the refuge is underway.

Comment: What is Patuxent RR's thought on domestic animals, especially in alternative B? The refuge is better off without allowing domestic animals (dogs, horses, etc.), as this would reduce one possible vector of disease transmission.

> **Response:** When we have more information and evidence regarding disease transmission then we will be able to address this issue at that time. We have not seen any evidence of disease transmission to date.

Comment: Is there a need, or should Patuxent RR, address the issue of feral cat control on the refuge. Highlight the potential for feral cat "colonies" developing offsite and impacting onsite resources.

> **Response:** Currently we try to capture these animals when found onsite and then work with local authorities to minimize their impacts. The refuge has no authority to manage feral cat

colonies located off refuge lands. The public is encouraged to report such colonies to local authorities to deal with them.

Comment: The increase of bottomland forest may increase the probability of eastern equine encephalitis as Patuxent RR is a hotspot. Should this become the case, would we then encourage mosquito control?

Response: Restoration of impoundments will increase the fluctuation of water levels and should allow for more natural movement of water, and reduce stagnant pools of water more conducive to mosquito populations. Also, the refuge is striving for a more balanced system where natural predators of mosquitoes would exist, such as fish and various bat species.

Public Hours

Comment: The public should have regulated access to the refuge during hunting season. For instance, allowing the non-hunters on hard or dirt roads and in restricted areas set aside for non-hunt activities, and requiring them to wear orange or optic green. Reinstitute longer hours for the public to use the refuge, including keeping North Tract open until sunset, rather than closing it at 4 p.m., especially on the weekends. Extended hours would facilitate wildlife observation because in earlier years, when the refuge was open later, more wildlife could be seen near sunset.

Response: Under the refuge's chosen management direction public access to the refuge would increase. Extended hours for the grounds would be administered for the South Tract, with grounds and trails being open from dawn to dusk to facilitate increased public access. During the hunting season, the public will be allowed to use a variety of trails on the North Tract. Limited historical and interpretive tours of the Central and North Tracts would also begin to be offered as resources and staff members become available. Fishing opportunities would be expanded at the South Tract by increasing calendar days available to fishing. If possible, increased fishing hours on the North Tract would also become available. Blue Heron Pond will be opened to facilitate increased fishing opportunities.

Hunting

Comment: Patuxent RR may not have say over military use of green ammo on ranges, but Patuxent RR does have a say in promoting green ammo for hunting purposes.

Response: Currently lead ammunition is prohibited on the refuge for waterfowl hunting, per Service policy. Current use of ammunition for other types of hunting complies with Service policy. Policy and regulations to further curtail lead may be considered in the future.

Comment: The Service is scamming the public by using phrases like "wildlife-dependent recreation" when really what it is doing is "wildlife killing."

Response: Congress defined wildlife-dependent public uses in the National Wildlife Refuge Improvement Act of 1997. The six wildlife-dependent public uses that are identified in the act are wildlife observation and photography, environmental education and interpretation, hunting, and fishing.

Comment: The Service should not use the reason that hunting and fishing are "traditional" activities as justification to continue them – this reasoning could be problematic if other "traditional" uses are eliminated on the refuge.

Response: Hunting and fishing are allowed on the refuge because they are wildlife-dependent public uses that have been determined not to materially interfere with or detract from the purposes of the refuge. In the Refuge Improvement Act of 1997, Congress stated that these uses would be considered priority public uses. While hunting and fishing have taken place on refuge lands for many years, the reasoning that they are "traditional" uses is not a determining factor in allowing those uses.

Comment: Commenters expressed support for continued hunting access on the refuge, particularly for waterfowl. The North Tract is the only area on the western shore for public hunting of waterfowl and provides a large and diverse environment for hunting. Given the scarcity of waterfowl hunting opportunities on public lands, waterfowl hunting is cost prohibitive outside of the refuge.

Response: There are no plans to make major changes to the waterfowl hunting program at Patuxent RR. Our season is within the framework of the seasons established by the State of Maryland, in consultation with the Service.

Comment: There were objections to the closing of the January hunting season, as described under alternative C, and any further restrictions on hunting. Such restrictions and closures are unnecessary because hunters do little to disturb forest-interior dwelling species; waterfowl hunters typically hunt near the water and deer hunter numbers decrease in January due to cold weather, among other reasons. There are already some restrictions on hunters on the refuge, such as only being allowed to hunt 5 months of the year and on Sundays.

Response: As a part of the CCP process, we consider a variety of different management options. One of the comments that we heard early in the process was that non-hunters were concerned about the number of days that the North Tract is closed to them. We considered the option of closing the January hunt season as a way to address this issue. We also considered allowing non-hunters access to parts of the North Tract during hunting season and closing certain hunting areas. In our final plan, we have allowed access to non-hunters on additional trails during the hunting season.

