



U.S. Fish & Wildlife Service

Supawna Meadows National Wildlife Refuge

Comprehensive Conservation Plan July 2011

Abstract

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|-------------------------------------|--|
| Type of Action: | Administrative – Development of a Comprehensive Conservation Plan |
| Lead Agency: | U.S. Department of the Interior, Fish and Wildlife Service |
| Location: | Supawna Meadows National Wildlife Refuge Salem County, NJ |
| Administrative Headquarters: | Cape May National Wildlife Refuge Cape May Courthouse, NJ |
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This Comprehensive Conservation Plan (CCP) for managing the 3,016-acre Supawna Meadows National Wildlife Refuge (NWR) is the culmination of a multi-year planning effort involving New Jersey State agencies, local partners, refuge neighbors, private landowners, the Friends of Supawna Meadows NWR, and the community. This CCP establishes 15-year management goals and objectives for wildlife and habitats, public use, and administration and facilities.

Under this plan, we propose improvements to our biological and public use programs. We focus refuge management on restoring refuge tidal habitats to support Federal trust resources and species of conservation concern in the area, in particular, we emphasize providing resting and foraging habitat for Pea Patch Island colonial-nesting wading birds, secretive marsh birds, migratory waterfowl, shorebirds, and other species of conservation concern. Our Visitor Services program will be enhanced to provide more opportunities for wildlife observation, photography, hunting, fishing, environmental education, and interpretation. We will also continue to identify and protect valuable wildlife habitats diligently with our partners. Finally, we will employ an adaptive management approach that includes adjusting our activities as results from management actions and monitoring efforts are better understood. This flexibility is especially important as we face increasing ecological uncertainties, such as predicted effects of climate change.

Supawna Meadows National Wildlife Refuge

Comprehensive Conservation Plan *July 2011*

Refuge Vision Statement

Supawna Meadows National Wildlife Refuge will continue to provide essential tidal marsh habitat to feed and shelter migrating waterfowl and to feed nearby colonial-nesting wading birds, thereby maintaining its significant role as part of the Delaware Bayshore system of wetlands and upland buffers that is one of the most important migratory bird habitats in the nation.

The refuge will continue to serve as an oasis of native biotic communities within sight of the burgeoning industrial, transportation, and residential developments of the lower Delaware River Basin and South Jersey by providing an array of wetland and upland habitats that support a diverse community of breeding and migrating birds, native mammals, and other species.

Visitors will be able to hunt and fish, observe and photograph wildlife, and learn of the ecological importance and diversity of wildlife at Supawna Meadows National Wildlife Refuge. They will understand the refuge as part of a larger network of protected lands within the National Wildlife Refuge System, set aside specifically for wildlife.

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Chapter 1



USFWS

Impoundment at Supawna Meadows NWR

The Purpose of and Need for Action

- Introduction
- The Purpose of and Need for Action
- Project Area
- The Service and the Refuge System Policies and Legal Mandates Guiding Planning
- National and Regional Conservation Plans Guiding the Project
- Establishing Authority and Refuge Purposes
- Refuge Vision Statement
- Refuge Goals

Introduction

This Comprehensive Conservation Plan (CCP) for Supawna Meadows National Wildlife Refuge (Supawna Meadows NWR, the refuge) was prepared pursuant to the National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997 (16 U.S.C. 668dd et seq.; Refuge Improvement Act). An environmental assessment (EA), required by the National Environmental Policy Act of 1969 (NEPA), was prepared with the draft CCP.

This final CCP presents the combination of management goals, objectives, and strategies that the U.S. Fish and Wildlife Service (Service, we, our) believes will best achieve our vision and goals for the refuge, contribute to the mission of the National Wildlife Refuge System (NWRS, Refuge System), achieve the refuge purposes, fulfill legal mandates, address key issues, incorporate sound principles of fish and wildlife management, and serve the American public. This CCP will guide management decisions and actions on the refuge over the next 15 years. It will also help us communicate our priorities to the natural resource agencies of New Jersey, our other conservation partners, local communities, and the public.

Chapter 1, “The Purpose of and Need for Action,” sets the stage for chapters 2 through 5.

The chapter

- describes the purpose and need for a CCP for the refuge;
- defines the planning analysis area;
- identifies national and regional mandates and plans that influenced this document;
- highlights establishing purposes and land acquisition history of the refuge; and
- presents the vision and goals that drive refuge management.

Chapter 2, “The Planning Process,” explains the planning process we followed in developing this document, and describes the key issues, concerns, and opportunities that arose as we developed the plan.

Chapter 3, “Existing Environment,” describes the physical, biological, and human environment of the refuge.

Chapter 4, “Management Direction and Implementation,” presents the management strategies for meeting refuge goals and objectives that will guide our decisions.

Chapter 5, “Consultation and Coordination,” summarizes how we involved the public and our partners in the planning process and credits Service and non-Service contributors.

The glossary with acronyms, literature cited, and nine appendixes provide additional documentation and references to support our narratives and management decisions.

The Purpose of and Need for Action

We developed a final CCP for the refuge that, in the Service's best professional judgment, best achieves the refuge's establishing purposes, vision and goals, contributes to the mission of the Refuge System, adheres to relevant Service policies and mandates, addresses key public and conservation issues, and uses sound principles of fish and wildlife science.

Our purpose in developing a CCP for Supawna Meadows NWR is to establish management direction that best meets the following goals:

Goal 1: Protect, enhance, and restore biological integrity, diversity, and environmental health of tidally influenced habitats to support native wildlife and plant communities including species of conservation concern.

Goal 2: Protect, enhance, and restore biological integrity, diversity, and environmental health of upland habitats to support native wildlife and plant communities with emphasis on migrating and wintering birds and other species of concern.

Goal 3: Protect, enhance, and restore biological integrity, diversity, and environmental health of non-tidal wetland habitats to support native wildlife and plant communities with emphasis on breeding, migrating, and overwintering birds and other species of conservation concern.

Goal 4: Provide opportunities for compatible, high-quality, wildlife-dependent public uses.

Goal 5: Protect cultural resources on the refuge.

Goal 6: Enhance refuge management through partnerships, friends, volunteers, and community outreach.

Developing a CCP is vital for the future management of every national wildlife refuge. A CCP provides strategic management direction for the next 15 years by

- providing a clear statement of desired future conditions for habitat, wildlife, visitor services, staffing, and facilities;
- providing state agencies, refuge neighbors, visitors, and partners with a clear understanding of the reasons for management actions;
- ensuring refuge management reflects the policies and goals of the Refuge System and legal mandates;
- ensuring the compatibility of current and future public use;
- providing long-term continuity and direction for refuge management; and
- providing direction for staffing, operations, maintenance, and annual budget requests.

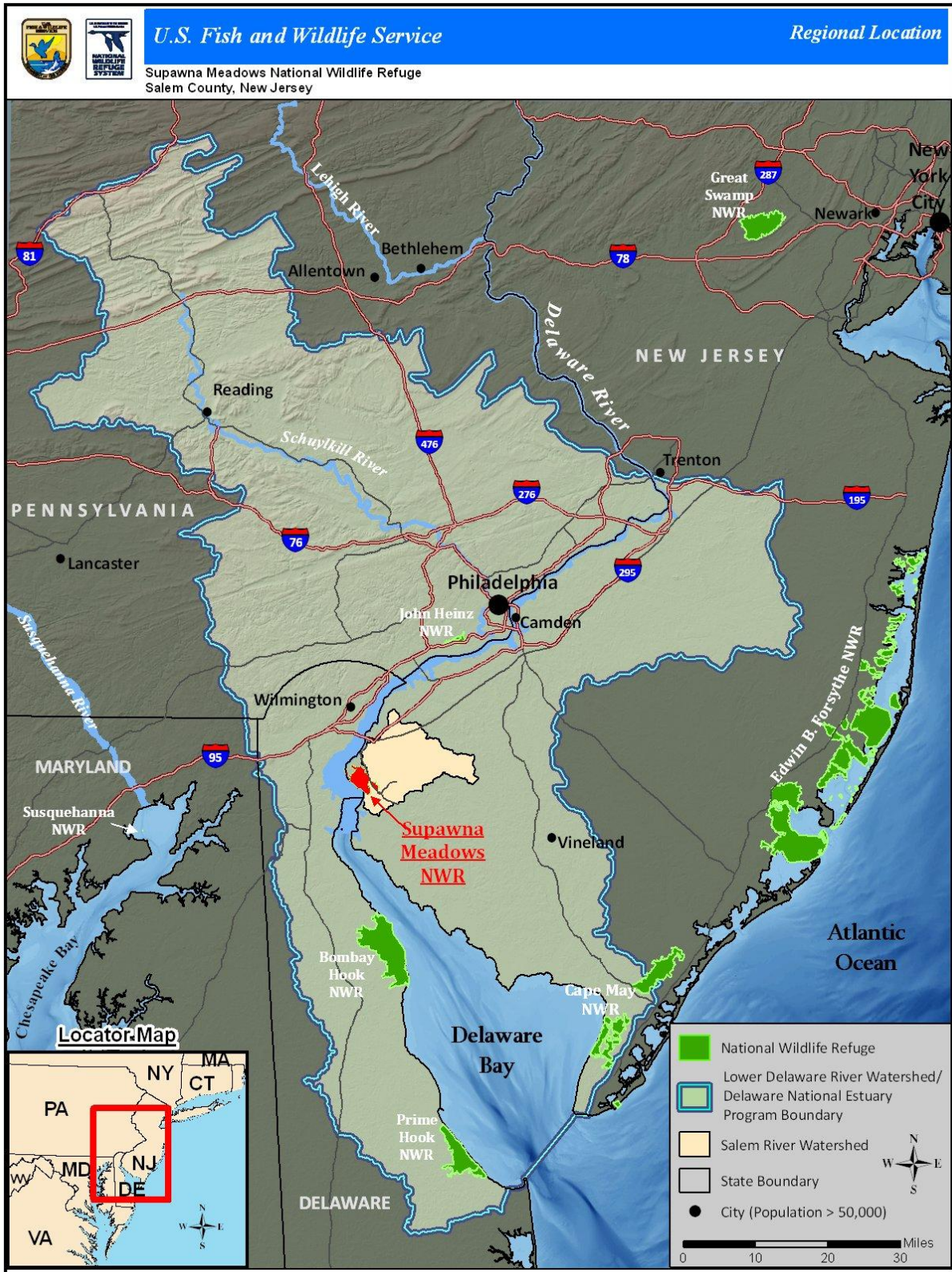
The need to develop a CCP for the refuge is threefold. First, the Refuge Improvement Act requires that all refuges have a CCP in place to help fulfill the mission of the Refuge System. Second, the refuge was administratively complexed with Cape May NWR (located in Cape May Court House, New Jersey) in March 2004 to increase management efficiencies, which resulted in changes to onsite staffing. The CCP for Cape May NWR was completed separately in June 2004. Third, there is currently no master plan establishing priorities and ensuring consistent and integrated management for Supawna Meadows NWR. A vision statement, goals, objectives, and management strategies are needed to effectively manage the refuge's natural resources. Public and partner involvement is critical to resolving issues related to public use, cultural resources, and habitat management.

Project Area

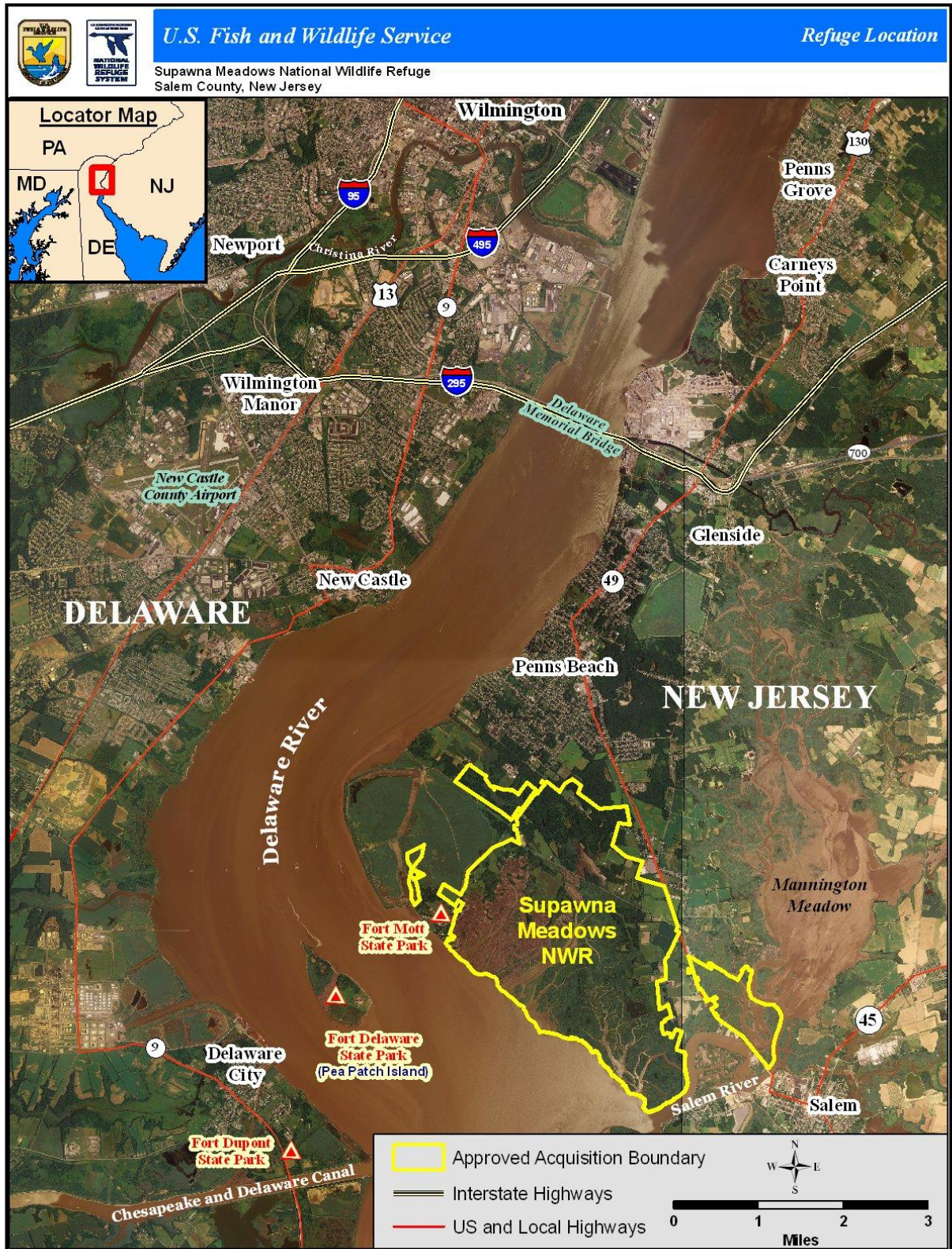
Supawna Meadows NWR is located along the shoreline of the Delaware River where it widens to become the Delaware Bay estuary (map 1.1) in Salem County, New Jersey (map 1.2). The refuge currently includes 3,016 acres of tidal waters and marsh¹, grassland, shrubland, and forest habitats. The approved refuge acquisition boundary (map 1.3) encompasses approximately 4,527 acres along the Upper Delaware Bay and Salem River in Pennsville Township, New Jersey. The refuge boundaries are roughly defined by the Delaware Bay, Salem River, and Fort Mott Road. It is located with the Service's Northeast Region, also known as Region 5.

Supawna Meadows NWR was originally established in 1971 as the Goose Pond addition to the Killcohook Migratory Bird Refuge. Killcohook Migratory Bird Refuge (also referred to as the Killcohook Coordination Area) was established by Executive Order 6582 on February 3, 1934. The lands acquired as the Goose Pond addition were renamed Supawna Meadows National Wildlife Refuge and officially separated from Killcohook Migratory Bird Refuge on April 10, 1974. On October 30, 1998, the Service's jurisdiction over Killcohook Migratory Bird Refuge was revoked (Public Law 105-312, Sec. 203).

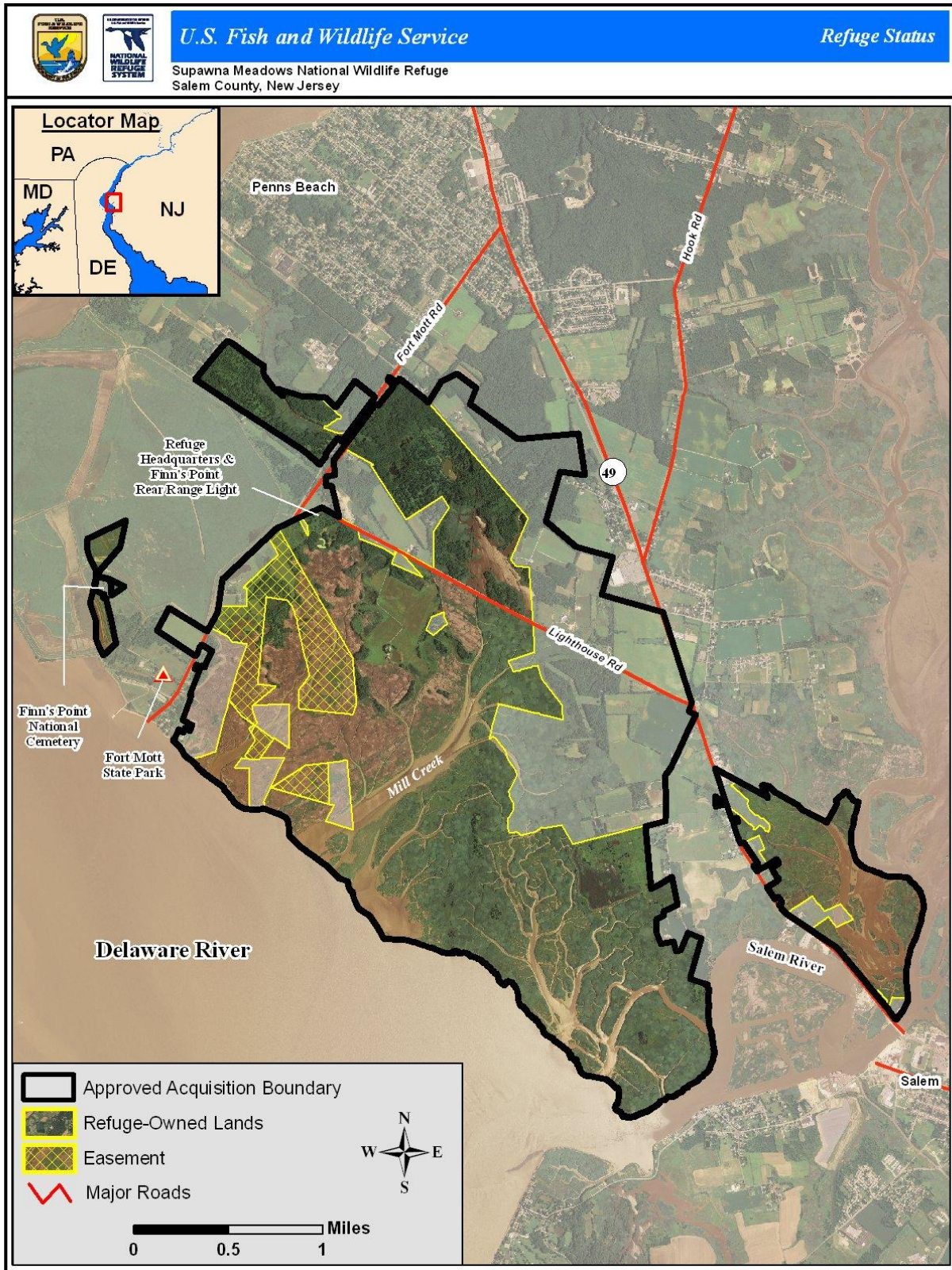
¹The state of New Jersey retains ownership over open tidal waters below the mean high tide. In this document, when we refer to Service ownership, or describe refuge management actions in tidal waters, we mean tidal marsh areas and areas above mean high tide.



Map 1.1. Supawna Meadows National Wildlife Refuge regional location.



Map 1.2. Supawna Meadows National Wildlife Refuge location.



Map 1.3. Supawna Meadows National Wildlife Refuge current land status map.

The Service and the Refuge System Policies and Legal Mandates Guiding Planning

This section presents hierarchically, from the national level to the local level, highlights of Service policy, legal mandates, and existing regional, State, and local resource plans that directly influenced development of this CCP.

The U.S. Fish and Wildlife Service and Its Mission

The Service, part of the Department of the Interior, administers the National Wildlife Refuge System. 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 the Service with the conservation and protection of national resources such as migratory birds and fish, federally listed endangered or threatened species, inter-jurisdictional fish, and certain marine mammals. The Service also manages national wildlife refuges (refuges) and national fish hatcheries, enforces Federal wildlife laws and international treaties on importing and exporting wildlife, assists with state fish and wildlife programs, and helps other countries develop wildlife conservation programs.

The Service manual contains the standing and continuing directives to implement its authorities, responsibilities, and activities. You can access it at <http://www.fws.gov/policy/manuals/>. Special Service directives affecting the rights of citizens or the authorities of other agencies are published separately in the Code of Federal Regulations (CFR), and are not duplicated in the Service manual.

The National Wildlife Refuge System and its Mission

The Refuge System is the world's largest collection of lands and waters set aside specifically for conserving wildlife and protecting ecosystems. Since its inception in 1903, the Refuge System has grown to over 550 refuges and other lands encompassing more than 150 million acres (USFWS 2009a). The Refuge System has interests in every state and several island territories. Each year, more than 34 million visitors hunt, fish, observe and photograph wildlife, or participate in environmental education or interpretation activities on refuges, generating almost \$1.7 billion annually (Carver and Caudill 2007). More detailed information on the Refuge System can be found on the Service's Web site at <http://www.fws.gov/refuges/>.

In 1997, Congress passed the Refuge Improvement Act, which amended the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee). The Refuge Improvement Act established a unifying mission for the Refuge System, a new process for determining compatible public use activities on refuges, and required CCPs for all refuges. It states that, first and foremost, the Refuge System must focus on wildlife conservation. It further states that the Refuge System mission, coupled with the purpose(s) for which a refuge was established, will provide the principal management direction for 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 (Refuge Improvement Act; Public Law 105-57).

In addition, the Refuge Improvement Act requires that all existing or proposed public uses of a refuge must be compatible with refuge purpose(s). The refuge manager determines compatibility after evaluating an activity's potential impact on refuge resources, and ensuring that it does not materially interfere with, or detract from, refuge purpose(s). This act also stipulates six wildlife-dependent public uses that are to receive enhanced consideration in CCPs: hunting, fishing, wildlife observation and photography, and environmental education and interpretation. These are called the six priority public uses for refuges.

Fulfilling the Promise

During the late 1980s and throughout the 1990s, changes in the guiding mission and vision for the Refuge System, combined with growing concerns for the needs of fish, wildlife, and plants, underscored the need for the Service to articulate what the Refuge System would be over the next century. In 1997, the Service initiated a yearlong process involving four teams of Service employees who examined the Refuge System within the framework of Wildlife and Habitat, People, and Leadership. The teams completed a draft report that focused on these four key areas and was at the center of the first ever Refuge System Conference in Keystone, Colorado in October 1998. Every refuge manager in the country, other Service employees, and scores of conservation organizations attended the conference. The final report, "Fulfilling the Promise: The National Wildlife Refuge System, Visions for Wildlife, Habitat, People, and Leadership" (USFWS 1999), was completed in 1999. Many "Promises Teams" formed to develop strategies for implementing the 42 recommendations of the final report. Information from teams, such as Wildlife and Habitat, Goals and Objectives, Strategic Growth of the Refuge System, Invasive Species, and Inventory and Monitoring, helped guide the development of the goals, strategies, and actions in this CCP.

Refuge System Planning Policy

This policy establishes requirements and guidance for Refuge System planning, including CCPs and step-down management plans. It states that we will manage all refuges in accordance with an approved CCP, which, when implemented, will achieve refuge purposes; help fulfill the Refuge System mission; maintain and, where appropriate, restore the ecological integrity of each refuge and the Refuge System; help achieve the goals of the National Wilderness Preservation System; and meet other mandates. This policy helps to ensure that CCPs are founded on principles of sound fish and wildlife management and available science, and are consistent with legal mandates and our other policies, guidelines, and planning documents. Above all else, it helps ensure that wildlife comes first on refuges (602 FW 1, 2, 3).

Appropriate Refuge Uses Policy

This policy provides a national framework and procedure for refuge managers to follow in deciding whether uses are appropriate on a refuge. It also clarifies and expands on the compatibility policy (603 FW 2.10D), which describes when refuge managers should deny a proposed use without determining compatibility. When we find a use is appropriate, we must then determine if the use is compatible before we allow it on a refuge. This policy applies to all proposed and existing uses in the Refuge System only when we have jurisdiction over the use, and does not apply to refuge management activities or situations where reserved rights or legal mandates provide we must allow certain uses (603 FW 1). The appropriate use requirements of the Refuge Improvement Act were adopted in the Service's Final Appropriate Refuge Uses Policy, published June 26, 2006 (*Federal Register*, Vol. 71, No. 122, pp. 36408-36418). Appendix B further describes the Appropriate Refuge Uses Policy and describes its relationship to the CCP process.

Compatibility Policy

Federal law and Service policy provide the direction and planning framework to protect the Refuge System from incompatible or harmful human activities and ensure that Americans can enjoy its lands and waters. The Refuge Improvement Act is the key legislation regarding management of public uses and compatibility. This act requires that all existing or proposed public uses of a refuge must be compatible with refuge purpose(s). Specifically, for a use to be found compatible, it must not “materially interfere with or detract from the fulfillment of the mission of the Refuge System or the purposes of the refuge” (Refuge Improvement Act; Public Law 105–57). The refuge manager is responsible for determining if a public use is compatible.

The current compatibility requirements of the Refuge Improvement Act were adopted in the USFWS Final Compatibility Regulations and Final Compatibility Policy, published October 18, 2000 (*Federal Register*, Vol. 65, No. 202, pp. 62458-62496). The compatibility determinations for the Supawna Meadows NWR can be found in appendix B, along with additional information on the process. The policy and regulations can be viewed online at <http://www.fws.gov/hanfordreach/documents/compatibility.pdf>.

Maintaining Biological Integrity, Diversity, and Environmental Health Policy

This policy 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 found 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 to restore lost or severely degraded environmental components. It also provides guidelines for dealing with external threats to the biological integrity, diversity, and environmental health of a refuge and its ecosystem (601 FW 3).

Wildlife-dependent Recreation Policy

The Refuge Improvement Act establishes six wildlife-dependent priority public uses: hunting, fishing, wildlife observation and photography, and environmental education and interpretation. The Refuge Improvement Act further states that, if compatible, these six public uses are to receive enhanced consideration over other public uses in refuge planning and management. The Wildlife-Dependent Recreation Policy explains how we will provide visitors with opportunities for those priority public uses on units of the Refuge System and how we will facilitate the priority public uses (605 FW 1-7).

Other Legal and National Policy Mandates

Although Service and Refuge System policy and each refuge's purpose provide the foundation for management, the administration of refuges conforms to a variety of other Federal laws (e.g., Migratory Bird Treaty Act, Endangered Species Act, Wilderness Act, Archaeological Resources Protection Act, National Historic Protection Act), Executive Orders, treaties, interstate compacts, and regulations pertaining to the conservation and protection of natural and cultural resources. The “Digest of Federal Resource Laws of Interest to the USFWS” lists these and can be viewed online at <http://www.fws.gov/laws/Lawsdigest.html>.

Wild and Scenic River Review

There are no rivers or segments of rivers that qualify for review within the boundary of the refuge; therefore, a wild and scenic river review was not conducted for this CCP.

National and Regional Conservation Plans Guiding the Project

In late 2001, the U.S. Congress passed the Department of the Interior and Related Agencies Appropriations Act of 2002 (Appropriations Act; Public Law 107- 63) which created the State Wildlife Grants (SWG) program. State Wildlife Grants are available to state fish and wildlife agencies “for the development and implementation of programs for the benefit of wildlife and their habitat, including species that are not hunted or fished.” To continue receiving SWG

**New Jersey Wildlife
Action Plan (revised 2008)**

money, each state was required to develop a Wildlife Action Plan (WAP; officially known as a Comprehensive Wildlife Conservation Strategy) focusing on the species of greatest conservation need by October 1, 2005. To satisfy this Federal requirement, the New Jersey Division of Fish and Wildlife (NJDFW), in collaboration with the public; New Jersey conservation groups; and other stakeholders, developed the New Jersey WAP for the conservation of the State's species of greatest conservation need. Originally submitted in 2005, the most recent draft is dated January 23, 2008 (NJDFW 2008a).

To better assess conservation needs, goals, and priorities, the New Jersey WAP uses the landscape regions (or ecoregions) and 26 conservation zones already identified in the State's Landscape Project (NJDFW 2008b). It identifies nearly 200 species of greatest conservation need, as well as identifying habitat needs and priorities for each region and conservation zone. We discuss the Landscape Project in more detail below. The refuge's tidal marshes supply important resting, feeding, and over-wintering habitat for colonial-nesting wading birds, freshwater wetland birds, and many other special concern wildlife species identified by the State. We used this plan to help develop habitat management goals, objectives, and strategies, and in developing the list of species of conservation concern in appendix A.

**North American
Waterfowl Management
Plan (updated 2004)**

The North American Waterfowl Management Plan (NAWMP) is designed to promote partnership-based habitat conservation for waterfowl and other wetland birds. This plan was first developed in 1986 and has been revised twice, most recently in 2004 (USFWS 2004a). Another revision is planned for 2011/2012. The first NAWMP established "joint venture" partnerships across the country (USFWS 1986). Joint venture partnerships involving Federal, State and provincial governments, Tribal nations, local businesses, conservation organizations, and individual citizens are assembled for the purpose of protecting habitat and species. Currently, there are 18 habitat-focused joint ventures in the United States and three species-focused joint ventures. Supawna Meadows NWR falls within the Atlantic Coast Joint Venture (ACJV). The current mission of the ACJV is to "...provide a forum for Federal, State, regional and local partners to coordinate and improve effectiveness of bird conservation planning and implementation in the Atlantic Flyway region of the United States" (ACJV 2004).

The ACJV has developed several plans to help step-down the goals and objectives identified by NAWMP including the ACJV Waterfowl Implementation Plans (ACJV 1988, ACJV 2005) and the ACJV Strategic Plan (ACJV 2004). The most recent ACJV Waterfowl Implementation Plan (ACJV 2005) identifies several focus areas, i.e., habitat complexes that are priorities for waterfowl conservation. Seven focus areas have been identified in New Jersey. Portions of the Supawna Meadows NWR fall within one of these focus areas, called the Delaware Bayshores Marshes Focus Area.

**North American
Waterbird Conservation
Plan (2002) and Mid-
Atlantic/New
England/Maritimes
(MANEM) Waterbird
Conservation Plan
(Review Draft 2006)**

The North American Waterbird Conservation Plan (Kushlan et al. 2002) represents a partnership among individuals and institutions with the interest in and responsibility for conserving waterbirds and their habitats. The partnership, known as Waterbird Conservation for the Americas, shares a vision that the distribution, diversity, and abundance of populations and habitats of breeding, migratory, and non-breeding waterbirds are sustained or restored throughout the lands and waters of North America, Central America, and the Caribbean (Kushlan et al. 2002). It provides a framework for conserving and managing waterbirds. The plan also facilitates continent-wide planning and monitoring, national, state, and provincial conservation, regional coordination, and local habitat protection and management.

Sixteen waterbird planning regions were identified to allow for planning at a scale that is practical yet provides a landscape-level perspective. Supawna Meadows NWR falls within the Mid-Atlantic/New England/Maritimes (MANEM) region. To facilitate waterbird conservation in the MANEM region of the United States and Canada, a partnership of organizations and individuals has drafted a regional waterbird conservation plan for 2006 – 2010. According to the MANEM Waterbird Conservation Plan, 74 waterbird species utilize habitats in the MANEM region for breeding, migrating and wintering (MANEM Waterbird Working Group 2006). Avian families that occur within the region include loons, grebes, shearwaters, storm-petrels, boobies, pelicans, cormorants, herons, ibises, rails, gulls, terns, skuas, jaegers, and alcids. Summarized information on waterbirds and their habitats from this plan provides a regional perspective for local conservation action. We used this plan to help develop objectives and strategies for goals 1 and 3.

U.S. Fish and Wildlife Service Birds of Conservation Concern (2008)

The Birds of Conservation Concern (BCC) is a report that identifies nongame migratory birds that, without strong conservation action, are likely to become candidates for listing under the Federal Endangered Species Act (ESA; USFWS 2008b). The BCC compiles the highest ranking species of conservation concern from these major nongame bird conservation plans: Partners in Flight North American Landbird Conservation Plan (Rich et al. 2004), the United States Shorebird Conservation Plan (Brown et al. 2001), and the North American Waterbird Conservation Plan (Kushlan et al. 2002). We used the BCC list in compiling appendix A and to help focus on which species might warrant special management attention.

U.S. Shorebird Conservation Plan (2001, 2nd Edition) and North Atlantic Regional Shorebird Plan (2000)

Concerns about shorebirds led to the creation of the U.S. Shorebird Conservation Plan (Brown et al. 2001). Developed as a partnership with individuals and organizations throughout the United States, the plan presents conservation goals for each United States region, identifies important habitat conservation and research needs, and proposes education and outreach programs to increase public awareness of shorebirds and of threats to them.

In the Northeast, the North Atlantic Regional Shorebird Plan (USFWS 2004b) was drafted to step-down the goals of the continental plan to smaller scales to identify priority species, species goals, habitats, and prioritize implementation projects. We used both plans in developing our objectives and strategies for goals 1 and 3.

Partners-in-Flight Bird Conservation Plan: Physiographic Area 44, Mid-Atlantic Coastal Plain (1999)

Partners in Flight (PIF) began in 1990 as a voluntary, international coalition of government agencies, conservation organizations, academic institutions, private industries, and citizens, dedicated to reversing the population declines of bird species. The mission of PIF is to help species at risk, keep common birds common, and encourage voluntary partnerships for birds, habitats, and people (PIF 2009). The foundation of PIF's long-term strategy is a series of scientifically based bird conservation plans using physiographic areas as planning units. The plan for each physiographic area ranks bird species according to their conservation priority, describes their desired habitat conditions, develops biological objectives, and recommends conservation measures. The priority ranking factors include habitat loss, population trends, and the vulnerability of a species and its habitats to regional and local threats.

Supawna Meadows NWR lies in Physiographic Area 44, the Mid-Atlantic Coastal Plain. The PIF plan for this region was completed in 1999 (Watts 1999). We used this plan in compiling appendix A and to help develop our habitat goals, objectives, and management strategies for the refuge.

**Mid-Atlantic/ Southern
New England Bird
Conservation Region (BCR
30) Final Implementation
Plan (2008)**

Bird Conservation Regions (BCRs) originated from the North American Bird Conservation Initiative (NABCI). NABCI is a coalition of many governmental agencies, private organizations, academic organizations, and private industry leaders in Canada, the United States, and Mexico (NABCI 2009). It was formed to address the need for coordinated bird conservation that will benefit all birds in all habitats. NABCI's approach to bird conservation is regionally based, biologically driven, and landscape-oriented. It fills in knowledge gaps, implements conservation actions through dynamic partnerships, and draws together the major bird conservation plans already in existence for waterbirds, shorebirds, waterfowl, and landbirds. NABCI members developed BCRs to facilitate regional planning efforts. The primary purposes of BCRs are to facilitate communication among the bird conservation initiatives; facilitate a regional approach to bird conservation; promote new, expanded, or restructured partnerships; and identify overlapping or conflicting conservation priorities. BCRs are ecologically distinct regions in North America with similar bird communities, habitats, and resource management issues. There are 67 BCRs across the United States, Canada, and Mexico.