Comment: Support for the idea of having a retriever training facility to promote year-round use and hunting season conservation.

Response: Under the Service's preferred alternative, the refuge would continue to require retrieving dogs for the waterfowl hunting season. Related to this requirement, retriever training would be accommodated on the North Tract at New Marsh and Cattail Pond annually from August 1 to August 31 and during the refuge's open waterfowl season. The use would be restricted to those individuals holding a valid Mead Natural Heritage Association hunting permit (refuge hunt permit) and a valid Federal waterfowl hunting stamp.

Comment: Suggestion to add a senior lottery hunt, including seniors in junior hunts, and/or adding one general lottery hunt in early January.

Response: The refuge would be supportive of establishing a senior lottery hunt. Establishing an additional lottery hunt would depend on deer populations and harvest goals. Our hunt plan retains the flexibility to amend lottery hunts as deemed necessary.

Comment: An individual expressed appreciation for the refuge's non-lead ammunition policy.

Response: Comment noted. Thank you for your support.

Horseback Riding

Comment: A number of commenters expressed appreciation for the refuge, particularly the North Tract, as being a great place to ride. They noted that the refuge is a convenient location for riding, and that the footing and trails are good. The North Tract is one of the best places to train young horses to handle trails because of the consistent, firm footing and width of trails. The refuge is one of the only places in the region where riders can go during wet weather without damaging trails since refuge trails are hard-packed. Having the North Tract trails available for riding helps to preserve other, less durable trails.

Response: The refuge is aware of the unique trail conditions offered to equestrians, particularly during wet weather. North Tract trails currently open to horseback riding will remain open to horseback riding.

Comment: Riders have an interest in maintaining the condition of the trails and made suggestions for how the refuge could better maintain them:

- Limit riding to walk only when ground conditions are questionable.
- Limit riding during heavy rains.
- Ask for a trail fee during very wet weather.

Response: The refuge is appreciative of, and open to, suggestions for how to better maintain trails.

Comment: Suggestion to ask Trail Riders of Today (TROT) to supply riding ground rules for trails. They have decades of experience in resolving user conflicts and have long history of working with Maryland and Virginia counties and their planning institutions.

Response: To date, the refuge is not aware of user conflicts. Stipulations for riding are outlined in the refuge's compatibility determination for horseback riding (CD) including when and where activities related to horseback riding may occur. The CD can be found in appendix C of the final CCP.

Comment: The costs of riding outlined in the CCP seemed to be too high. The commenter said that in the CCP, equestrians are just 2 percent of users but the costs are more than half of cost assigned to hikers and bikers, who are 66 percent of users ($44,650 annually for riding versus

$84,800 annually for hiking and biking). However, equestrians do not enjoy more additional resources and services than is provided to hikers and bikers.

> **Response:** The cost figures in the draft CDs for many of the public uses on Patuxent RR were based on estimates developed many years ago. It does appear that the horseback riding community is assigned a higher than reasonable cost estimate, based on numbers of riders. Updated cost estimates are provided in the final CD (appendix C of the final CCP).

Environmental Impacts from Riding

Comment: A commenter noted that wildlife are not disturbed by horses on trails – most trail rides are done at a walk or brief trot segment so wildlife is able to move without any stress. If wildlife stress is a concern, the commenter recommended prohibiting galloping.

> **Response:** As noted in the horseback riding CD (appendix C), the refuge anticipates that impacts of horseback riding on wildlife may 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. In addition, trails open to horseback riding are located in upland forested habitat which spreads the disturbance over the largest habitat type on the refuge, minimizing the overall impact on refuge wildlife associated with this habitat.

Comment: It is difficult to support horseback riding over the long term based on wildlife and habitat management goals, even if trails are already degraded. Continuing riding would not help to reverse or mitigate damage from previous activities.

> **Response:** 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. While this is a concern, this is only one of several contributing sources for the invasive species along roadsides and trails. Transport of weed seeds from vehicle tires or footwear are other contributors. This makes it difficult to measure the relative contributions from each source. The elimination of horses from trails would not alone resolve the issue. To date, the refuge has not been able to attribute the spread of invasive species or significant trail degradation to horseback riding more so than any other public use. Under the anticipated impacts section of the CD for horseback riding (appendix C), the negative impacts to wildlife and habitat are found to be minimal.