Supawna Meadows NWR lies within BCR 30, which includes portions of 10 states and covers approximately 24.4 million acres. Members of the ACJV have developed the Mid-Atlantic/Southern New England Bird Conservation Region (BCR 30) Final Implementation Plan to guide conservation priorities in the region (ACJV 2008). The purpose of this plan is to bring the common goals of many other regional plans (e.g., State Wildlife Action Plans, Partners in Flight Bird Conservation Plan for the Mid-Atlantic Coastal Plain [Physiographic Area 44], U.S. Shorebird Conservation Plan) together into one format that can be used by state agencies, non-governmental organizations, and other bird conservation interests to implement bird conservation activities. The plan identifies the bird species and habitats in greatest need of conservation action in the region, activities thought to be most useful to address those needs, and geographic areas believed to be the most important places for work to occur. It identifies Supawna Meadows NWR as part of a focus area (i.e., important bird area) important to a broad range of shorebirds, waterfowl, and landbirds within BCR 30. We used this plan to help develop objectives and strategies for goals 1 and 2, and to help create appendix A.

**The Pea Patch Island
Heronry Region: Special
Area Management Plan
(1998)**

Pea Patch Island is a small island located in the mid-channel of the Delaware River near its entrance into Delaware Bay. It is a low, marshy island currently owned by the State of Delaware as Fort Delaware State Park (see map 1.2). Pea Patch Island is home to the largest wading bird colony on the Atlantic Coast of the United States. The Delaware River, wetlands, and uplands that surround the island support the foraging habits of these birds. The birds nest on the island from March to September and depend on the region's natural resources during this time. The Pea Patch Island Heronry Region Special Area Management Plan (SAMP) was published in July 1998 (Delaware Department of Natural Resources and Environmental Control 1998). The purpose of the SAMP was to outline a broad, ecosystem-based approach to protecting and improving the resources that support the Pea Patch Island Heronry, to build knowledge about the heronry, and to ensure the commitments necessary for its long-term protection. The development of the SAMP was a consensus-based effort involving representatives from Federal, State and local government agencies, nonprofit organizations, and industry. The SAMP identifies several issues that may positively or negatively affect the health of the heronry population and surrounding area, and uses these issues to guide the development and ranking of 28 management strategies. Birds breeding on Pea Patch Island frequently use the refuge to rest and forage. We used this plan to help develop our habitat goals, objectives, and management strategies for the refuge.

**National - State Agency
Herpetological
Conservation Report (Draft
2004)**

The National State Agency Herpetological Conservation Report (NHCR) is a summary report sponsored by Partners in Amphibian and Reptile Conservation (PARC 2004). Partners in Amphibian and Reptile Conservation (PARC) was created in response to the increasing national declines in amphibian and reptile populations. PARC members come from state and Federal agencies, conservation organizations, museums, the pet trade industry, nature centers, zoos, the power industry, universities, herpetological organizations, research laboratories, forest industries, and environmental consultants. Its five geographic regions - Northeast, Southeast, Midwest, Southwest, and Northwest - focus on national and regional herpetofaunal conservation challenges. Regional working groups allow for region-specific communication.

The NHCR provides a general overview of each state wildlife agency's support for reptile and amphibian conservation and research, and includes lists of the amphibian and reptile species of concern for each state. Its purpose is to facilitate communication among state agencies and partner organizations throughout the PARC network to identify and address regional and national priorities for reptiles and amphibians. PARC intends to expand the scope of the NHCR to include other states, provinces, and territories. It would also include other state agencies that are supporting conservation and research on amphibians and reptiles, such as transportation departments, park departments, and forest agencies. We used the latest draft NHCR plan in developing objectives and strategies for goals 1 through 3, and in developing appendix A.

**U.S. Fish and Wildlife
Service Fisheries Program
Northeast Region
Strategic Plan (2009)**

The Service's Fisheries Program maintains healthy populations of coastal and anadromous fish, fish species that cross state or national boundaries, and endangered aquatic animals and their habitats. In 2002, working with its many partners in aquatic conservation through the Sport Fishing and Boating Partnership Council's Fisheries Steering Committee, the Service completed its Strategic Vision (Vision) document, "Conserving America's Fisheries, U.S. Fish and Wildlife Service Fisheries Program Vision for the Future" (USFWS 2002a). The document includes goals, objectives, and action items on a national programmatic scale.

The Service's original Northeast Region Strategic Plan (USFWS 2004c) is an extension of our Fisheries Program Strategic Vision document (USFWS 2002a), describing more specifically how the Northeast Region will fulfill the goals and objectives identified in this document over 5 years (2004 through 2008). This plan, developed in cooperation with over 40 partners and stakeholders, addresses the decline of fish populations and other aquatic resources, and the economic impact of those declines. The plan is implemented with partners through annual project work plans.

Recently, the Service updated the plan (USFWS 2009b) to address the years 2009 to 2013. The updated plan uses a more transparent process to show partners and other members of the public how we arrived at various priorities. We have consulted with the Northeast Region's Fisheries Program staff and used this plan in developing aquatic objectives and strategies under goals 1 and 2, and in creating appendix A.

**Regional Wetlands
Concept Plan - Emergency
Wetlands Resources Act
(USFWS 1990)**

In 1986, Congress enacted the Emergency Wetlands Resources Act to promote the conservation of our nation's wetlands. This act directed the Department of the Interior to develop a National Wetlands Priority Conservation Plan identifying the location and types of wetlands that should receive priority attention for acquisition by Federal and state agencies.

In 1990, the Service's Northeast Region completed a Regional Wetlands Concept Plan to provide more specific information about wetlands resources in the Northeast. It identifies nearly 850 wetland sites that warrant consideration for acquisition to conserve wetland values in this region. A portion of one of these sites, Mannington Meadow, is included within the refuge boundary. We used this plan to help guide management strategies for this and other wetlands within the refuge.

**U.S. Fish and Wildlife
Service Indiana Bat Draft
Recovery Plan: First
Revision (2007)**

In 1967, the Federal Government listed the Indiana bat (*Myotis sodalis*) as endangered because of declines in their numbers documented at seven major hibernacula in the Midwest. At the time of their listing, Indiana bats numbered around 883,300. Surveys in 2005 numbered the population at 458,332. Although population numbers are down, surveys in most states' hibernation sites indicated that populations increased or at least remained stable in 2004 and 2005.

In 2006, the first evidence of a new illness affecting cave-dwelling bats was detected (USFWS 2009c). While the causative agent of this illness is still in question, it is called white-nose syndrome because affected bats usually have a white fungus on their muzzles and other parts of their bodies. Bats with white-nose syndrome frequently lack adequate body fat to survive until spring and exhibit uncharacteristic behavior, such as flying during the day or flying when they would normally be hibernating. Smaller bats, such as Indiana bats, appear to be more susceptible to white-nose syndrome than larger bats.

Since the initial detection in 2006, white-nose syndrome has been detected from Vermont to Virginia. In some affected hibernacula, 90 to 100 percent of the bats are dying. Preliminary estimates of the Northeast Region's Indiana bat population indicate that the population has declined approximately 30 percent between 2007 and 2009 (USFWS 2009c).

Long-term effects of this illness on bat species are unknown, but it is possible that entire bat species, including the Indiana bat, may become extinct. Supawna Meadows NWR is home to a maternity colony of about 1,500 bats that use a barn on the refuge. We conducted surveys of the maternity colony in 2004, 2007, and 2008. Using mist nets and harp traps, approximately 250 bats were captured and identified. The majority of bats were little brown bats (*Myotis lucifugus*), a small number were big brown bats (*Eptesicus fuscus*). We have not confirmed that any of the bats from the Supawna Meadows NWR site have white-nose syndrome and the colony is not showing signs observed at maternity colonies in affected areas. Signs of white-nose syndrome observed at other maternity colonies include malformed pups, large numbers of dead pups, and little to no reproduction (Scherer 2009 personal communication).

While no Indiana bats have been documented at the Supawna Meadows NWR, the refuge's forested and upland habitats have a potential for supporting wintering, foraging, and roosting habitats for Indiana bats. The Service would implement recovery plan tasks (USFWS 2007a) for this species, as appropriate, if the Indiana bat was documented within the refuge boundary.

**National Marine Fisheries
Service Final Recovery
Plan for the Shortnose
Sturgeon (1998)**

Shortnose sturgeon (*Acipenser brevirostrum*) was listed as endangered in 1967 under the Endangered Species Preservation Act (32 FR 4001). The original listing did not specify reasons for the decline, but subsequent documents cite water pollution and overfishing, including bycatch in the shad fishery, as principal reasons for the species' decline (NMFS 1998). The National Marine Fisheries Service (NMFS) currently recognizes 19 distinct population segments, including one population in the Delaware River (NMFS 1998). While the Delaware River is not included within the refuge boundary, the river and several

tributaries form part of the refuge's border. Therefore, activities occurring on the refuge could have minimal effects on the shortnose sturgeon habitat. We used this plan to help guide management strategies for refuge habitat to ensure potential effects on adjacent sturgeon habitat are neutral or wholly beneficial.

The Landscape Project, New Jersey Endangered and Nongame Species Program, New Jersey Department of Environmental Protection (2002)

In 1994, the New Jersey Division of Fish, Game, and Wildlife's Endangered and Nongame Species Program (ENSP) adopted a landscape-level approach to rare species protection. The goal is to protect New Jersey's biological diversity by maintaining and enhancing rare wildlife populations within healthy, functioning ecosystems. Five landscape regions have been identified. Supawna Meadows NWR lies within the Piedmont Plains Region. Using an extensive database that combines rare species location information with land cover data, the ENSP has identified and mapped areas of critical habitat for rare species (i.e., State-listed and federally listed threatened or endangered species) within each landscape region. Critical areas are ranked by priority. A geographic information system (GIS) database provides baseline information to conservation partners for help in prioritizing habitat protection, open space acquisition, and land management planning. This information was utilized in our land protection planning.

Comprehensive Conservation and Management Plan for the Delaware Estuary (1996)

The Delaware Estuary is faced with continuing threats from toxic substances, habitat loss and fragmentation, and human development. To help address these threats, the Delaware Estuary Program worked with many partners to develop the Comprehensive Conservation and Management Plan (CCMP) for the Delaware Estuary (Delaware Estuary Program 1996). The CCMP is a comprehensive document describing the existing conditions of the Delaware Estuary and providing seven action plans (land management, water use management, habitat and living resources, toxics, education and involvement, and monitoring) and an implementation plan. While the Delaware Estuary Program has since merged with the Partnership for the Delaware Estuary, this reorganized entity is still active and is now responsible for addressing the various actions identified in the CCMP. We used this plan as a reference in developing habitat management and land protection planning objectives.

Establishing Authority and Refuge Purposes

Refuges can be established by Congress through special legislation, by the President through Executive Order, or administratively by the Secretary of the Interior (delegated to the Director of the Service), who is authorized by Congress through legislation. Refuge System lands may be acquired under a variety of legislative and administrative authorities.

Supawna Meadows NWR Establishing Authority

Supawna Meadows NWR was originally established as an addition to the Killcohook Migratory Bird Refuge. Killcohook Migratory Bird Refuge was established by Executive Order 6582 on February 3, 1934. In 1971, the Service purchased 653 acres from the Philadelphia Conservationists (now known as the Natural Lands Trust). These acres were called the Goose Pond addition to the Killcohook Migratory Bird Refuge. On April 10, 1974, the Service renamed these 653 acres as the Supawna Meadows National Wildlife Refuge and officially separated this land from Killcohook Migratory Bird Refuge. On October 30, 1998, the Service's jurisdiction over Killcohook Migratory Bird Refuge was revoked. The Service has acquired interests in over 2,300 additional acres for this refuge since 1971. Killcohook Migratory Bird Refuge is now called the Killcohook Coordination Area, and is used by the U.S. Army Corps of Engineers (ACE) to deposit dredged soil.

Supawna Meadows NWR Purposes

Refuge purposes are specified in or derived from the laws, proclamations, executive orders, agreements, public land orders, donation documents, or administrative memoranda, that establish, authorize, or expand a refuge, refuge unit, or refuge subunit.

Supawna Meadows NWR was established for the following purposes:

- as property with particular value in carrying out the national migratory bird management program (The Transfer of Certain Real Property for Wildlife Conservation Purposes Act, as amended [16 U.S.C. §667b-667d; 62 Stat. 240]);
- for use as an inviolate sanctuary, or for any other management purpose, for migratory birds (The Migratory Bird Conservation Act [16 U.S.C. §715D]); and
- as a refuge suitable for (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species (Refuge Recreation Act, as amended [16 U.S.C. 460k-1]).

Refuge Vision Statement

Our team developed the following vision statement to provide a guiding philosophy and sense of purpose for our planning effort:

Supawna Meadows National Wildlife Refuge will continue to provide essential tidal marsh habitat to feed and shelter migrating waterfowl and to feed nearby colonial-nesting wading birds, thereby maintaining its significant role as part of the Delaware Bayshore system of wetlands and upland buffers that is one of the most important migratory bird habitats in the nation.

The refuge will continue to serve as an oasis of native biotic communities within sight of the burgeoning industrial, transportation, and residential developments of the lower Delaware River Basin and South Jersey by providing an array of wetland and upland habitats that support a diverse community of breeding and migrating birds, native mammals, and other species.

Refuge visitors will be able to hunt and fish, observe and photograph wildlife, and learn of the ecological importance and diversity of wildlife at Supawna National Wildlife Refuge. They will understand the refuge as part of a larger network of protected lands within the National Wildlife Refuge System, set aside specifically for wildlife.

Refuge Goals

Our planning team developed the following goals for the refuge after a review of legal and policy guidelines, the Service mission, regional plans, refuge purposes, our vision for the refuge, and public comments. All of these goals fully conform with and support national and regional mandates and policies.

Goal 1: Protect, enhance, and restore biological integrity, diversity, and environmental health of tidally influenced habitats to support native wildlife and plant communities including species of conservation concern.

Goal 2: Protect, enhance, and restore biological integrity, diversity and environmental health of upland habitats to support native wildlife and plant communities with emphasis on migrating and wintering birds and other species of concern.

Goal 3: Protect, enhance, and restore biological integrity, diversity, and environmental health of non-tidal wetland habitats to support native wildlife and plant communities with emphasis on breeding, migrating, and overwintering birds and other species of conservation concern.

Goal 4: Provide opportunities for compatible high-quality, wildlife-dependent public uses.

Goal 5: Protect cultural resources on the refuge.

Goal 6: Enhance refuge management through partnerships, friends, volunteers, and community outreach.

Chapter 2



USFWS

Snowy Egret on the Refuge

The Planning Process

- The Comprehensive Conservation Planning Process
- Issues and Opportunities
- Plan Amendment and Revision

The Comprehensive Conservation Planning Process

This chapter describes the process by which we developed this CCP and outlines how others were included in that process. It details how we first invited, and will continue to encourage, the partnership of other Federal and state agencies, civic, public, and private conservation and education organizations, and the affected public in our decisions about managing the refuge.

Service policy establishes an eight-step planning process that also facilitates our compliance with NEPA (figure 2.1.²). Our planning policy and CCP training course materials describe those steps in detail. We followed that process in developing this CCP.

Since 1974, we have focused on conserving and managing Supawna Meadows NWR to help sustain migrating waterfowl, wading birds, and other trust species, and to facilitate wildlife-dependent public uses.

We began the CCP process for the refuge in May 2007 (Step A) with a kick-off meeting. 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 team to include refuge managers and staff from Cape May NWR, Service regional planners, and a NJDFW representative.

We held an internal scoping meeting, site visit, and field review in July 2007 to identify issues, concerns, management ideas, and data sources for the development of the CCP and analysis of management strategies.

We published and distributed our first newsletter in August of 2007 (Step B).

On September 7, 2007, we held two public scoping meetings at the Pennsville Public Library 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 draft CCP/EA.

We published an official notice in the *Federal Register* on September 24, 2007, that announced we were preparing a draft CCP/EA.

Between 2008 and 2010, we worked on “Step C: Review Vision Statement, Goals, and Identify Significant Issues” and “Step D: Develop and Analyze Alternatives.” On April 15, 2008, we held a biological workshop with representatives of the Service, the NJDFW, and the Delaware Division of Parks to discuss management objectives for the array of refuge habitats.

On May 6, 2008, we held a public use objectives meeting that addressed hunting, access to Finns Point Rear Range Light (FPRRL), and a variety of other public use opportunities, issues, and concerns.

After a review meeting in June 2008 with senior staff at the Service’s Northeast Region headquarters, we revised the biological and public use objectives.

We distributed a second newsletter in July 2008.

² “The Comprehensive Conservation Planning Process” (<http://policy.fws.gov/602fw3.html>)

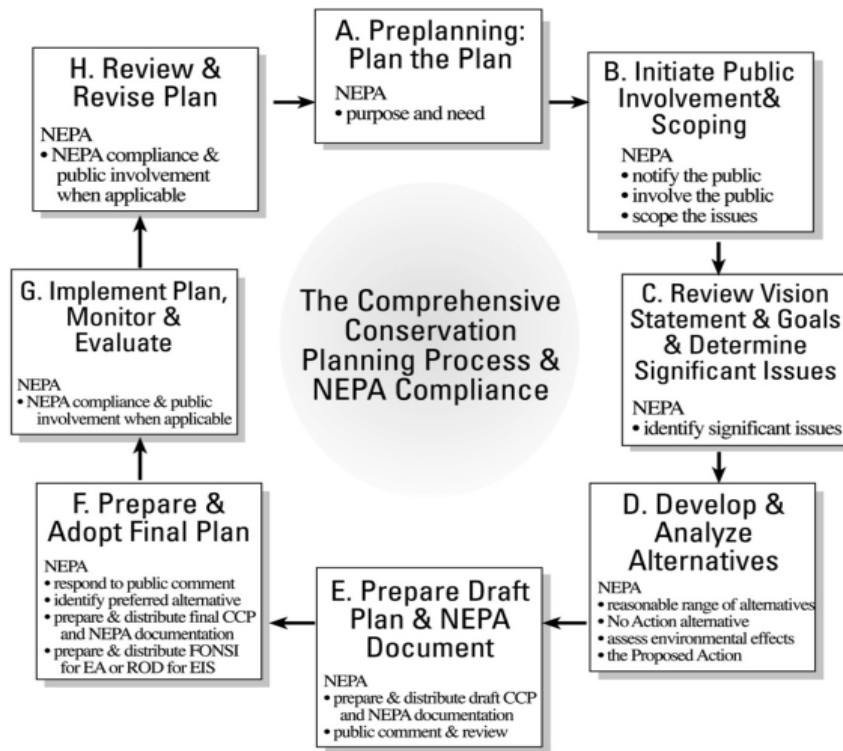


Figure 2.1. The Comprehensive Conservation Planning Process

We completed “Step E: Prepare Draft Plan and NEPA Document” by publishing our Notice of Availability (NOA) in the *Federal Register* announcing the release of the draft CCP/EA and by distributing it for public review on September 27, 2010. During a 30-day period of public review, we distributed a third newsletter and a press release and held two public meetings to obtain comments. We also received comments by regular mail, electronic mail, and at the refuge. After the comment period expired, we reviewed and summarized all of the substantive comments we have received and prepared our responses. These are presented in appendix H.

At the same time, we sent a copy of the draft CCP/EA to the New Jersey State Historic Preservation Office (SHPO) for review and comment on compliance with the National Historic Preservation Act (NHPA) and other applicable State and Federal laws relating to cultural resources. On November 23, 2010, we received an email indicating New Jersey SHPO concurrence with the draft CCP/EA. We also sent a copy of the draft CCP/EA and an intra-service consultation form to the Service’s New Jersey Ecological Services (ES) Office to ensure compliance with the ESA. We received the signed concurrence from the New Jersey ES Office on November 29, 2010.

This CCP was submitted to our Regional Director for review and approval. He determined that it warranted a Finding of No Significant Impact (FONSI; see appendix I) and found its analysis sufficient to simultaneously issue his decision adopting this CCP. We announced his final decision by publishing a Notice of Availability in the *Federal Register*, where we also notified people of the availability of the CCP. This completes “Step F: Prepare and Adopt a Final Plan.”

“Step G: Implement Plan, Monitor and Evaluate” can now begin with approval of this CCP. As part of “Step H: Review and Revise Plan,” we will modify the final CCP as warranted following the procedures in Service policy (602 FW 1, 3, and 4) and NEPA requirements. Minor revisions that meet the criteria for categorical exclusions (550 FW 3.3C) will require only an Environmental Action Memorandum. As the Improvement Act and Service policy stipulate, we must fully revise CCPs every 15 years.

Issues and Opportunities

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 two categories: key issues and issues outside the scope of the EA.

Key issues - Key issues are those the Service has the jurisdiction and authority to resolve. The key issues, together with refuge goals, formed the basis for developing and comparing the different management alternatives we analyzed in chapter 3 of the draft CCP/EA. The varying alternatives were generated by the wide-ranging opinions on how to address key issues and conform to the goals and objectives.

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.

Key Issues

We derived the following key issues from public and partner meetings and further team discussions. Chapter 4, “Management Direction and Implementation” shows how these issues will be addressed in such a way as to best support refuge goals.

1. Which species should be a focus for management and how will the refuge promote and enhance their habitats?

Congress entrusts the Service with protecting federally listed endangered or threatened plant and animal species, anadromous and inter-jurisdictional fish species, migratory birds, and certain marine mammals, and mandates their treatment as management priorities when they occur on a refuge. Appendix A identifies Federal trust resources on the refuge, as well as other species of special concern.

Numerous species of concern, including those species listed by the NJDFW as endangered, threatened, or a species of special concern, are potentially present in the vicinity of the refuge. The shortnose sturgeon is present in the adjacent Delaware River. Other federally listed threatened or endangered species may enter the Delaware Bay and may occasionally travel up the river as far as the refuge. No sea turtle nesting habitat is present on the refuge; however, some turtles including Atlantic hawksbill (*Eretmochelys imbricata*), Atlantic loggerhead (*Caretta caretta caretta*), Atlantic ridley (*Lepidochelys kempi*), and Atlantic leatherback (*Dermochelys coriacea*) may enter the Delaware Bay. Whales occasionally enter the Delaware Bay and one individual is known to have strayed as far north as Philadelphia, Pennsylvania (Spotila et al. 2007). Sensitive joint-vetch (*Aeschynomene virginica*), a federally listed threatened species, was found on the muddy tidal banks of the Delaware River on August 8, 1881. No plants were found during a survey conducted on September 30, 1992. Although these federally listed species may be found close to the refuge, their presence is largely limited to the Delaware River and Delaware Bay where the Service does

not have jurisdiction. Therefore, the Service is limited in its ability to support recovery objectives for these species through refuge management.

Migratory birds are also a Federal trust resource. The challenge with migratory bird management lies in determining how each refuge can contribute significantly to the conservation of migratory bird species of concern. One important question we address is, “Which migratory bird species and associated habitat types should be a priority for management on these refuges?” Management emphasis on a certain species or species group may preclude management for other migratory bird species of concern. On the refuge, for example, managing for grassland-dependent bird nesting habitat would likely reduce the habitat potential for interior forest nesting birds. Migratory bird species associated with both habitat types are in decline throughout PIF Area 44.

This CCP identifies the migratory bird species of management emphasis, associated management and land protection, and their impacts on other species of concern. Refuge goals 1 through 3 address our response to this issue.

2. How will the refuge manage invasive, exotic, and overabundant species?

Invasive plant species such as phragmites (*Phragmites australis*), Japanese stiltgrass (*Microstegium vimineum*), Japanese honeysuckle (*Lonicera japonica*), mile-a-minute vine (*Polygonum perfoliatum*), autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), and Canada thistle (*Cirsium arvense*) threaten refuge habitats by displacing native plant and animal species, degrading wetlands and other natural communities, and reducing natural diversity and wildlife habitat values. They out-compete native species by dominating light, water, and nutrient resources, and are particularly menacing when they affect native habitats, as when phragmites invades tidal marsh habitat.

Invasives are able to establish themselves easily, reproduce prolifically, and disperse readily, which makes eradicating them difficult. Once they have become established, getting rid of them is expensive and labor intensive. Many cause measurable economic impacts, especially in agricultural fields. Preventing new invasions is extremely important for maintaining biological diversity and native plant populations. The control of affected areas will require extensive partnerships with adjacent landowners, State agencies, and local governments.

Invasive animal species, such as mute swans (*Cygnus olor*) and feral cats also threaten refuge habitats by displacing, harming, or devastating native plant and animal species, degrading wetlands and other natural communities, and reducing natural diversity and wildlife habitat values. The threats of invasive animal and plant species are very similar.

We suspect that several wildlife species on the refuge are adversely affecting natural biological diversity. Native species (e.g., deer, resident Canada geese, and snow geese) and small furbearing mammals (e.g., beavers, raccoons, woodchucks, and muskrats) can become problems when their populations exceed the range of natural fluctuation and the ability of their habitat to support them. In particular, issues surface when these animals directly affect trust species or degrade natural communities. Small mammalian predators have been known to destroy neotropical migratory bird nests. Although we expect some predation in a natural system, concerns arise when it prevents our meeting conservation objectives.

There can be adverse ecological and economic impacts when deer, Canada geese, or snow geese forage excessively on fields or marsh vegetation, or when beavers and woodchucks affect water quality, degrade water control structures or impoundment dikes, or cause flooding where it is not desirable. As adjacent lands are developed for residential or commercial use, the concentrations of deer can rise on less developed lands, like the refuge. An overabundance of deer can produce long-term negative effects, such as potential disease epizootics (Demarais et al. 2000); increased browsing pressure on landscapes, vegetation, and crops; and severe habitat degradation (Cypher and Cypher 1988). When deer populations become excessive, they can also compromise human health and safety. An increase in vehicle-deer collisions or the incidence of Lyme disease raises community concerns. The measures for controlling each species are potentially controversial, and may include lethal removal, visual and acoustic deterrents, and destroying nesting or den sites. Our response to this issue is addressed in refuge goals 1 through 4.

3. How will the refuge manage impoundments and forested wetlands?

Impoundments are confined bodies of water. The refuge has five impoundments with water control structures (WCS) totaling approximately 84 acres, and five impoundments without WCSs totaling approximately 4 acres. Natural changes in water levels can occur from rainfall and natural springs. Water levels can be altered in impoundments with WCSs by inserting or removing boards that either release water or allow tidal water to flow into the impoundments. Currently, the water level is managed in three of the five impoundments with water control structures. Changes in water levels during specific times of the year provide habitat and food for an array of wildlife including shorebirds, wading birds, and waterfowl. Shorebirds benefit from impoundments when water levels are lowered and mudflats are exposed providing foraging habitat. Wading birds and waterfowl benefit when water levels are higher providing food such as aquatic vegetation, invertebrates, and fish.

The refuge has approximately 186 acres of forested wetland habitat. A WCS is located along Xmas Tree Lane in forested wetland habitat. Managing the water levels here would provide additional forested wetland habitat (i.e., a green-tree reservoir). This area represents an excellent example of mature forest quality with great size class diversity. Forested wetlands provide habitat for wood duck nesting and brood rearing, roosting eastern screech owls, and breeding reptiles and amphibians.

Managing areas with WCSs could benefit a variety of species by changing water levels at various times of year. The habitats could also be restored by removing WCSs and dikes to allow the habitat to revert to historic conditions, such as in the Tract 11 impoundment where the habitat surrounding the dike is tidal marsh, or by plugging ditches and restoring the natural hydrology to the forested wetland habitat. The Tract 11D Lighthouse Road impoundment could be managed to benefit wading birds and waterfowl. The Xmas Tree Lane impoundment could be used to provide fishing opportunities to the public. Our responses to these issues are addressed in refuge goals 3 and 4.

4. How will the refuge provide opportunities for compatible wildlife-dependent public uses, realizing that those uses occasionally conflict?

The Refuge Improvement Act does not establish a hierarchy among the six wildlife-dependent priority public uses of refuges, nor does it establish any clear process for determining such a hierarchy. Unfortunately, those uses sometimes conflict with each other in time, space, or the allocation of resources. For

example, environmental education and interpretation programs could conflict with hunting if they occur in an area open to hunting at the same time. In the Northeast Region, we have established “areas of emphasis” to identify where each refuge may make its greatest contribution to the six priority public uses. Supawna Meadows NWR’s areas of emphasis are the same as Cape May NWR’s areas of emphasis - interpretation and wildlife observation and photography.

Some people express concerns when refuge resources are disproportionately allocated toward one use and opportunities for other uses suffer. An additional challenge for the refuge manager is determining the carrying capacity of the refuge to support these uses while still managing to provide a quality experience. Our responses to this refuge issue are addressed in refuge goal 5.

Traditional wildlife-dependent uses of the refuge include fishing and hunting of waterfowl and white-tailed deer. Until 2007, the refuge provided opportunities for limited shotgun, muzzleloader, and bow hunting for white-tailed deer. After the completion of an approved EA and FONSI, deer hunting opportunities were changed to include only bow hunting.

5. How will the refuge manage compatible non-priority public uses on the refuge?

Service policy provides that a use might be inappropriate based on compliance with other laws and policy, the availability of resources to manage the uses, possible conflicts with other uses, safety concerns, or other administrative factors. Inappropriate uses may, nonetheless, be compatible in the sense that it may not materially interfere with the purposes of the refuge or the Refuge System’s mission. Other uses, such as historic uses, might be appropriate and compatible, but may not be priority public uses or wildlife-dependent uses.

During the period 1989 through 2004, we provided public access to the Finn’s Point Rear Range Light (FPRRL) for 10 weekends (Saturday and Sunday) during the summer months. With the decline in onsite personnel and safety concerns, this activity is currently limited to allowing access only during the New Jersey Lighthouse Challenge, directly sponsored by the Friends of Supawna Meadows and the New Jersey Lighthouse Society. The Challenge is held annually one weekend in October.

Visitors have requested permission to participate in a variety of non-priority public uses at Supawna Meadows NWR. A few of these non-priority public uses (e.g., scientific research) have been considered compatible. All other non-priority public uses (for example, horseback riding, bicycling, jogging, physical geocaching, group gatherings not related to wildlife-dependent recreation, and picnicking) have been determined to be inappropriate and incompatible with the refuge’s purposes (see appendix B for Findings of Appropriateness and Compatibility Determinations).

6. How will the refuge cultivate an informed and educated public to support the mission of the Service and the purposes for which the refuge was established?

Community involvement in support of our Refuge System mission is both very important and very rewarding. Outreach ties the refuge to local communities, inspiring an interest in the Refuge System and in natural resource conservation and stewardship. It is important that people understand what we are doing, why we are doing it, and how we can work together to improve our communities. Our challenge lies in determining how best to reach out, raise the visibility of the

refuge in the local community, and cultivate a relationship. Some people advocate increasing the number of refuge programs open to the public, while others promote refuge staff involvement in established community events, government committees, and conservation organizations. Goal 6 of the CCP addresses our responses to this issue.

7. What additional lands will the refuge protect or acquire?

New Jersey is the most densely populated state in the nation. One of the consequences of that distinction is the extreme pressure it places on natural resources. Previously undeveloped lands are being developed rapidly. During our public scoping process, many individuals encouraged us to expand the refuge for a variety of reasons and many expressed concern over the rapid rate of development. Some spoke of the direct benefits, even the necessity, of maintaining land in its natural state, which the refuge exemplifies.

The refuge's current approved acquisition boundary encompasses 4,527 acres, of which the Service currently owns 3,016 acres in fee title lands. An additional 254 acres is managed under a conservation agreement. We will continue to maintain an active land acquisition program and work with willing sellers to acquire properties within the existing acquisition boundary. The primary funding source for land acquisition comes from the Land and Water Conservation Fund (LWCF), which Congress approves annually. In past years the availability of LWCF funding for Supawna Meadows NWR has been limited. As funds become available, the primary acquisition emphasis will be on those properties within the acquisition boundary.

8. How will the refuge obtain the staffing and funding necessary to complete priority projects?

Between 1998 and 2004, Supawna Meadows NWR was staffed with a refuge manager, a biologist, a maintenance worker with collateral law enforcement responsibilities, and a part time administrative assistant. In March 2004, the refuge was administratively complexed with Cape May NWR. In response to funding shortfalls, the 2006 Regional Work Force Planning Report identified Supawna Meadows NWR as an unstaffed satellite refuge complexed to the Cape May NWR. Therefore, the refuge currently has no onsite staff. Approximately 20 percent of the Cape May NWR staff's time is spent annually providing management, maintenance, and law enforcement support to Supawna Meadows NWR.

As the CCP was developed, we had to consider what could be accomplished in the next 15 years without onsite staff. If we are able to hire onsite staff, what positions would we want to fill and what additional management activities would they be able to support?

9. How will we preserve, protect, and interpret cultural and historic resources on refuge lands?

The FPRRL was listed in the National Register of Historic Places on August 30, 1978. It is a well-known historic feature located on refuge land. The catwalk was open to the public for viewing in the recent past, but engineering inspection has shown it to pose a potential safety hazard that would require substantial funding to correct. Although it is not directly related to the goals of refuge management, the Service recognizes its responsibility to maintain the FPRRL in accordance with the National Historic Preservation Act of 1974. The New Jersey Lighthouse Society and others expressed interest in having the refuge provide

opportunities for public access to the lighthouse during the annual Statewide lighthouse challenge. Questions were raised as to how best to meet the needed protection of the lighthouse and provide public access. Would this be more appropriately accomplished through a property transfer agreement with the State Division of Parks and Forestry, or through cooperative agreements with non-government agencies, such as the New Jersey Lighthouse Society, and/or the Friends of Supawna Meadows NWR?

We also recognize the potential of the lighthouse to be a focal point for enhancing the public's knowledge and understanding of the environmental importance that the refuge provides to a variety of wildlife species and habitats, as well as interpreting the historic value of the lighthouse. Efforts in this regard would be subject to maintaining the historic integrity of the lighthouse.

There are two other sites on the refuge that generate cultural and historic interest. The first of these sites is a small family cemetery dating back to the late 1800s, located just off County Route 197 along the entrance road to the location of the old refuge office. The cemetery has not been assessed for eligibility as a site for the National Register of Historic Places; however, we do recognize the importance of maintaining this site suitable for visitor appreciation.

The second of these sites is the previous headquarters, the old farmhouse of the Samuel Urion Farmstead, which has been referred to as the Urion-Yerkes homestead. We will consult with the New Jersey SHPO about disposition of this building and will comply with any applicable requirements including mitigation, if needed. The farmhouse has fallen into extensive disrepair beyond reasonable restoration value over the years; therefore, demolition is the anticipated outcome.

The draft CCP/EA was sent to New Jersey SHPO for review and comment. We received an email response indicating their concurrence with the document, provided we continue to work with them to comply with applicable Federal and State laws and regulations.

Issues Outside the Scope of this CCP

1. Water Quality – Proposal to dredge the Delaware River

During the public scoping process, some members of the public expressed concerns about water quality in the Delaware and Salem rivers and the potential harmful effects a proposed dredging operation within the Delaware River could have on Supawna Meadows NWR. The project has been proposed for many years by the Army Corps of Engineers. The proposal to increase the depth of the river from 40 feet to 45 feet is currently involved in various lawsuits from environmental organizations and the States of Delaware, Pennsylvania, and New Jersey. At this point in time, the outcome of the litigation and final dredging operation plan are unclear and cannot be addressed in this CCP. Furthermore, completion of this project is not within the Service's jurisdiction.

2. Will the refuge expand upland hunting opportunities?

During a scoping meeting with NJDFW, it was recommended that we look into expanding hunting opportunities on the refuge, in particular to include wild turkey, American woodcock, eastern gray squirrel, northern bobwhite, ruffed grouse, and rabbit. Although we considered this recommendation, we have eliminated this from detailed evaluation because of the small size of the huntable area within the refuge and the potential conflicts with other public uses.

Plan Amendment and Revision

Periodic review of the CCP will be required to ensure that objectives are being met and management actions are being implemented. Ongoing monitoring and evaluation will be an important part of this process.

Monitoring results or new information may indicate the need to change our strategies. At a minimum, CCPs will be fully revised every 15 years. We will modify the CCP documents and associated management activities as needed and we will follow the procedures outlined in Service policy, the Refuge Improvement Act, and NEPA requirements.

Chapter 3



Steve Maslowski

Northern Bobwhite

Existing Environment

- Introduction
- Physical Environment
- Socioeconomic Setting
- Refuge Administration
- Biological Resources
- Wildlife-dependent Public Use
- Cultural Resources

Introduction

This chapter describes in detail the physical, cultural, socioeconomic, biological, and administrative environments of the Supawna Meadows NWR and its resources directly related to our goals and key issues. It also provides the context for our management direction in chapter 4, “Management Direction and Implementation.”

Physical Environment

Elements of the physical environment considered include regional setting, air quality, water quality, soil types, and regional conservation lands.