Comment: Manure collection is unnecessary because horse manure is not harmful to the environment. Manure is plant-based, biodegradable, and breaks down in just a few days. Birds and other wildlife eat the grasses and seeds in the manure and commenters say that studies have shown that horse manure is not a substantial factor in the spread of invasives. In addition, based on the current and projected level of trail riding discussed in the CCP, it is unlikely that there would be a lot of manure left by horses on the trails.

> **Response:** 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. While this is a concern, this is only one of several contributing sources for the

invasive species along roadsides and trails. Transport of weed seeds from vehicle tires or footwear are other contributors. This makes it difficult to measure the relative contributions from each source and the elimination of horses from trails would not alone resolve the issue. To date, the refuge has not been able to contribute the spread of invasive species or significant trail degradation to horseback riding more so than any other public use. Under the anticipated impacts section of the CD for horseback riding (appendix C), the negative impacts to wildlife and habitat are found to be minimal. Riders are not required to collect horse manure while on the trail, however riders are required to clean up and pack out horse manure from staging areas. Cleaning out trailers or shoveling horse manure from trailers is prohibited while on site.

Comment: Horseback riders can be natural allies and stewards for the refuge. The equestrian community has been a vocal and effective leader in environmental protection and land and watershed preservation and could be strong advocates for the refuge. Riders can and often do help the refuge – riders can report unusual things, pickup trash, and participate in trail maintenance. It is in the interest of the refuge to keep the equestrian community involved and engaged with the refuge throughout the planning process and in the future.

Response: The refuge welcomes the opportunity to discuss partnership opportunities with the horseback riding community. This could include a strategy to address clean-up of horse manure along trails or invasive species work days.

Riding Restrictions

Comment: The proposed restrictions on horseback riding (speed, horse diapers, manure collection) are onerous and unreasonable and would severely curtail riding on the refuge. Riding should continue to be allowed on the refuge without these limitations. Several of the commenters, including the Equestrian Partners in Conservation, noted that the CD for horseback riding indicates that the impacts from riding are few, so there seems to be little scientific basis for the new rules. It is often difficult or impossible for some people to dismount and remount without a mounting block or help. Elderly or less-able-bodied riders would be unable to do this. Having this requirement might mean that the refuge would have to provide mounting blocks, or riders would have to go off trail to find something high enough to stand on. Manure clean up from trails and roads is potentially dangerous because it would be hard for riders to collect manure while holding onto horses. Horses are more controllable when a rider is in the saddle and dismounting increases the chance that the horse could get away from the rider and become loose. In addition, riders often do not know that horses are defecating – often it happens as the horse is moving. One person thought that manure clean up is unenforceable unless you plan on having an officer posted at the trailheads seven days a week and/or do DNA testing on all horse manure found on the trails.

Some commenters thought that it was reasonable to require manure clean up from parking lots and grounds adjacent to check-in station. Volunteers who sign in riders could remind them of this requirement and/or that other horseback riders could help ensure that riders are cleaning up manure in the parking lot by providing signs and educating other riders.

Response: The refuge is aware of the implications certain restrictions may have on the equestrian community and on the ability to use the refuge for horseback riding. The refuge will allow the use as outlined in the refuge's final CD for horseback riding (found in appendix C of the final CCP). Stipulations of concern have been addressed in hopes to meet both parties' needs. Riders are requested to clean-up and pack-out manure when in staging areas and parking lots, but riders will not be required to clean up horse manure along the trails. Only certified weed-free hay is allowed on-site and it must be contained within the trailer at all times. Feeding must take place only inside the trailer. In addition, cleaning-out of trailers on-site is prohibited.

Comment: There was concern about the proposal to eliminate horseback riding under alternative C and commenters asked that it be stricken from the alternative.

Response: NEPA and Service planning policy require that we investigate a reasonable range of alternatives. Horseback riding is an activity that does not occur on all national wildlife refuges. We determined that including elimination of horseback riding warranted analysis. We have not proposed elimination of horseback riding in our final CCP.

Comment: Several commenters noted that horse manure is potentially less harmful than waste from humans and dog feces. According to one commenter, dog feces are more likely to spread diseases than herbivore feces, and it is harder to control trash and waste from people and dogs. The commenters said that each year there are 90 to 150 horses on the refuge compared to 446 hunting dogs off leash. However, there are no requirements for hunters to pick up dog feces or require diapers because it would be impractical and burdensome even though carnivore feces present greater likelihood to spread diseases than herbivore feces.

Response: The refuge is aware of the implications that certain restrictions may have on the equestrian community and on the ability to use the refuge for horseback riding. The refuge will allow the use as outlined in the refuge's final CD for horseback riding (found in appendix C of the final CCP). Riders are requested to clean-up and pack-out manure when in staging areas and parking lots, but riders are not required to clean up horse manure along the trails. Only certified weed-free hay is allowed on-site and it must be contained within the trailer at all times. Feeding must take place only inside the trailer. In addition, cleaning-out of trailers on-site is prohibited. Refuge visitors walking dogs are required to clean-up after their pet and pack out all waste.

Comment: Numerous commenters think that requiring horse diapers is an unreasonable and unworkable restriction that would impede horse usage at the refuge. Commenters note that horse diapers are not designed for trail horses and are used almost exclusively in cities for horses that are pulling carts or carriages. They say that saddles don't have the necessary D-rings for the diapers and diapers cannot be bought at most tack shops or online tack suppliers. In addition, commenters explain that horses must be trained to accept the diapers; otherwise, the use of diapers could spook the horse or distract it from paying attention to the rider.

Response: The refuge is aware of the implications that certain restrictions may have on the equestrian community and on the ability to use the refuge for horseback riding. The refuge

will continue to allow the use as outlined in the refuge's final CD for horseback riding (found in appendix C of the final CCP). Stipulations of concern have been addressed in hopes to meet both parties' needs. Riders are requested to clean-up and pack-out manure when in staging areas and parking lots, but riders are not required to clean up horse manure along the trails. Only certified weed-free hay is allowed on-site and it must be contained within the trailer at all times. Feeding must take place only inside the trailer. In addition, cleaning out of trailers onsite is prohibited.

Comment: A few commenters thought that the speed limitations are unnecessary and questioned why the refuge is proposing to limit riding to walking gait – they state that there are no reasons for given for this in the CCP and there have been no issues in the past.

Limiting speed to a walk would be a major disincentive for some riders to ride at the refuge. Several commenters said that they would be unwilling to trailer their horse and drive to the refuge for a walk-only ride. Walking 8 to 10 miles on the refuge would be long and tedious.

There are no speed restrictions for biking or cross-country skiing and that this walking limitation feels like the refuge is singling out horseback riders.

The walking limitation is unnecessary when there are no other users on the trail. Trails have good visibility and it is possible to see other users farther down the trail. This gives horseback riders enough time to slow down to a walk when passing others users. It is common courtesy to slow down when you see others on the trails, and that experienced riders know to pass foot traffic at a walk. One of the commenters suggested posting trail etiquette signage at trailheads to ensure that trotting or cantering riders are considerate to other users.

Trotting past people on the opposite side of the road is no danger to anyone and can be necessary if a rider needs to pass a jogger or bike rider who is moving slower than a trotting horse but faster than a walking one.

Limiting riding to walking is unnecessary because riding at a faster pace would not cause any damage or erosion to the trails. They noted that the roads were designed to hold much larger traffic than the average-sized horse, and that trotting, cantering, or galloping on the packed dirt roads would not have an impact on the trails.

There were a few people thought that bikers, runners, and other pedestrians should know to exercise caution when passing horses so as not to frighten them. This would also apply for people passing dogs.

Response: The refuge is aware of the implications certain restrictions may have on the equestrian community and on the ability to use the refuge for horseback riding. The refuge will allow the use as outlined in the refuge's CD for horseback riding found in appendix C of the final CCP. As outlined in the CD, there are no direct restrictions on horseback riding speed; however, riders are required to slow to walk or stop when other users are passing.

Comment: A few commenters noted that horseback riding facilitates the priority public use of wildlife observation. These commenters said that they get to see more wildlife and more of the refuge while horseback riding than when hiking. They speculated that this is because wildlife is less disturbed by humans on horseback than humans on foot, and because a rider has a higher vantage point than a hiker.

Response: We agree that it is possible to observe wildlife from horseback; however, it is not a priority public use under the Refuge Improvement Act of 1997.

Shooting Ranges and Lead Shot

Comment: A commenter suggested closing down the shooting ranges due to the hazards of lead shot on wildlife and people. Another asked how the firing ranges fit into all of this, especially after the consideration of eliminating/altering horseback riding and softball fields?

Response: Given the large and diverse population of range users, most of which are involved in national security and law enforcement professions, it is unrealistic to shut down the ranges at this time. The refuge continues to work with the shooting range users to minimize environmental impacts from lead deposition. Lead use has dropped significantly in recent years, as green ammo alternatives become more available. However, there are multiple reasons that lead remains in use on the shooting ranges, including agency-specific requirements for qualification-compliant ammunition, availability for law enforcement calibers and weapon type, and cost.

The refuge has developed a conceptual plan for capturing and recycling of expended rounds; unfortunately, to do so will require tens of millions of dollars for further design and implementation.

With regard to how the shooting ranges "fit into all of this", please refer to chapter 4, page 4-12, where we address compatibility of the ranges with refuge management.