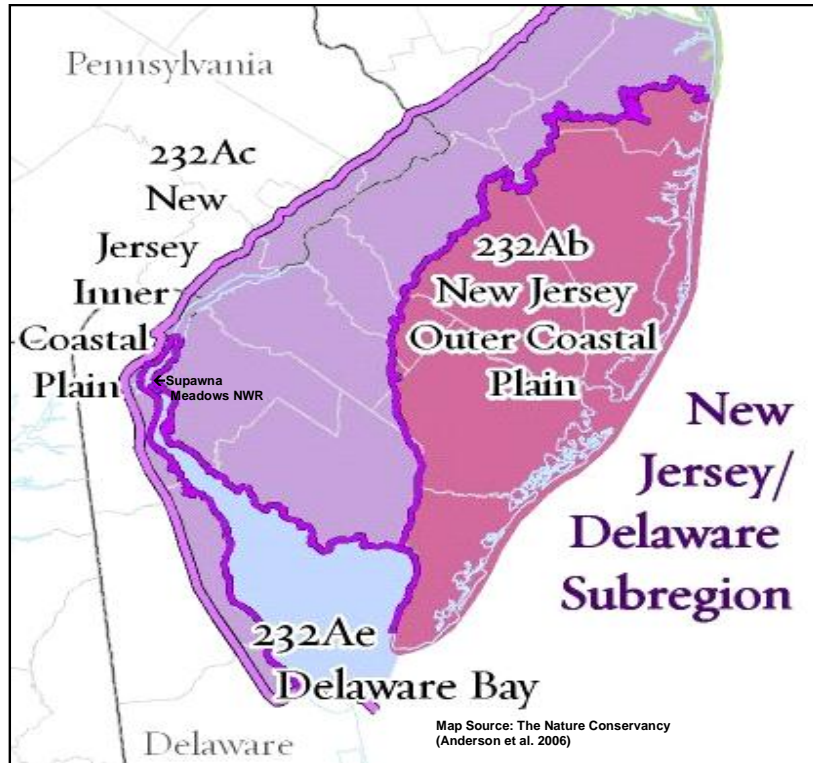
Regional Setting

According to The Nature Conservancy, Supawna Meadows NWR is located on the southwestern tidal shore of the Delaware River estuary in Salem County, New Jersey (Anderson et al. 2006). It is on the western edge of the New Jersey Inner Coastal Plain (232Ac) in the North Atlantic Coast Ecoregion (map 3.1). The New Jersey Wildlife Action Plan (NJDFW 2008a) shows the refuge located at the southwestern-most tip of New Jersey’s Southern Piedmont Plains conservation zone within the Piedmont Plains Landscape (map 3.2). The refuge is approximately 10 miles south of Wilmington, Delaware, and 35 miles south of Philadelphia, Pennsylvania. The refuge’s acquisition boundary encompasses approximately 4,527 acres. The refuge has acquired approximately 3,016 acres within the approved boundary.

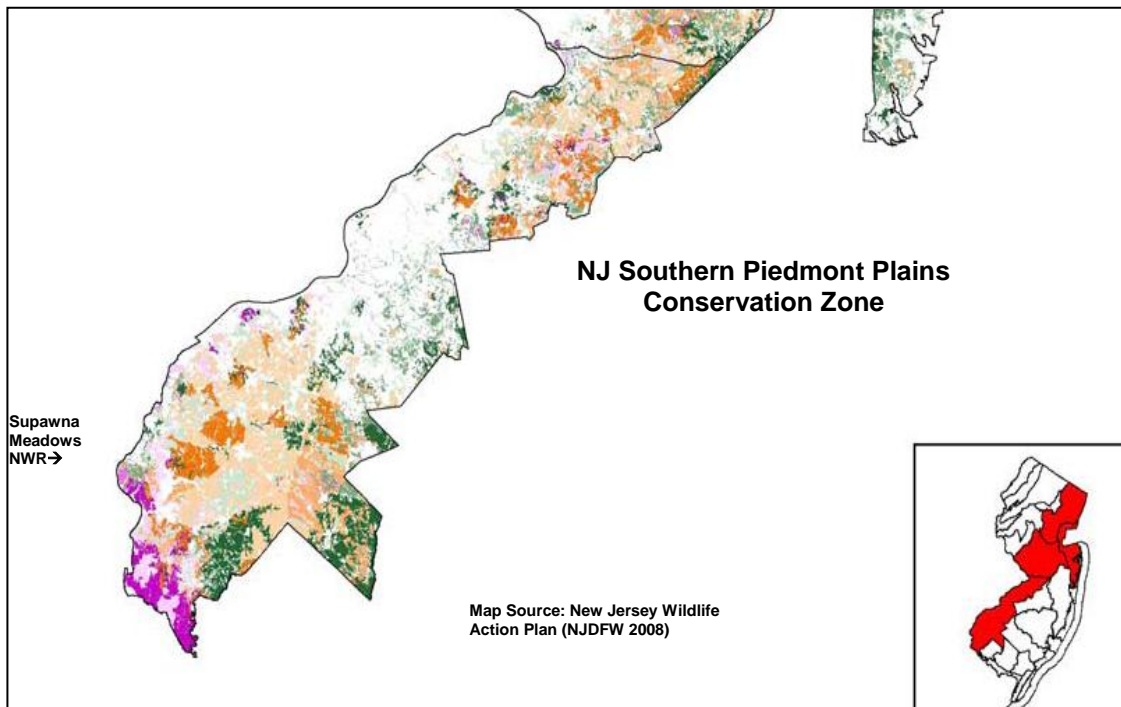
The refuge has a flat terrain typical of Delaware Estuary tidal areas. Elevations on the refuge range from zero to 10 feet above mean sea level (msl) (USFWS 2005a); however, in Pennsville, adjacent to the refuge, the elevation is 19 feet above msl.

According to the National Oceanic and Atmospheric Administration (NOAA), the tidal amplitude on the Delaware River estuary in the vicinity of the refuge, as measured at a point near the refuge on the Salem River, averages about 5 feet (5.32 feet at Sinnickson’s Landing). The area’s climate can best be described as moderate, under a coastal influence (Delaware River/Bay). Days below zero degrees Fahrenheit (F) and above 100 degrees F are rare. The average frost-free period runs from late April to early October. Annual precipitation averages 41 inches per year and snowfall averages about 21 inches per year. Prevailing winds are from the northwest during the winter and from the southwest during the summer.

Lands in the vicinity of the refuge have been in cultivation since the first permanent settlement was established in Salem County by John Fenwick in 1675, and farming is still the predominant land use surrounding the refuge. In the past, dikes were developed to block off the tides so wetlands could be farmed. These dikes required considerable maintenance. Storms and vandalism eventually breached all the dikes around the refuge; however, they remain to some degree between the Delaware River and the refuge. The last efforts by farmers to dike what are now refuge marshes ended in the late 1930s. Other traditional uses of the area include shad and sturgeon fishing, boat building and repair, muskrat trapping, and waterfowl hunting. All these activities, with the exception of sturgeon fishing, continue today.



Map 3.1. Ecoregion location of Supawna Meadows NWR in the New Jersey/Delaware Subregion.



Map 3.2. Ecoregion location of Supawna Meadows NWR in the New Jersey Southern Piedmont Plains zone.

The land surrounding the refuge is primarily residential, commercial, and agricultural. A Ganes Chemical Company facility, a shopping center with a Wal-Mart store, and an ACE facility are located on properties either immediately adjacent to the refuge or just outside the refuge acquisition boundary. Agriculture is declining, leaving some lands fallow while others are replaced by development. Recent recreational use of lands adjacent to or near the refuge has included waterfowl hunting, deer hunting, fishing, trapping, wildlife observation, photography, horseback riding, and all-terrain vehicle/off-road vehicle use. All of these lands are in private ownership; general public access to these lands is rare. Recreational uses of waterways adjacent to or near the refuge include canoeing and kayaking, use of motorized boats, and jet skiing. Waterways adjacent to the refuge are under jurisdiction of New Jersey State, which allows public access.

Fort Mott State Park and the Salem River Wildlife Management Area are adjacent to the refuge acquisition boundary. Several other wildlife management areas and private conservation lands are located within a 30-mile radius of the refuge. These lands provide some degree of protection for wetlands, uplands, and deciduous forests.

Air Quality

The U.S. Environmental Protection Agency (EPA) has issued the following air quality standards (table 3.1):

Table 3.1. Environmental Protection Agency (EPA) air quality standards

| Air pollutant | Air Quality Standard* |
|---|--|
| Carbon monoxide | 35 ppm (1-hour average), 9 ppm (8-hour average) |
| Nitrogen dioxide | 0.053 ppm (annual mean) |
| Ozone | 0.12 ppm (1-hour average), 0.075 ppm (8-hour average) |
| Sulfur dioxide | 0.14 ppm (24-hour average), 0.030 ppm (annual mean) |
| Airborne Particulates (< 2.5 micrometers in diameter) | 35 µg/m ³ (24-hour average), 15.0 µg/m ³ (annual mean) |

* ppm = parts per million

The New Jersey Department of Environmental Protection Bureau of Air Monitoring maintains a network of 44 air monitoring sites throughout the State for continuous monitoring of criteria air pollutants (NJDEP 2008). Air quality monitoring for Salem and Cumberland Counties is conducted at a monitoring site in Millville, New Jersey, approximately 30 miles southeast of Supawna Meadows NWR. In operation since 1983, the Millville site is currently monitoring nitrogen dioxide (NO₂), ozone (O₃), sulfur dioxide (SO₂), and particulate matter (PM) less than 2.5 micrometers in diameter (PM_{2.5}). The Salem/Cumberland County area is in non-attainment for ozone for the 8-hour standard, but is in attainment for the other criteria pollutants (EPA 2010). See table 3.2 for 2004 to 2008 ozone measurements at Millville.

Table 3.2. Ozone measurements* closest to Supawna Meadows NWR from 2004 to 2008.

| Year | Ozone (in parts per million) | |
|------|------------------------------|----------------|
| | 2nd Max 1-hour | 4th Max 8-hour |
| 2004 | 0.092 | 0.083 |
| 2005 | 0.111 | 0.085 |
| 2006 | 0.103 | 0.083 |
| 2007 | 0.093 | 0.083 |
| 2008 | 0.089 | 0.079 |

* Measurements taken in Millville, Cumberland County, New Jersey. Source: Environmental Protection Agency. 2010. US AirData webpage. <http://www.epa.gov/air/data/index.html> Accessed 9 July 2010.

Water Quality

New Jersey water quality is monitored and managed within watershed management areas. Watershed Management Area 17 (WMA 17) includes the Cohansey, Maurice, and Salem rivers, and the Alloway, Dividing, Manantico, Manusmuskin, Miles, Mill, Stow, and Whooping creeks. This area includes portions of Atlantic, Cumberland, Gloucester, and Salem Counties; over 39 municipalities; and encompasses 885 square miles. Land use in this watershed is about 40 percent cropland with the rest being woodland, tidal/freshwater marsh, urban, and pasture. Nonpoint sources of water pollution range from agricultural activities, such as tree harvesting, crop production, and animal pastures, to urban runoff from construction, septic systems, and urban surfaces.

The Salem River drains an area of 114 square miles and flows 32 miles, from Upper Pittsgrove Township west to Deepwater, then south to the Delaware River. The area lies within Salem County, the major population center being the city of Salem. Much of the lower portions of the river are tidal.

The Delaware River is the longest undammed river east of the Mississippi, extending 330 miles from the confluence of its east and west branches at Hancock, New York, to the mouth of the Delaware Bay where it meets the Atlantic Ocean (DRBC 2008). The river is fed by 216 tributaries, the largest of which are the Schuylkill and Lehigh rivers in Pennsylvania. In all, the basin contains 13,539 square miles, draining parts of Pennsylvania (6,422 square miles; 50.3 percent of the basin's total land area); New Jersey (2,969 square miles; 23.3 percent); New York (2,362 square miles; 18.5 percent); and Delaware (1,004 square miles; 7.9 percent). Included in the total area number is the 782 square mile Delaware Bay, which lies roughly half in New Jersey and half in Delaware. Nearly 15 million people (approximately five percent of the nation's population) rely on the waters of the Delaware River Basin for a multitude of uses, but the watershed drains only four-tenths of one percent of the total continental U.S. land area. The Delaware River Basin Commission's (DRBC) recreational use standards for fecal coliform and enterococcus bacteria apply in the tidal Delaware River and Delaware Bay (DRBC 2009). August 2009 sampling at Pea Patch Island and Reedy Island showed levels of enterococcus that exceeded the standard of 35 colony forming units (cfu)/100 milliliters.

Currently, fish consumption advisories exist for waters in all states surrounding the Delaware Estuary and along the Delaware River (Delaware Estuary 2008). Contaminants found in estuarine fish that result in consumption advisories include polychlorinated biphenyls (PCBs), mercury, dioxins/furans, and chlorinated pesticides, including dichlorodiphenyltrichloroethane, better known as DDT. Given that fish accumulate many contaminants in their fatty tissues,

certain species with higher oil contents can pose more human consumption risks than others.

Soil Types

The U.S. Department of Agriculture's Natural Resource Conservation Services mapped the soils within Salem County, New Jersey in 1996. The major soil types found within the refuge include Transquaking mucky peat (65 percent of total acres), Mannington-Nanticoke complex (10 percent), Mattapex silt loam (9 percent), and Othello, Falsington, and Trussum soils (9 percent). The remaining soils on the refuge include Mattapex silt loam (2 percent); Othello and Falsington soils (2 percent); Sassafrass-Woodstown complex (2 percent), and Matapeake silt loam (1 percent). The major soil types are described below (USDA 1996, 2002):

Transquaking mucky peat, 0 to 1 percent slopes-This series consists of very deep, very poorly drained soils formed in thick organic deposits. They are very frequently flooded and occur on the brackish estuarine marshes along tidally influenced rivers and creeks.

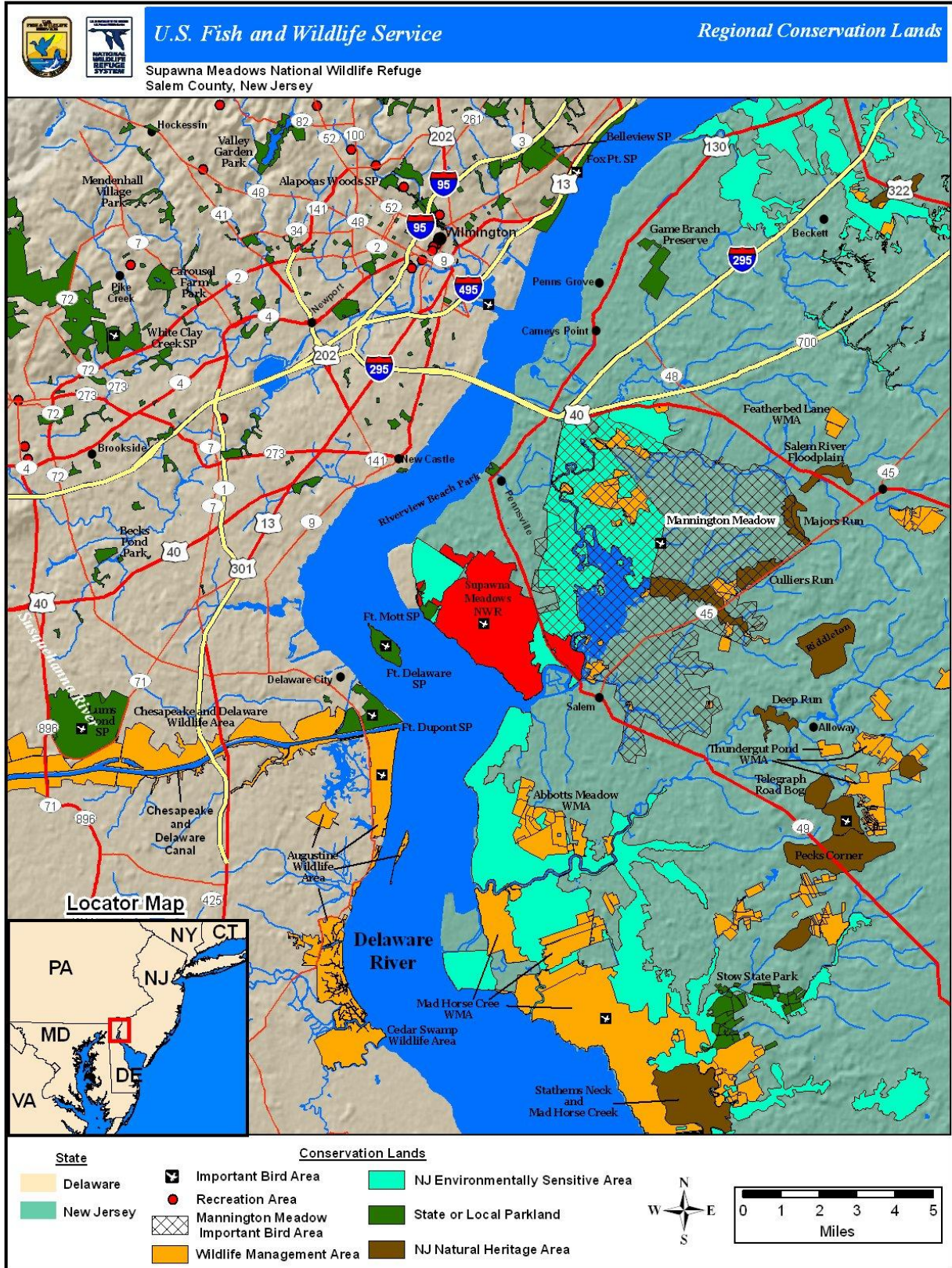
Mannington-Nanticoke complex, 0 to 1 percent slopes-This series consists of mucky silt loam, formed in silty estuarine deposits over organic, herbaceous material. These soils are non-acidic, fine silty, mixed soils that are very poorly drained, frequently flooded, and occur in tidal flats.

Mattapex silt loam, 2 to 5 percent slopes-These are very deep, moderately well drained soils formed from silty eolian deposits over coarser fluviomarine deposits. They have moderate to rapid permeability and are slightly acidic.

Othello, Falsington, and Trussum soils, 0 to 2 percent slopes-Both the Falsington and Othello series are very deep, poorly drained soils formed from silty eolian deposits over fluviomarine deposits. These occur on upland flats and depressions.