Alternatives

Alternative A

Comment: Sixty-six commenters fully support alternative A. Commenters noted various reasons for supporting alternative A:

- Current management balances the needs of visitors and wildlife.
- Alternative A maintains Uhler marshes, Hance Pond and its surrounding wetlands, and Knowles Pond. All are important waterfowl habitat and important for research.
- Alternative A maintains grasslands and impoundments.
- Why spend money changing a good thing? Use money for upkeep, maintenance, and minor improvements.
- Alternative A includes no changes to horse policies.

Response: Comments noted.

Comment: Several commenters support alternative A with amendments. Suggested amendments include:

- Adding visitor services to foster more public use.
- Allowing some small grasslands to revert to forest.

Response: Comments noted.

Alternative B

Comment: Five commenters fully support alternative B.

Response: Comments noted.

Comment: Several commenters support alternative B with amendments. Suggested amendments include:

- Maintaining impoundment and grassland habitats.
- Making no changes to the horseback riding policy.

Response: Comments noted. After careful consideration, we are not requiring clean up after horses on the trails, but will work with users to develop a way to ensure that the parking lot and areas within one-half mile of the parking lot are kept free of manure.

Comment: Fourteen commenters do not support alternative B. Reasons for opposing the alternative include:

- Riding restrictions.
- Conversion of impoundments and grassland.
- Virtual geocaching.

Response: Comments noted. The final management direction is outlined in chapter 4 of the final CCP.

Alternative C

Comment: Eleven commenters do not support alternative C. Reasons for opposing the alternative include:

- Conversion of grasslands and impoundments.
- Closing January hunting season.
- Restrictions on public uses.

Response: Comments noted. Alternative C has not been chosen for implementation.

General

Comment: One commenter found it difficult not to consider each alternative differently for each of the tracts on the refuge.

- South Tract – Alternative B seems optimal for managing the tract in terms of providing educational opportunities.
- Central Tract – Minimize manipulations to habitats that could be used for future research.
- North Tract – Needs to be cleared and cleaned in terms of wildlife use habitat; monitoring and surveys of contaminants and nutrient overloads needs to continue.

Response: We agree that each portion of the refuge has its own unique "character" and as such designed the draft CCP and alternatives to reflect management options. We also considered how the entire refuge fits within the context of the surrounding landscape. We have proposed the balance of management that we believe best suits the local conditions.

Comment: One person commented that the three alternatives are presented as being mutually exclusive and that it would be preferable to adopt the best features of each alternative.

Response: We do not consider each of the pieces of the alternatives to be mutually exclusive. For the final CCP we have chosen alternative B with modifications based on information that we received during the comment period.

Historic, Cultural, and Archaeological

Comment: One person provided suggestions for changes to section 2.8, regarding the refuge's historic and cultural resources:

- Develop and publish a booklet for public use describing the cultural history of the North Tract in particular and the refuge in general.

Response: The refuge would support doing this; however, it will take time and money, neither of which is available at the moment.

- Replace cemetery nameplates. In 1977 Eagle Scout candidate Andy Watcher did a census of the graves on Fort Meade. Andy noted, among other things, which cemeteries did and did not have nameplates. These cemetery nameplates and least five commemorative plaques (Lake Allen for example) are missing throughout the North Tract. These should be replaced perhaps with a cheaper plastic material which may help in deterring thief.

- Conduct oral histories. Grubb and Associates recommended establishing an oral history program. There have been at least five people in the last couple of years who have some cultural connections with the North Tract who may provide good oral histories. Examples include: Mr. Blake who now lives on Route 198 – his mother was a child living on land that was confiscated by the Army in 1941; a soldier who was posted on the North Tract and was assigned to the Walter Reed facility there; and Mr. Rieves of the Rieves Pond area.

- Provide a video camera and a list of questions for oral histories.

- Develop and encourage the military history on the North Tract.

- Have a special private "get to know the refuge day" for members of Congress and personnel at Fort Meade. Show them what we have to offer besides a convenient location.

- Make more of effort to involve the military and their spouses. Combine the military history and culture with what Service is and wants to do.

- The camping sites are underused. Offer the camping sites to Fort Meade, scouts etc. for some winter or spring camping. The additional impact should be negligible. Camping is available to any scout groups from mid-March through June. An effort could be made to promote this nearby resource to Fort Meade scouts.

Response: These are all good suggestions that the refuge will look into.

Table I-1 List of Commenters

Letter ID	First Name	Last Name	Organization Affiliation
1	Jean	Public	
2	Craig	Shimer	
3	George	Haehl	
4	Charles	Cate	
5	Dennis	Fawson	
6	"Tuffy"		
7	Mary	Johnston	
8	Judy	Thacher	
9	Stan	Hopkins	
10	Anonymous		
11	Theresa	Bly	
12	Dana	Grabiner	
13	Kate	Masterton	
14	Jane	Seigler	Maryland Horse Council
15	April	Smith	
16	Barbara	Thelen	
17	Laura	Bodtke	
18	Katherine	Coviello	
19	Janet	Young	
20	David	Tobin	EPIC (Equestrian Partners for Conservation)
21	Jeanette and Gary	Hoenig	
22	Lori	Brown	
23	Barbara	Taylor	
24	Gary	Surguy	

25	Mary	Blair	
26	L.	Gulley	
27	Joan	Spinner	
28	Valerie	Ormond	
29	Lawrence	Fox	
30	George	Bateman	
31	J. Claire	Simpson-Jones	
32	MaryAnn	Riess	
33	Naomi	Manders	
34	Barbara	Sollner-Webb	
35	Beverly	Healy	
36	Jeanie	Feldman	
37	Bradley	Gilson	
38	M.	Watton	
39	Maryann	Kelley	
40	Michael	Lacaran	
41	Jessica	Miklasz	
42	Charlie	Lynch	
43	Jim	Crocker	
44	Dennis	Green	
45	Nick	Carassanesi	
46	Matthew	Stover	
47	Mary	Prowell	
48	Donald	Fink	
49	Edward	Kirk	
50	Michael	Conroy	
51	Sam	Droege	
52	Judith	Robinson	
53	Ronald	MacNab	
54	George and Frances	Alderson	
55	Kurt	Schwarz	Maryland Ornithological Society, Inc.
56	Matthew	Perry	

57	Frederick	Fallon	
58	Deanna	Dawson	
59	Dan	Ellis	
60	Gary	Grey	
61	Paula	Henry	
62	Jane	Fallon	
63	Frederick	Tutman	Patuxent RiverKeeper
64	Nancy	Osgood	
65	Holliday	Obrecht III	
66	Susan	Gray	
67	Qiang	Cai	
68	Chris	Van Brocklin	
69	Russell	Nichols	
70	Ross	Swope	
71	Roy	Souders	
72	David	Turner	
73	Mary	Jurkiewicz	Montepelier Mansion/Historic Site
74	Dave	Goshorn, Ph.D.	Maryland Department of Natural Resources
75	Beth	Cole	Maryland Historical Trust

Appendix J.

USFWS

Harding Spring Pond Outlet

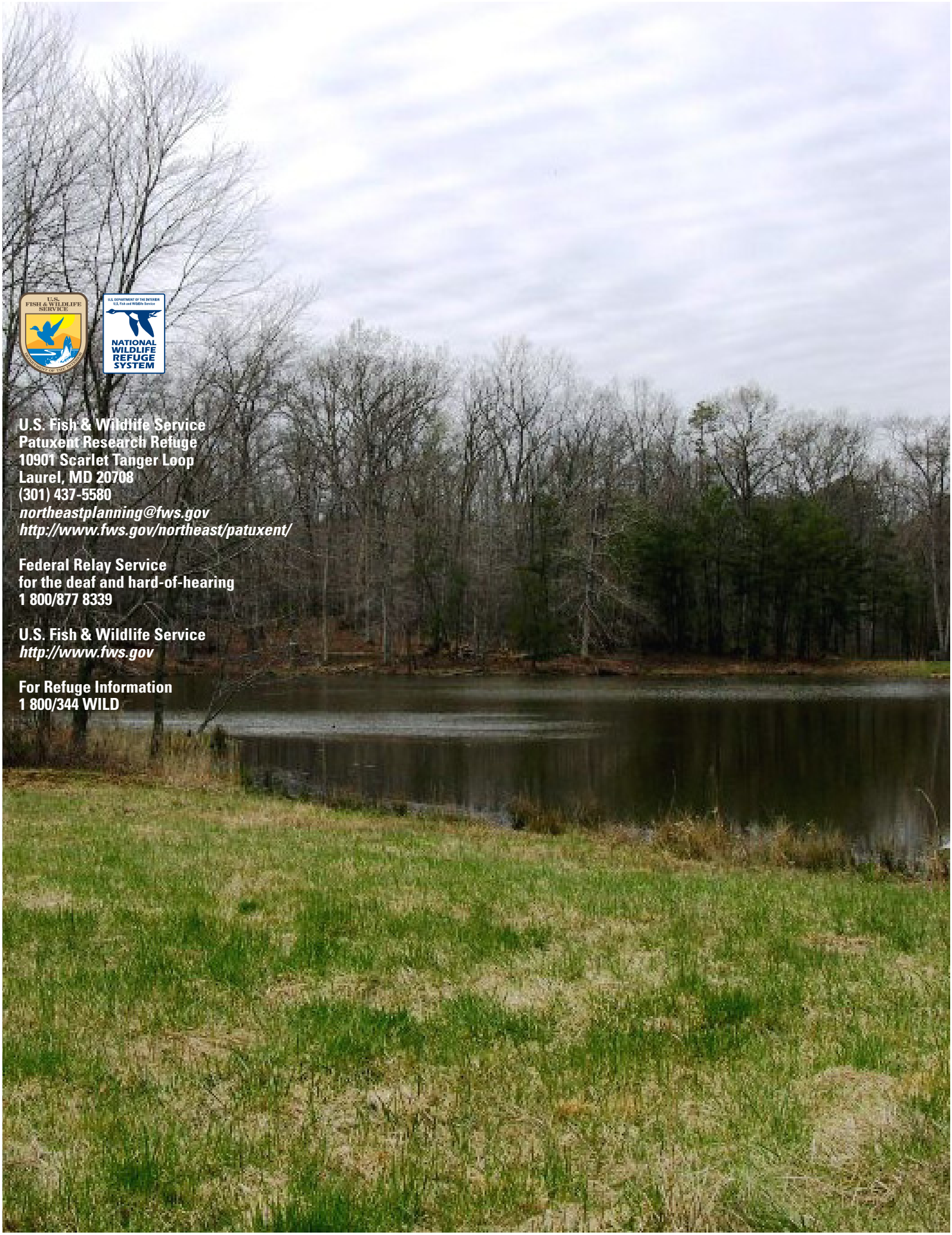
Master List of Impoundments and Wetlands – Acreages and Cover Types