Regional Conservation Lands

There are several state, Federal, and locally managed conservation lands in the vicinity of Supawna Meadows NWR (map 3.3).



Map 3.3. Regional conservation lands around Supawna Meadows National Wildlife Refuge.

Socioeconomic Setting

Located in the southwestern corner of New Jersey, Salem County is bordered by Gloucester County to the north, Cumberland County to the east and south, and the Delaware River to the west. While only 15 minutes from Wilmington, Delaware and 35 minutes to Philadelphia, Pennsylvania, Salem County remains by far the least populated county in New Jersey. In spite of its close proximity to these urban and regional centers and major roadways (such as the New Jersey Turnpike, I-295, U.S. Routes 40 and 130, and New Jersey State Highways 45 and 49), only 13 percent of the county's land has been developed for residential, commercial, or industrial use. The remaining 90 percent of the county is farmland or tidal and freshwater wetlands, lakes, ponds, and forests (NJDEP 2002b).

Salem County

Salem County has, for the most part, maintained its traditional industries and land use patterns. The original settlements were made in the western end of the county where a network of rivers, streams, and creeks feed into the Delaware River. Lumber and grain mills were established among the major creeks as early industry was supported by timber and agriculture. Agriculture has played an important role in Salem County, both prior to European settlement, when it was inhabited by the Lenni Lenape Tribe, and through the 17th Century arrival of the Swedes, Finns, and Quakers (Salem County Visitors Center 2010).

Approximately 40 percent of the county contains productive farmland today, largely concentrated in the rural central and eastern sections. According to the Census of Agriculture, more than \$70.5 million of agricultural products were grown and raised on the 753 farms in Salem County in 2002 (USDA 2002). Salem ranks first in the State for wheat, barley, sweet corn, and potatoes, and second for milk production, soybeans, asparagus, and corn harvested for grain. Representing more than 10 percent of the State's agricultural market, Salem County is among the leaders for many other agricultural products as well (USDA 2002).

While agriculture is the mainstay of the eastern and central sections, western Salem County remains home to industry, the county's major employer. For more than a century, E.I. DuPont de Nemours and Company (DuPont) has formed the backbone of the chemical industry. At its peak in 1917, DuPont reportedly employed 25,000 people. By the 1960s, DuPont Chambers Works was the largest chemical factory in the world and DuPont employed 25 percent of Salem County households. Since then, the manufacturing industry in the United States has declined, as have the payrolls and outputs of DuPont and other companies in Salem County. Global competition and environmental regulations have led DuPont to relocate many of the site's business lines, cease operations of some altogether, and otherwise downsize its operation at the Chambers Works facility. The corresponding reduction in the industrial tax base, diminished employment opportunities, and significant loss of disposable income in the community has compromised the high quality of life associated with Salem County. By 2000, the county's per capita income was \$20,874, 23 percent lower than the State's per capita income of \$27,006 (US Census 2000).

Pennsville Township

Pennsville Township comprises 23.10 square miles located in the Philadelphia-Camden Metropolitan area. Pennsville has a population of 13,194, according to the 2000 Census. Estimated median household income in 2007 was \$57,310, which increased about 17 percent from \$47,494 in 2000. The town is predominately white, non-Hispanic (96.1 percent); Hispanic is the second largest demographic, at 1.6 percent (City Data 2009).

Contribution of the Refuge to the Local Economy

Refuges provide many benefits to local economies. Property values and associated property taxes often increase near open spaces, benefitting local communities (Gies 2009). In addition, land in public ownership requires little in the way of services from municipalities, yet provides valuable recreation opportunities for local residents. Based on a 2006 report completed by the Service, over 34 million people visited refuges for recreation that year (Carver and Caudill 2007). These visits generated almost \$1.7 billion in sales for regional economies, supporting 27,000 jobs and nearly \$543 million in employment income. Refuge recreation spending generated an additional \$185.3 million in tax revenue at the local, county, state, and Federal levels.

National wildlife refuges currently contribute to local economies through shared revenue payments. Under the provisions of the Refuge Revenue Sharing Act (the Act of June 15, 1935, 16 U.S.C. §715s), the Service pays an annual refuge revenue sharing payment to counties that contain lands the Service administers. The exact amount of the annual payment depends on Congressional appropriations, which in recent years have tended to be less than the amount to fully fund the authorized level of payments. Those payments will be continued in accordance with the law, commensurate with changes in the appraised market value of refuge lands, and new appropriation levels dictated by Congress. Recent Service revenue sharing payments for Supawna Meadows NWR are presented in table 3.3.

Table 3.3. Supawna Meadows NWR Revenue Sharing Payments

| Year Paid | Amount Paid* |
|-----------|--------------|
| 2000 | \$9,396.00 |
| 2001 | \$8,199.00 |
| 2002 | \$8,369.00 |
| 2003 | \$7,818.00 |
| 2004 | \$7,549.00 |
| 2005 | \$6,677.00 |
| 2006 | \$7,541.00 |
| 2007 | \$7,816.00 |
| 2008 | \$7,558.00 |
| 2009 | \$5,864.00 |

*Paid to Pennsville, Salem County

Refuge Administration

The refuge’s approved acquisition boundary encompasses approximately 4,527 acres along the Delaware and Salem Rivers in Pennsville Township, New Jersey. The refuge boundaries are defined by the Delaware River, Salem River, New Jersey Route 49, West Supawna Road, Fort Mott Road, and Lighthouse Road (see map 1.3 in chapter 1).

Supawna Meadows NWR Land Acquisition History

Table 3.4 lists the land acquisition history for the refuge. The dates from the 1800s represent when some of the original refuge lands were first transferred from private ownership to the Federal government. These properties were owned by different Federal agencies and were eventually transferred to the U.S. Fish and Wildlife Service.

Table 3.4. Land acquisition history for Supawna Meadows NWR

| Acquisition Year | Acres | Price* |
|------------------|-----------------|-----------------------|
| 1837 | 18.89 | 0 |
| 1837 | 19.01 | \$1,500.00 |
| 1876 | 1.86 | 0 |
| 1935 | 1.86 | 0 |
| 1941 | 5.0 | 0 |
| 1973 | 562.4 | 0 |
| 1973 | 91.0 | \$300,000.000 |
| 1974 | 41.8 | \$15,700.00 |
| 1979 | 1002.3 | 0 |
| 1979 | 11.9 | \$154,044.00 |
| 1987 | 367.5 | 0 |
| 1987 | 114.4 | \$84,000.00 |
| 1990 | 81.06 | 0 |
| 1990 | 254.47 | \$415,000.00 |
| 1992 | 288.4 | 0 |
| 1992 | 32.8 | \$327,400.000 |
| 2006 | 121.0 | 0 |
| 2009 | 254.3** | 0 |
| Total | 3,270.05 | \$1,297,644.00 |

*Zero price indicates land was donated

**All held in conservation easement

Operating Budget

With the complexing of Supawna Meadows NWR to Cape May NWR in 2004 and the implementation of the Northeast Region's Strategic Workforce Plan in 2006, no specific operating budget has been allocated for Supawna Meadows NWR. All operation and maintenance funding for Supawna Meadows NWR is supported by Cape May NWR's allocated annual budget.

Supawna Meadows NWR Staffing

The staff at Supawna Meadows NWR once consisted of a wildlife biologist, a maintenance worker (with collateral law enforcement duties), and an administrative support assistant. When the Northeast Region's Strategic Workforce Plan was implemented in 2006, the refuge was deemed an unstaffed satellite of Cape May NWR. The plan eliminated the wildlife biologist and administrative support assistant, and the maintenance worker position was relocated to Cape May NWR. Supawna Meadows NWR currently has no onsite staff. Cape May NWR currently has six full-time staff. Annually, about 20 percent of each full-time employee's time from Cape May NWR is spent providing management, maintenance, or law enforcement support to Supawna Meadows NWR (for more detailed information on staffing refer to appendix E).

Facilities and Maintenance

The refuge headquarters office is located along Lighthouse Road adjacent to the FPRRL. The building design was modeled after the FPRRL keeper's house to compliment this historic structure. It serves as office space for staff as well as a reception area for visitors; however, the building is currently unoccupied because there is no staff assigned to Supawna Meadows NWR. Also located at this site are a four-bay garage for storing equipment and three other outbuildings, including a small building that used to store oil for FPRRL. Buildings at the previous headquarters site, located approximately 0.5 miles from the refuge headquarters off Lighthouse Road, include a barn, garage, house, and office. The

refuge has two housing quarters. One is located off Route 49 and is currently used to house temporary employees. The other, located off Lighthouse Road, is vacant.

Refuge Operational Plans ("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 every 5 to 10 years. Some require additional NEPA analysis, public involvement, and compatibility determinations before they can be implemented.

The following step-down plans are completed and up-to-date:

- Hunt Plan (reviewed annually)
- Fishing Plan (reviewed annually)
- Safety Plan
- Continuity of Operations Plan
- Fire Management Plan

The following step-down plans need to be completed for the refuge:

- Habitat Management Plan (HMP) (the highest priority plan to complete)
- Water Management Plan (to be incorporated into HMP)
- Law Enforcement Plan
- Integrated Pest Management Plan (to be incorporated into HMP)
- Facilities Plan
- Sign Plan
- Visitor Services Plan

Partnerships

The reduced staff time at Supawna Meadows NWR has limited our ability to fully participate in partnerships with agencies and organizations with which we have common conservation goals. We currently maintain partnerships with New Jersey Forest Fire Service, NJDFW, Friends of Supawna Meadows NWR, and New Jersey Audubon Society.

Volunteer Program

Approximately seven people regularly volunteer on the refuge. The primary duties consist of maintenance activities such as mowing around facilities and mowing and maintaining trails. The activities of the volunteers are critical to the operation of the refuge due to the lack of assigned full-time staff. Volunteers also engage in outreach activities sponsored by the Friends of Supawna Meadows NWR.

Friends Program

The Friends of Supawna Meadows NWR was created in 2003 by local residents and volunteers. The mission of the group is "To enhance this national treasure by fostering community awareness, conducting outreach and environmental education, and supporting habitat and wildlife conservation on the refuge." The group currently consists of about 50 members; however, the number of members is increasing and the group is actively working to raise the profile of the refuge.

The group's primary annual activity is the Youth Fishing Event, usually held in early June. Up to 100 youths attend the fishing derby. Participants are provided the gear and bait needed to fish. They also receive a free lunch and a prize.

Other activities organized by the Friends group include nature walks, trail maintenance days, and off-site outreach at local festivals such as Septemberfest and the Winter Raptor Festival. The Friends Group is also active in educating local and Federal officials about refuge needs and events.

Research

An impoundment study was conducted on the Tract 11 impoundment from 2005 through 2008 in cooperation with 22 other refuges in the Northeast and Midwest. The objectives of the study were to determine the response of waterbirds, plants, and invertebrates while providing habitat for migratory waterbirds; to use impoundment bathymetric data to meet spring shorebird, fall shorebird or fall waterfowl habitat requirements; and to study vegetation response to spring and summer drawdowns. Water levels in the impoundment were lowered for shorebird use and raised for waterfowl use during various times of year.

Special Use Permits

In general, special use permits are issued for associated wildlife related research projects or studies to cooperating partners such as NJDFW, New Jersey Audubon Society, and others. Proposed research projects and other compatible uses are issued special use permits when they are determined to be beneficial to the refuge mission.

Biological Resources

This section describes the physical characteristics and plant species composition of the principal refuge habitats as well as the invasive plant species that occur. It also identifies the wildlife species of conservation concern that use those habitats. Table 3.5 summarizes the acreage of each habitat type within the refuge. Approximately 87 percent of the refuge is in wetlands and impoundments, the other 13 percent is upland.

Tidal Marsh

The largest single habitat type on Supawna Meadows NWR is slightly brackish (0 to 8 parts per thousand) tidal marsh, which comprises 2,423 acres, about 75 percent of the refuge's acreage. This habitat type includes marsh habitat (1,931 acres) and the open water tidal rivers and creeks (492 acres). The tidal marsh soils consist of organic silts and fine to very coarse dredge river material. They occur on flats along the Delaware River to a depth of 20 feet. These features are regularly flushed during high tides. Tidal pools and ponds are generally found in the interior portions of regularly flowing tidal marshes, but these water bodies themselves may not be flooded on every tidal cycle.

The tidal marsh west of Route 49 was diked and drained for farming in the 18th century. Portions of the dike blew out in the 1930s, and the marsh relooded. Originally, there was more sheet flow from the Delaware Bay to Mannington Meadow (to the east of Route 49). However, flow is now restricted to a few locations and Mannington Meadow is fresher than the marshes on the west side of Route 49.

The portion of the refuge east of Route 49 lies within Mannington Meadow and contains a diversity of vegetation. Dominant species include smooth cordgrass (*Spartina alterniflora*), pickerelweed (*Pontederia cordata*), water hemp (*Amaranthus cannabinus*), wild rice (*Zizania aquatica*), rice cutgrass (*Leersia oryzoides*), and common reed or phragmites. The Baldrige Creek area contains a diversity of vegetation similar to that found in the Mannington Meadow area, but there is a greater amount of phragmites in this area. Several rare plants occur in tidal marshes on the refuge (for example, seashore mallow (*Kosteletzkya virginica*) and long-awned sprangletop (*Leptochloa fascicularis* var. *maritima*)).

The Mill Creek and Mud Creek areas of the tidal marsh are extensively dominated by phragmites, which is the most prevalent invasive plant found on the refuge. Altogether, about 859 acres of the tidal marsh remain in native marsh vegetation; 762 acres are phragmites-dominated.

Breeding birds that inhabit the tidal marsh include the clapper rail (*Rallus longirostris*), king rail (*Rallus elegans*), least bittern (*Ixobrychus exilis*), coastal plain swamp sparrow (*Melospiza georgiana nigrescens*), seaside sparrow

Table 3.5. Habitats and refuge acres for Supawna Meadows NWR

| Habitat Type | Current Acreage |
|--|------------------|
| Developed | 27.26 |
| Developed | 0.42 |
| Levee | 5.21 |
| Road | 7.29 |
| Rural | 14.34 |
| Forested Uplands | 240.14 |
| Mesic Mixed Oak Forest | 22.73 |
| Northeastern Modified Successional Forest | 139.16 |
| Norway Spruce Plantation | 1.10 |
| Successional Sweetgum Forest | 77.15 |
| Forested Wetlands | 181.97 |
| Red Maple - Sweetgum Swamp | 172.03 |
| Red Maple / Lizard's-tail Swamp | 9.94 |
| Grassland | 122.02 |
| Cropland | 36.25 |
| Hay | 5.22 |
| Northeastern Old Field | 77.78 |
| Pasture | 2.78 |
| Herbaceous Wetland | 41.61 |
| Freshwater Phragmites Marsh | 38.79 |
| Smartweed Pond | 0.35 |
| Successional Wet Meadow | 2.48 |
| Impoundments with Water Control Structures | 85.61 |
| Impoundments without Water Control Structures | 3.98 |
| Creeping Lovegrass Coastal Plain Pond | 1.30 |
| Other Impoundments | 2.68 |
| Scrub/Shrub Uplands | 37.87 |
| Northeastern Modified Successional Shrubland | 37.87 |
| Scrub/Shrub Wetlands | 56.00 |
| Northeastern Modified Successional Shrubland | 56.00 |
| Scrub/Shrub Wetlands (Tidal) | 27.66 |
| Maritime Shrubland (northern bayberry type) | 3.90 |
| Northeastern Modified Successional Shrubland | 23.76 |
| Tidal Marsh | 1,934.05 |
| Atlantic Giant Cordgrass Marsh | 5.41 |
| Brackish Meadow | 2.31 |
| Brackish Tidal Low Marsh | 64.63 |
| Cattail Brackish Marsh | 370.41 |
| Mesohaline Seepage Marsh | 2.53 |
| Oligohaline Marsh | 47.27 |
| Tidal Phragmites Marsh | 1,438.23 |
| Woolgrass Marsh | 0.26 |
| Open Waters | 491.70 |
| Grand Total | 3,249.89* |

*Includes 231 acres held under conservation easement by the refuge. The owners have reserved certain rights on an additional 20 acres of this easement so these acres are not included.

(*Ammodramus maritimus*), and sedge wren (*Cistothorus platensis*). The tidal marsh is an important foraging area for the nine Pea Patch Island colonial-nesting wading birds, which include five priority species: little blue heron (*Egretta caerulea*), glossy ibis (*Plegadis falcinellus*), snowy egret (*Egretta thula*), black-crowned night-heron (*Nycticorax nycticorax*), and least bittern.

The tidal marsh supports raptors including the bald eagle (*Haliaeetus leucocephalus*) and osprey (*Pandion haliaetus*). The marsh also provides migrating and wintering habitat for two populations of the Canada goose (*Branta canadensis*), Atlantic Population Canada geese and North Atlantic Canada geese; and for the tundra swan (*Cygnus columbianus*). It also supports migrating shorebirds such as the semipalmated sandpiper (*Calidris pusilla*), dunlin (*Calidris alpina*), and greater yellowlegs (*Tringa melanoleuca*).

The tidal marsh supports a diversity of other wildlife species including the marsh rice rat (*Oryzomys palustris*), a New Jersey nongame species of conservation concern (NCC), and the northern diamondback terrapin (*Malaclemys terrapin terrapin*). It also supports NCC insects of conservation concern such as the frosted elfin butterfly (*Callophrys irus*) and a noctuid moth (*Macrochilo* sp. 1 nr. *absortalis*).

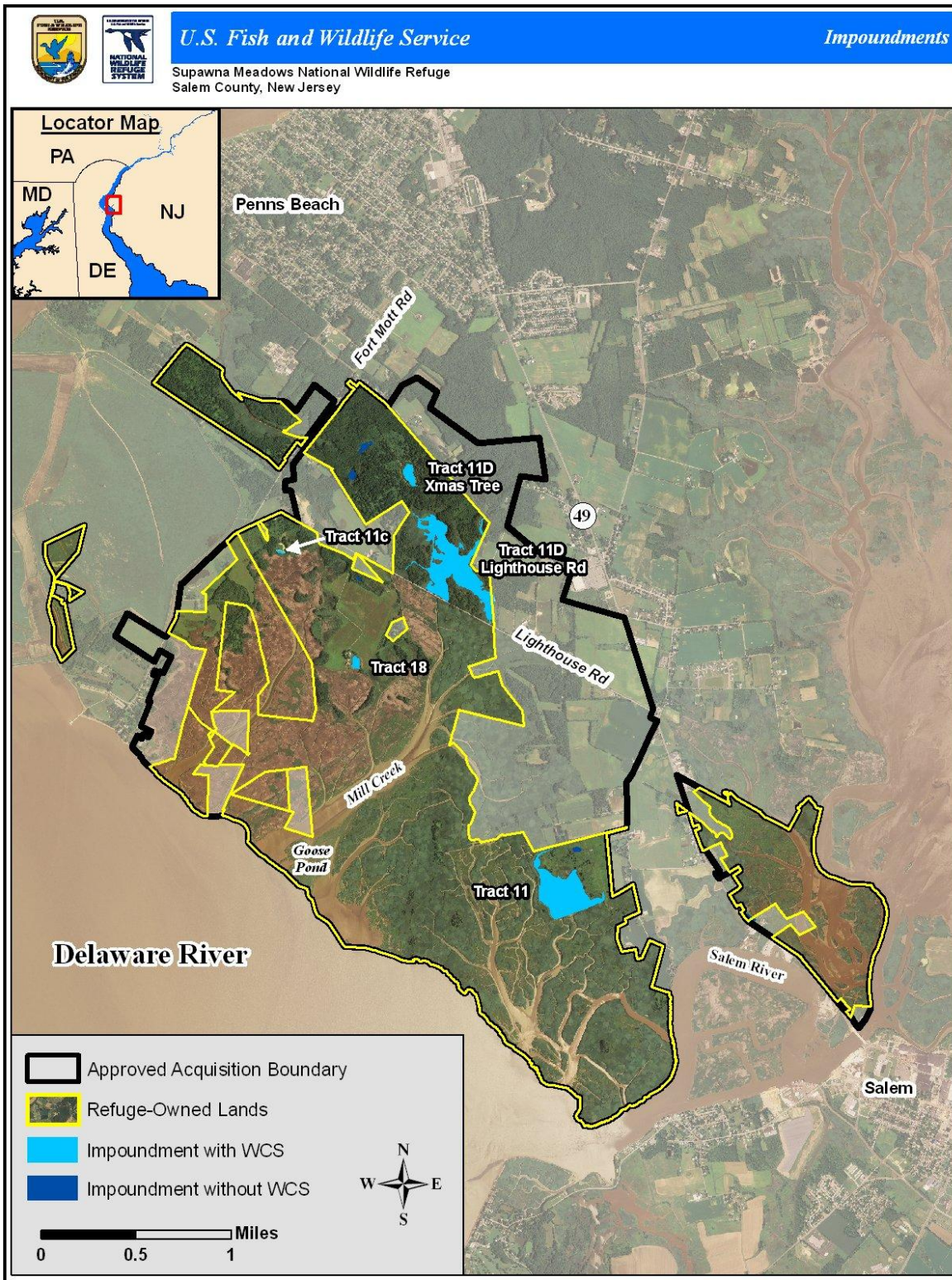
Managed Impoundments and Ponds

The refuge has five impoundments with water control structures, totaling approximately 84 acres (table 3.6, map 3.4). A natural increase in water levels can occur from rainfall and from natural springs. In these impoundments, boards are placed or removed to control the water level; either releasing impounded waters or allowing tidal water to flow into the impoundment. Currently, the water level is managed in three of the five impoundments.

Table 3.6. Managed impoundments of Supawna Meadows NWR

| Name | Location | Size (acres) | Habitat: |
|--------------------------------|---|--------------|---|
| Tract 11 | Off West Supawna Road | 30 | cattail marsh; surrounded by tidal marsh and farm fields |
| Tract 11C | Behind new office/quarters | 0.3 | open water; surrounded by tidal marsh, forested and scrub/shrub wetlands, old field |
| Tract 11D Lighthouse Rd (LHR) | On Lighthouse Rd | 48.5 | open water; surrounded by tidal marsh, forest |
| Tract 18 | At old office/barn | 1.5 | open water; surrounded by grassland and tidal marsh |
| Tract 11D Xmas Tree Lane (XTL) | Off X-mas Tree Lane/ off Forest Habitat Trail | 3.3 | open water; surrounded by forest |

The Tract 11 impoundment is a 30-acre freshwater emergent wetland adjacent to the tidal marsh. A water control structure at the head of a tidal creek is used to manipulate water levels within the impoundment. Prescribed fire has been used to control vegetation in the impoundment. Mowing and flooding can also be used to reduce overcrowding vegetation. Water levels are managed to provide habitat for trust resources, primarily shorebirds, wading birds, and waterfowl. Plants that occur in this impoundment include Walter's cockspur grass (*Echinochloa walteri*), spreading panic grass (*Panicum dichotomiflorum*), cattail (*Typha* sp.), bulrush (*Scirpus* sp.), and sedges (*Cyperus* sp.). Several rare plants occur in and around this impoundment including hooded arrowhead (*Sagittaria calycina* var.



Map 3.4. Impoundments at Supawna Meadows National Wildlife Refuge.

calycina) and giant foxtail (*Setaria magna*). Invasive species such as phragmites, purple loosestrife (*Lythrum salicaria*), Canada thistle, and mile-a-minute weed are displacing native species in the impoundments and along the dikes.

Breeding birds that use the impoundments include the little blue heron, marsh wren (*Cistothorus palustris*), American black duck (*Anas rubripes*), wood duck (*Aix sponsa*), and clapper rail.

Also supported are spring-migrating shorebirds including the semipalmated sandpiper, greater yellowlegs, and dunlin. In response to impoundment management for spring-migrating shorebirds during 2000 to 2001, almost 3,000 shorebirds were observed in the Tract 11 impoundment during late May at the peak of the spring migration. In 2004, weekly shorebird surveys were conducted from March through July at high tide. Greater yellowlegs, lesser yellowlegs (*Tringa flavipes*), semipalmated sandpipers, least sandpipers (*Calidris minutilla*), dunlin, common snipe (*Gallinago gallinago*), solitary sandpipers (*Tringa solitaria*), spotted sandpipers (*Actitis macularia*), and semipalmated plovers (*Charadrius semipalmatus*) were observed. The greatest number of shorebirds was detected on May 11 when 840 shorebirds, mostly semipalmated and least sandpiper, were observed.



Tract 11 Impoundment

The Pea Patch Island wading birds use the impoundments for foraging. Weekly wading bird surveys were conducted from March through September 2002 at high tide. Great blue herons (*Ardea herodias*), great egrets (*Ardea alba*), snowy egrets, little blue herons, cattle egrets (*Bubulcus ibis*), and glossy ibis were observed. The greatest number of wading birds was observed in the Tract 11 impoundment on May 14 when 63 individuals of 6 species were counted.

Weekly waterfowl surveys were conducted January through March and September through December 2002. American black ducks, Canada geese, gadwall (*Anas strepera*), green-winged teal (*Anas carolinensis*), mallards (*Anas platyrhynchos*), northern pintail (*Anas acuta*), and wood ducks were observed. The greatest number of ducks and geese was observed in the Tract 11 impoundment on November 25 when 326 Canada geese, 15 green-winged teal, 190 mallards, and 329 Northern pintail were counted.

Common snapping turtles (*Chelydra serpentina*), red-eared sliders (*Trachemys scripta elegans*), redbelly turtles (*Pseudemys rubriventris*), eastern painted turtles (*Chrysemys picta picta*), northern water snakes (*Nerodia sipedon*),

southern leopard frogs (*Rana sphenoccephala*), and northern spring peepers (*Pseudacris crucifer crucifer*) also are present in this impoundment. A number of amphibian and reptile species use all of the impoundments, including the Fowler's toad (*Bufo woodhousii fowleri*), which is listed as a non-game species of conservation concern by the New Jersey Division of Wildlife.

There are a number of small, unmanaged impoundments that lack water control structures. These consist of old clay pit ponds and other depressions in the forested areas. The ponds are man-made, most have high berms surrounding them, and some have drainage outlets. These impoundments are generally open water and unvegetated. However, the edges contain some plant species, such as Walter's cockspur grass, spreading panic grass, cattail, bulrush, and sedges. Wood duck and eastern screech owls (*Megascops asio*) benefit from nest boxes placed near these unmanaged impoundments.

Forested Wetlands

Forested wetlands comprise about 182 acres of refuge land. These wetlands are closed canopy swamps dominated by deciduous trees. The forest is interspersed with permanent and vernal ponds. Mature trees mostly have a 14 to 20 inch diameter breast height (dbh); dominant species include red maple (*Acer rubrum*), willow oak (*Quercus phellos*), sweetgum (*Liquidambar styraciflua*), and sour gum (*Nyssa sylvatica*). Dominant understory plants include southern arrowwood (*Viburnum dentatum*) and sweet pepperbush (*Clethra alnifolia*). Common groundcover plants include New York fern (*Thelypteris noveboracensis*) and false nettle (*Boehmeria cylindrica*). Several rare plant species occur in this habitat (for example, cutleaf water milfoil (*Myriophyllum pinnatum*) and stalked water horehound (*Lycopus rubellus*)). In many areas, the ground cover is dominated by the invasive plant Japanese stiltgrass (USFWS 2005a).

Upland Forests

Forested uplands, which include small forest openings not counted as scrub/shrub habitat, comprise about 240 acres of refuge land. At least 75 percent of the canopy coverage is from deciduous trees. The average height is at least 20 feet. Plant species include sweetgum, sour gum, black cherry (*Prunus serotina*), black oak (*Quercus velutina*), southern red oak (*Quercus falcata*), persimmon (*Diospyros virginiana*), American holly (*Ilex opaca*), and red maple. Dominant understory plants include southern arrowwood, highbush blueberry (*Vaccinium corymbosum*), and common greenbrier (*Smilax rotundifolia*).

Grassland

Approximately 86 acres of grassland habitat occur on the refuge, excluding cropland. A contiguous 78-acre grassland unit and several grassland patches of less than 6 acres occur on the refuge. The large grassland, located off Lighthouse Road, includes a diversity of grasses and forbs. It is maintained through mechanical methods, such as mowing, and by prescribed burning. Historically, the grassland was farmed; prior to farming, the conditions were maintained by fire that was periodically caused by lightning or man-made events. Some important plant species include cool season grasses, such as orchard grass (*Dactylis glomerata*), warm season grasses, such as switch grass (*Panicum virgatum*), and forbs, such as goldenrods (*Euthamia* sp. and *Solidago* sp.), and eupatoriums (*Eupatorium* sp.) (USFWS 2005a). Invasive plants of the grassland include Canada thistle, Chinese lespedeza (*Lespedeza cuneata*), and autumn olive. The grassland habitat does not support a large number of breeding birds but does provide migration and wintering habitat for songbirds, such as the bobolink, vesper sparrow, eastern meadowlark, and savannah sparrow, and for raptors, such as the northern harrier and short-eared owl.

Scrub/Shrub Habitat

There are approximately 122 acres of scrub/shrub and early successional habitats spread across the refuge, comprised of 84 acres of wetlands and 38 acres of uplands. These areas are dominated by a mixture of native plants (e.g.,

blackberry, goldenrod, grapevine, and bayberry (*Myrica pensylvanica*) and invasive plants (e.g., multiflora rose, autumn olive, Japanese honeysuckle, mile-a-minute weed, and phragmites) (USFWS 2005a).

Forest openings are mostly dominated by invasive plants (e.g., autumn olive, multiflora rose, Japanese honeysuckle, Japanese stiltgrass, and mile-a-minute vine). Other common plants in the forest openings include sweetgum, black cherry, blackberry (*Rubus* sp.), and grape vines (*Vitis* spp.). There are large patches within the mature forest where invasives do not occur. These patches host a number of S1³ and S2⁴ plants, including round-fruited hedge-hyssop (*Gratiola virginiana*), southern twayblade (*Listera australis*), stalked water horehound, cutleaf water milfoil, loblolly pine (*Pinus taeda*), and fragrant ladies' tresses (*Spiranthes cernua* var. *odorata*) (USFWS 2005a).

Invasive Plants

Invasive plants are found in all refuge habitats as discussed under each of the habitat types, but most importantly in the refuge's tidal marsh. The relative predominance of these species is shown in table 3.7, listing the most recent estimates of acreage across the refuge for each species.

Table 3.7. Important invasive plants* of Supawna Meadows NWR.

| Common Name | Scientific Name | Total Acreage | Acres of Dense (Monotypic) Coverage |
|--------------------------|-------------------------------|---------------|-------------------------------------|
| Phragmites/Common reed** | <i>Phragmites australis</i> | 531 | 511 |
| Japanese stiltgrass | <i>Microstegium vimineum</i> | 78 | 57 |
| Japanese honeysuckle | <i>Lonicera japonica</i> | 120 | 16 |
| Mile-a-minute vine | <i>Polygonum perfoliatum</i> | 63 | 6 |
| Autumn olive | <i>Elaeagnus umbellata</i> | 72 | 2 |
| Reed canary-grass | <i>Phalaris arundinacea</i> | 2 | 2 |
| Asiatic bittersweet | <i>Celastrus orbiculatus</i> | 16 | < 1 |
| Multiflora rose | <i>Rosa multiflora</i> | 93 | < 1 |
| Canada thistle | <i>Cirsium arvense</i> | 44 | < 1 |
| Chinese lespedeza | <i>Lespedeza cuneata</i> | 2 | < 1 |
| Wild Garlic | <i>Allium vineale</i> | 5 | < 1 |
| Johnsongrass | <i>Sorghum halepense</i> | 1 | < 1 |
| Bristled knotweed | <i>Polygonum caespitosum</i> | 11 | < 1 |
| Black locust | <i>Robinia pseudoacacia</i> * | 9 | 0 |
| Purple loosestrife | <i>Lythrum salicaria</i> | 1 | 0 |

*occupying a minimum of 1 acre as of 2002

**phragmites was not entirely mapped; the actual acreage is much higher.

Climate Change and Effects of Relative Sea Level Rise

Global climate change has already had an observable impact in the Northeastern United States, including an increase in the water temperatures, more days over 90 degrees Fahrenheit, less precipitation as snow fall, and sea level rise (Frumhoff et al. 2007). According to the Intergovernmental Panel on Climate Change (IPCC), sea level has risen worldwide approximately 4.8 to 8.8 inches (12 to 22 cm) during the last century (IPCC 2007). While there is some variation in projected sea level rise (e.g., Rahmstorf 2007, Pfeffer et al. 2008), the IPCC

³ S1: At very high risk due to extreme rarity (often 5 or fewer populations or occurrences in the State), very steep declines, or other factors.

⁴ S2: At high risk due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.

projects sea levels will rise an additional 7.1 to 23.2 inches, about 0.07 to 0.23 inches per year, between 1999 and 2099 (IPCC 2007). The historic trend for sea level rise for the refuge is 0.136 inches per year, about twice the global average for the last 100 years.

Tidal marshes are highly susceptible to effects of climate change, especially sea level rise. In an effort to address potential effects of sea level rise on refuges, the Service contracted the application of Sea Level Affecting Marshes Model (SLAMM) for many refuges in the Northeast, including Supawna Meadows NWR (see appendix G for SLAMM report). The SLAMM analysis looks at effects of projected sea level rise on the refuge's approved acquisition boundary under five scenarios: 1.28 ft, 2.26 ft, 3.28 ft, 4.92 ft, and 6.56 ft by 2100. Results from SLAMM indicate that by 2025 there will be noticeable changes in refuge habitats under all scenarios. For example, saltwater intrusion will increase salinity and the amount of saltmarsh within the refuge boundary between 140 and 200 percent (adding between 219 and 300 acres). Other tidal marsh habitats will likely decrease between 14 and 18 percent (losing about 300 to 400 acres). Over this same time span, tidal creeks within the refuge will likely increase between 22 and 31 percent (between 150 and 220 acres). Because much of the refuge's habitat is tidally influenced, sea level rise will likely change the species composition and associated habitat management for much of the refuge. We have not modeled potential effects of increased air temperatures and changes in seasons; however, these are likely to be much smaller compared to sea level rise given the tidal influence over much of the refuge's habitats.

**Federally listed
Threatened or Endangered
Species and Other
Species and Habitats of
Special Management
Concern**

The following federally listed threatened or endangered species may enter the Delaware Bay and may occasionally travel up the river as far as the refuge:

- Atlantic hawkbill
- Atlantic loggerhead
- Atlantic ridley
- Atlantic leatherback
- Shortnose sturgeon

All of these species are under the jurisdiction of NOAA. No sea turtle nesting habitat is present on the refuge. The shortnose sturgeon is present in the Delaware River; however, this species prefers larger rivers (Dadswell et al. 1984) and is not expected to occur within the refuge boundary. Whales occasionally enter the Delaware Bay, and one individual is known to have strayed as far north as Philadelphia, Pennsylvania.

Sensitive joint-vetch, a federally listed threatened species, has been reported at two locations near the refuge. It was found on the muddy tidal banks of the Delaware River on August 8, 1881 and to the north of the refuge in 1934. No plants were found during a brief survey conducted on September 30, 1992 (Snyder 2010 personal communication).

We will continue to consult with the Service's Ecological Services division and NOAA, as appropriate, regarding refuge activities that may affect federally listed threatened and endangered species. In addition, to ensure compliance with the ESA, this document has been subject to intragovernmental review under Section 7 of the ESA.

New Jersey maintains a State list of threatened or endangered species. Of these species, the osprey successfully nests on the refuge. Great blue heron feed on the refuge throughout the year. Bald eagles have nested on the refuge since 1998. Another pair of bald eagles has been maintaining a nest in the adjacent Salem River Wildlife Management Area. Peregrine falcons (*Falco peregrinus*) nest on

the Delaware Memorial Bridge, approximately seven miles north of the refuge. Peregrines may occasionally use the refuge for feeding and are occasionally observed during migration. Coast flatsedge (*Cyperus pseudovegetus*), a State-listed endangered species, was collected along the Delaware River on October 29, 1934. Floating pennywort (*Hydrocotyle ranunculoides*), another State-listed endangered species, was observed on the north side of Lighthouse Road, west/northwest of Harrisonville, in 1967 and again in 1985.

Appendix A lists the animals potentially found on the refuge that are federally listed threatened or endangered or are State-listed threatened, endangered, or a species of special concern.