Table J-1 Master List of Impoundments and Wetlands – Acreages and Cover Types

Water Body Type	Impoundment-Wetland Name	Land Cover	Sum of Acres
Impoundment	Bailey Bridge Marsh	Open Water	0.73
Wetland	Beaver Valley	Floodplain Forest and Swamp	29.15
Wetland	Beaver Valley	Open Water	0.84
Impoundment	Blue Heron	Open Water	9.22
Impoundment	Bluegill	Open Water	1.42
Impoundment	Borrow Pit 1	Open Water	0.47
Impoundment	Borrow Pit 2	Open Water	0.72
Impoundment	Borrow Pit 3	Depressional Forest Wetland	0.32
Impoundment	Borrow Pit 3	Emergent Wetland	0.17
Wetland	Bullfrog	Floodplain Shrub Wetland	1.27
Wetland	Bullfrog	Open Water	5.71
Impoundment	Cash Lake	Open Water	53.56
Impoundment	Cattail Pond	Floodplain Shrub Wetland	0.87
Impoundment	Cattail Pond	Open Water	1.78
Impoundment	Clay Pit Pond	Depressional Forest Wetland	0.08
Impoundment	Clay Pit Pond	Open Water	0.68
Impoundment	Dragonfly Pond	Open Water	0.50
Impoundment	Duvall 1	Open Water	14.98
Impoundment	Duvall 2	Floodplain Forest and Swamp	1.00
Impoundment	Duvall 2	Floodplain Shrub Wetland	0.25
Impoundment	Duvall 2	Open Water	6.43
Impoundment	Farm Pond	Open Water	0.88
Impoundment	Fire Control Pond	Deciduous, Pine, and Mixed Forest	0.00
Impoundment	Fire Control Pond	Depressional Forest Wetland	0.23
Impoundment	Fire Control Pond	Emergent Wetland	0.54
Impoundment	Fire Control Pond	Open Water	0.82
Impoundment	Fire Trail Pond	Depressional Forest Wetland	0.17
Impoundment	Goose Pond	Open Water	1.24
Impoundment	Gravel Pit Pond	Open Water	0.86
Impoundment	Greentree Reservoir	Depressional Forest Wetland	6.35
Impoundment	Hance 1	Floodplain Shrub Wetland	2.74
Impoundment	Hance 1	Open Water	4.72
Impoundment	Hance 2	Emergent Wetland	1.54
Impoundment	Hance 2	Floodplain Shrub Wetland	1.48
Impoundment	Hance 2	Open Water	3.20
Impoundment	Harding Spring Pond	Open Water	1.71
Impoundment	Hobbs Pond	Open Water	10.79
Wetland	Kingfisher	Open Water	4.50
Impoundment	Knowles 1	Deciduous, Pine, and Mixed Forest	0.00

Water Body Type	Impoundment-Wetland Name	Land Cover	Sum of Acres
Impoundment	Knowles 1	Floodplain Shrub Wetland	4.19
Impoundment	Knowles 1	Open Water	38.96
Impoundment	Knowles 2	Floodplain Forest and Swamp	0.21
Impoundment	Knowles 2	Floodplain Shrub Wetland	7.25
Impoundment	Knowles 2	Open Water	11.82
Impoundment	Knowles 3	Floodplain Forest and Swamp	1.72
Impoundment	Knowles 3	Floodplain Shrub Wetland	6.54
Impoundment	Knowles 3	Open Water	7.57
Impoundment	Lake Allen	Depressional Forest Wetland	0.82
Impoundment	Lake Allen	Open Water	19.11
Impoundment	Lake Redington	Administrative/Developed	0.00
Impoundment	Lake Redington	Open Water	35.41
Impoundment	Mabbott Pond	Administrative/Developed	0.00
Impoundment	Mabbott Pond	Open Water	4.09
Impoundment	Mallard Pond	Floodplain Forest and Swamp	0.36
Impoundment	Mallard Pond	Open Water	3.69
Impoundment	Merganser Pond	Open Water	2.71
Wetland	Midway Marsh	Depressional Forest Wetland	0.17
Wetland	Midway Marsh	Emergent Wetland	1.94
Impoundment	Midway Branch	Depressional Forest Wetland	1.91
Impoundment	Midway Branch	Emergent Wetland	0.62
Impoundment	Midway Branch	Open Water	0.36
Impoundment	Millrace	Emergent Wetland	38.44
Impoundment	Millrace	Floodplain Shrub Wetland	7.38
Impoundment	Millrace	Open Water	11.83
Impoundment	New Marsh	Administrative/Developed	0.51
Impoundment	New Marsh	Floodplain Shrub Wetland	0.15
Impoundment	New Marsh	Open Water	9.76
Impoundment	New Swamp	Floodplain Forest and Swamp	0.47
Impoundment	New Swamp	Floodplain Shrub Wetland	1.55
Impoundment	New Swamp	Open Water	1.66
Impoundment	Old Gravel Pit Pond	Open Water	1.38
Impoundment	Patuxent Marsh	Emergent Wetland	2.07
Impoundment	Patuxent Marsh	Floodplain Forest and Swamp	10.02
Impoundment	Patuxent Marsh	Floodplain Shrub Wetland	0.54
Impoundment	Patuxent Marsh	Open Water	1.24
Wetland	Peeper Pond	Open Water	1.01
Wetland	Powerline Swamp	Emergent Wetland	5.05
Wetland	Powerline Swamp	Floodplain Forest and Swamp	1.04
Impoundment	Rieve's Pond	Open Water	0.51

Water Body Type	Impoundment-Wetland Name	Land Cover	Sum of Acres
Wetland	Rogue Harbor	Open Water	8.10
Wetland	Salamander	Depressional Forest Wetland	0.07
Wetland	Salamander	Depressional Shrub Wetland	0.23
Wetland	Salamander	Open Water	1.32
Impoundment	Shaefer Farm Pond	Floodplain Forest and Swamp	1.57
Impoundment	Shaefer Farm Pond	Floodplain Shrub Wetland	0.28
Impoundment	Shaefer Farm Pond	Open Water	16.79
Impoundment	Shaefer Lake	Open Water	23.97
Wetland	Shangri-La	Emergent Wetland	2.73
Wetland	Shangri-La	Floodplain Forest and Swamp	6.56
Wetland	Shangri-La	Open Water	9.49
Impoundment	Snowden Pond	Open Water	8.25
Wetland	Sundew Pond (Bog, Central Tract)	Open Water	1.59
Wetland	Telegraph Swamp	Deciduous, Pine, and Mixed Forest	0.00
Wetland	Telegraph Swamp	Depressional Forest Wetland	4.69
Wetland	Telegraph Swamp	Floodplain Forest and Swamp	4.21
Impoundment	Uhler 1	Open Water	6.52
Impoundment	Uhler 2	Floodplain Shrub Wetland	1.16
Impoundment	Uhler 2	Open Water	4.39
Impoundment	Wood Duck Pond	Depressional Forest Wetland	13.41
Impoundment	Wood Duck Pond	Emergent Wetland	3.59
Impoundment	Wood Duck Pond	Open Water	1.70
Wetland	Z-Swamp (K Swamp)	Emergent Wetland	4.52
Wetland	Z-Swamp (K Swamp)	Floodplain Forest and Swamp	0.30
Wetland	Z-Swamp (K Swamp)	Floodplain Shrub Wetland	5.87
Wetland	Z-Swamp (K Swamp)	Open Water	3.55
Total Acres			550.82



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