Birds

Supawna Meadows NWR is located in the Atlantic Flyway where birds migrating from interior Canada and the coastal provinces merge to form the main stem of the flyway. The refuge not only serves as an important migration area, but also provides wintering habitat for large numbers of waterfowl. Midwinter waterfowl inventory flights for the Salem River watershed averaged more than 2,000 dabbling ducks and more than 11,500 Canada geese during the 2009 midwinter count (USFWS 2009d). Over 300 species of birds can be observed in Salem County during the year. Supawna Meadows NWR provides habitat for regionally and nationally significant species such as rails, neotropical migrants, and raptors (USFWS 2005a).

In describing the Supawna Meadows NWR Important Bird Area (IBA), the New Jersey Audubon Society noted the following:

The Supawna Meadows IBA provides breeding habitat for the State endangered bald eagle. Over 20 State threatened king rails also breed at this site. Significant numbers of breeding mixed upland forest, shrub/scrub, and forested wetland-dependent species occur at Supawna Meadows. The refuge marshes provide valuable foraging habitat for more than 6,000 pairs of colonial wading birds nesting less than a mile away on Delaware's Pea Patch Island. One of the largest heron rookeries on the east coast north of Florida supports nine species: great blue heron, great egret, little blue heron, tricolored heron, snowy egret, cattle egret, black and yellow-crowned night-heron and glossy ibis. The refuge provides important resting and feeding habitat for spring and fall migrants including waterfowl species and passerines. Mallards and northern pintails also winter at the refuge.

New Jersey Audubon Society 2009

Waterfowl

Thousands of waterfowl, including American black duck, American widgeon (*Anas americana*), Canada goose, blue-winged teal (*Anas discors*), green-winged teal, gadwall, mallard, northern pintail, snow goose (*Chen caerulescens*), and tundra swan use the refuge tidal marsh during winter and migration (USFWS 2005a).

Coastal salt marsh habitats of the mid-upper Atlantic coast, including the Delaware Bay marshes and Supawna Meadows NWR, have been identified by the Black Duck Joint Venture as the most important habitat for wintering black duck. Coastal wetlands, including the Delaware Bay marshes, are of international importance to wintering waterfowl, annually wintering 34 percent of the entire Atlantic Flyway black duck population (Black Duck Joint Venture 2008).

Raptors

Notable raptor species observed on the refuge include bald eagle, northern harrier (*Circus cyaneus*), sharp-shinned hawk (*Accipiter striatus*), Cooper's hawk (*A. cooperii*), red-shouldered hawk (*Buteo lineatus*), red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), and peregrine falcon. A number of State-listed endangered northern harriers and State-listed threatened osprey nest in the refuge tidal marsh (USFWS 2005a). A pair of bald eagles has nested on the refuge since 1998.

Forest Birds

The forest supports breeding wood thrush (*Hylocichla mustelina*), eastern wood-pewee (*Contopus virens*), northern flicker (*Colaptes auratus*), and Baltimore oriole (*Icterus galbula*); and migrating black-and-white warbler (*Mniotilta varia*), hooded warbler (*Wilsonia citrina*), and Kentucky warbler (*Oporornis formosus*), as well as Cooper's hawk.

Grassland Birds

As mentioned previously, the refuge's grassland habitat does not support a large number of breeding grassland birds, but it does support migrating and wintering songbirds, including the bobolink (*Dolichonyx oryzivorus*), vesper sparrow (*Pooecetes gramineus*), eastern meadowlark (*Sturnella magna*), and savannah sparrow (*Passerculus sandwichensis*), as well as raptor species such as northern harrier and short-eared owl (*Asio flammeus*).

Marsh, Wading, and Shorebirds

Supawna Meadows NWR provides foraging habitat for more than 6,000 pairs of 9 species of wading birds that nest on Pea Patch Island, one of the largest rookeries on the East Coast. Specifically, black-crowned night-heron, yellow-crowned night herons (*Nyctanassa violacea*) (State-listed threatened), great egret, and little blue heron (State species of special concern) forage in the tidal marsh throughout the breeding season. The refuge receives significant use by shorebirds during both spring and fall migrations, mostly least sandpiper and semipalmated sandpiper. King rail and least bittern (State species of special concern) breed in the refuge tidal marsh.

Pea Patch Island and the surrounding area, including the refuge, have been designated a Special Management Area (SMA) by the States of New Jersey and Delaware in accordance with the Coastal Zone Management Act.

The refuge receives significant use by shorebirds during both spring and fall migrations. Both the New Jersey and Delaware shores of the Delaware Bay are designated as International Shorebird Preserves, based on the importance of the estuary to migrating shorebirds.

Mammals

A large number of New Jersey non-game species of conservation concern mammals are on the refuge, including eastern small-footed myotis (*Myotis leibii*), eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), silver-haired bat (*Lasionycteris noctivagans*), and southern bog lemming (*Synaptomys cooperi*).

Common mammalian species include the meadow vole (*Microtus pennsylvanicus*), white-footed mouse (*Peromyscus leucopus*), short-tailed shrew (*Blarina brevicauda*), cottontail rabbit (*Sylvilagus floridana*), groundhog (*Marmota monax*), muskrat (*Ondatra zibethicus*), opossum (*Didelphis virginiana*), skunk (*Mephitis mephitis*), red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), mink (*Neovison vison*), long-tailed weasel (*Mustela frenata*), and river otter (*Lontra canadensis*).

White-tailed deer are numerous on the refuge. The NJDFW estimates the deer density around Salem County, Hunting Management Zone 63, to be 40.4 deer per square mile based on the harvest data for 2003 through 2005 hunting seasons.

The overall deer condition and productivity in this zone is considered excellent by the NJDFW. However, the high population of deer on the refuge, which has led to habitat overbrowsing, was the catalyst in initiating a special permit refuge deer hunting season in 1988. At least 50 deer are expected to be harvested annually from the refuge. Prior to 2008, deer hunting was conducted based on a permit system. Limited hunting seasons were open on the refuge for bow, shotgun, and muzzleloader. The number of hunters was limited to 35, 25, and 25 individuals, respectively, and hunters were selected through a random lottery system. Hunters were required to pay a fee for their refuge permit and attend a hunter orientation session. Beginning with the 2008 hunting season, the refuge is closed to all firearm seasons. The refuge is currently open for all of the State bow hunting seasons. There is no longer a lottery, permit, fee, or hunter orientation.

A large maternity colony of more than 1,500 bats, primarily the little brown bat, roosts in a barn on the refuge. The federally listed endangered Indiana bat is known to form small colonies within large little brown bat colonies. Indiana bats have been documented within the Highlands region of New Jersey, but little survey work has taken place within the southern portion of the State. It is not yet known if the species is present within the Coastal Plain. The nearest potential natural habitat for these bats is in a forest on the refuge about 1 mile from the barn (USFWS 2005a).

Reptiles and Amphibians

A number of amphibians and reptiles are found on the refuge, including the eastern painted turtle, common snapping turtle, eastern garter snake (*Thamnophis sirtalis*), black rat snake (*Elaphe obsoleta*), southern leopard frog, green frog (*Rana clamitans melanota*), and American bullfrog (*Rana catesbeiana*). Reptile and amphibian species of conservation concern include northern diamondback terrapin, eastern box turtle (*Terrapene carolina carolina*), spotted turtle (*Clemmys guttata*), and Fowler's toad (USFWS 2005a).

Fish

The tidal marshes, creeks, and ditches provide spawning, nursery, and feeding habitat for a variety of fish common to the Delaware Bay, Estuary, and River. Mummichog (*Fundulus heteroclitus heteroclitus*) is the most abundant forage fish. Striped bass (*Morone saxatilis*) and white perch (*Morone americana*) are two of the more important anadromous species. American eel (*Anguilla rostrata*), a catadromous species, is currently a species of concern in New Jersey and the Mid-Atlantic Fisheries Council. Prior to the closure of the season on elvers (immature eels), commercial netting of elvers on and around the refuge, and from road right-of-ways within the refuge boundary, was common. Other important fish species found near, and potentially affected by, refuge activities include the federally listed endangered short-nosed sturgeon, and the Atlantic sturgeon. The refuge provides nursery habitat for menhaden (*Brevoortia tyrannus*), blueback herring (*Alosa aestivalis*), alewife (*Alosa pseudoharengus*), American shad (*Alosa sapidissima*), and striped bass. Blue crabs (*Callinectes sapidus*) are also found within tidal waters near the refuge and are part of the local recreational shellfishery.

Invertebrates

A wide diversity of terrestrial and aquatic invertebrate species inhabit the refuge tidal marsh and other habitats, including the eastern amberwing (*Perithemis tenera*), common green darner (*Anax junius*), seaside dragonlet (*Erythrodiplax berenice*), and the calico pennant (*Calithemis elisa*). Butterfly species include the orange sulfur (*Colias eurytheme*), black swallowtail (*Papilio polyxenes*), spicebush swallowtail (*Papilio troilus*), and eastern tailed-blue (*Everes comyntas*).

**Wildlife-dependent
Public Use**

The priority public uses of the Refuge System are hunting, fishing, wildlife observation and photography, and environmental education and interpretation. The FPRRL, a historic lighthouse on the refuge, also draws visitors (USFWS 2005a). Further details on the various public uses occurring on the refuge are presented in chapter 3 (pp. 3-5 and 3-22) and in appendix B.

Visitor Numbers

In 2009, an estimated 15,000 visits were made to the refuge. A visit is defined as an individual, uninterrupted visit to the refuge for any length of time in a day. One person may make multiple visits to the refuge in one day if they leave and return. Over the past 5 years, visitation has ranged from 15,000 to 20,000 visits. Visitors participated in the following activities: hunting, fishing, wildlife observation, photography, interpretation, and other refuge approved activities.

Hunting

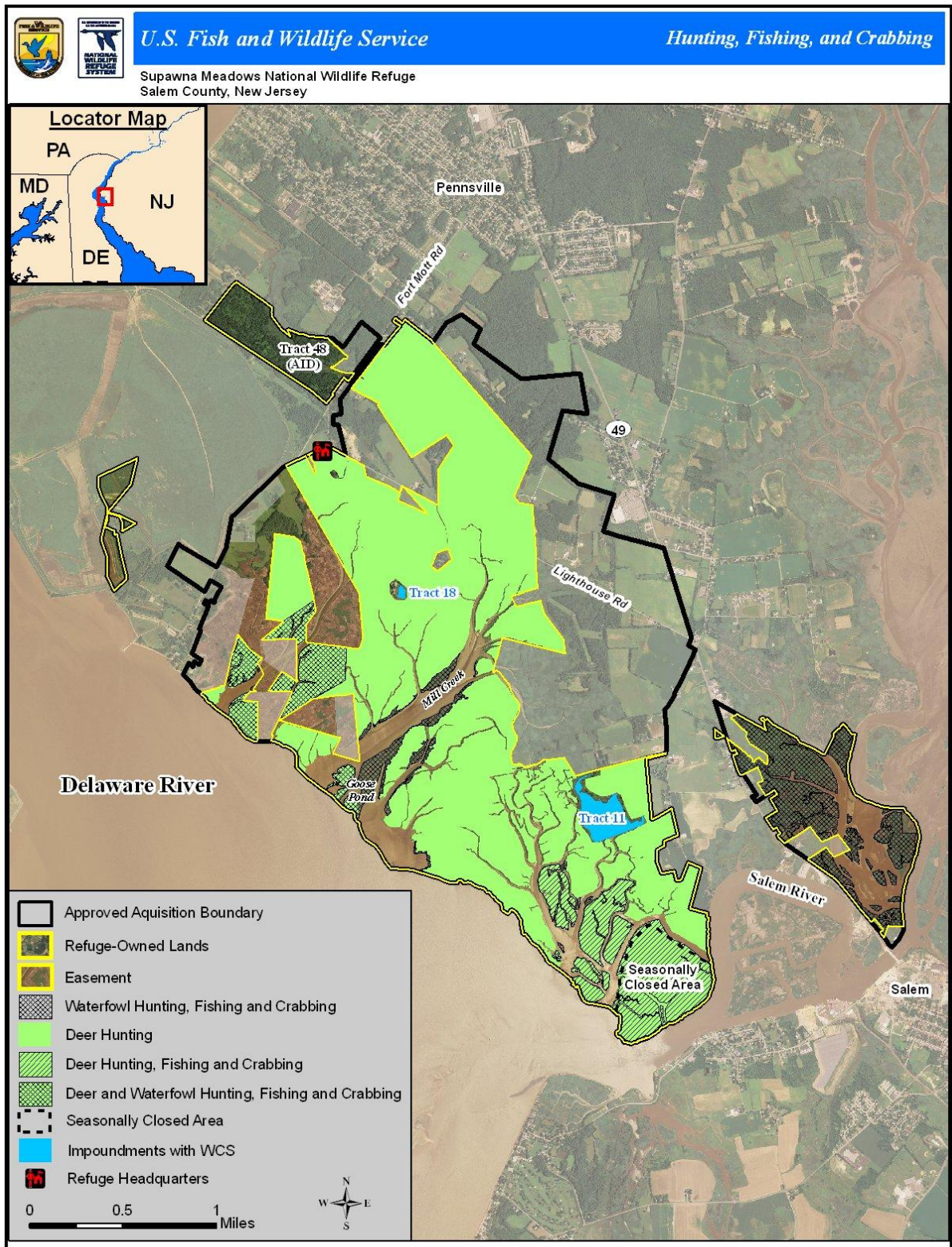
Portions of Supawna Meadows NWR are currently open for deer and waterfowl hunting (map 3.5). The refuge is open to deer hunting for all four of New Jersey's bow hunting seasons according to the State Deer Management Zone 63 regulations. Portions of the refuge are open to waterfowl hunting per State regulations. Waterfowl are hunted mainly by boat entry to the refuge from the Delaware River and Salem River.

Fishing and Crabbing

Fishing and crabbing in the tidal marsh, according to State laws and regulations, are currently allowed in specific areas of the refuge (map 3.5). While boating is prohibited on all of the freshwater ponds and impoundments within the refuge, an annual youth fishing event is authorized on a freshwater tidal pond (see chapter 4, objective 4.2 for more details).

**Wildlife Observation,
Photography, and
Interpretation**

There are two walking trails for wildlife observation, photography, and interpretation (see also chapter 4, map 4.3). The Grassland Trail, along Lighthouse Road, offers visitors the opportunity to view grassland, forest, and tidal marsh habitat. A portion of the trail and the marsh overlook are wheelchair accessible. The Forest Habitat Trail is located off Fort Mott Road on Xmas Tree Lane. This trail goes through a forested upland and wetland section of the refuge through scrub/shrub habitat and surrounds the Tract 11D impoundment. Wildlife observation, photography, and interpretation at the refuge can also be accessed by boat using the tidal streams.



Map 3.5. Areas of Supawna Meadows National Wildlife Refuge currently open to waterfowl hunting, deer hunting, and fishing and crabbing.

Cultural Resources

Human occupation of the New Jersey coast began with the arrival of Native American hunter-gatherer bands approximately 10,000 B.C. The Lenape Tribe inhabited the land that is now the refuge as well as the surrounding area (USFWS 2005a).

Archaeological Resources

An archaeological study conducted for ACE in 1992 (USACE 1994) identified four sites inhabited during the late Woodland period, circa A.D. 700 to A.D. 1600. Two additional pre-European contact sites were reported on current refuge lands in 1915, but they have not been scientifically investigated since that time. One is known to have contained pottery, so may also be Woodland in date.

Permanent settlement of the area by Europeans began in the 17th century. Beginning in the late 18th century, farmers began to extensively dike the tidal marsh and excavate ditches to convert it to salt hayfields. In 1900, a rock dike was built along the marsh edge to prevent erosion that was increasingly damaging the earlier dike system. The rock dike failed early in the 1930s, reflooding the tidal marsh. Remains of the dike are still present between the marsh and the Delaware Bay, possibly restricting tidal flow and decreasing the quality of the marsh habitat. Some of the drainage ditches and earth dikes are also still present within the tidal marsh, altering its hydrology.

There are 20 historic period archaeological sites recorded on the refuge, only one of which has been identified in the field. The locations of the other 19 are known only from historical maps. Up to five of them, including the Finn's Point Front Range Lighthouse (built in 1876) and a pair of small structures possibly associated with Fort Mott (begun in 1897), may have been lost to late 20th century coastal erosion. The majority of the others are farmsteads established in the mid-19th century or earlier and abandoned in the late 19th and early 20th century, many of which are now in marsh settings due to sea level rise.

There is also a family cemetery on the refuge containing three gravestones that all date from 1880 located along the refuge's Grassland Trail on Tract 18. It is maintained by refuge volunteers and often visited by Pennsville residents (USFWS 2005a).

Historic Period Structures

The FPRRL, built in 1876 to aid navigation on the Delaware River, is on the National Register of Historic Places. It was extensively restored by the Service in 1983, with additional repairs in 1990 and 2003. In the past, volunteers maintained the site and opened the structure to the public the third Sunday of the month from April through October. Due to staff shortages, the site is currently only open to the public during the New Jersey Lighthouse Challenge in mid-October. A 2007 engineering inspection of the structure indicated a potential safety hazard of the catwalk that would require repair to assure public safety. Therefore, until repair, the catwalk is closed to the public. There is also a small shed located nearby that was historically used to store oil for FPRRL.

The former Yerkes (Urion) farmstead, a 19th century dwelling with 20th century outbuildings, is located on Tract 18. All or part of the farmstead is potentially eligible for the National Register of Historic Places (National Park Service 2001). We plan to consult with the State Historic Preservation Office to formally determine its eligibility within fiscal years 2011 or 2012.

Chapter 4



Gene Nieminen/USFWS

Supawna Meadows NWR Impoundment

Management Direction and Implementation

- Introduction
- General Refuge Management
- Goals, Objectives, and Strategies

Introduction

This chapter describes the array of management actions that, in our professional judgment, work best toward achieving refuge purposes, vision and goals, and respond to public issues.

Summary

These actions prioritize protecting and restoring the refuge’s native tidal marsh habitat to benefit Pea Patch Island colonial-nesting wading birds, secretive marsh birds, migratory waterfowl, shorebirds, and other birds of conservation concern. A secondary consideration will be to manage a diversity of other refuge wetland and upland habitats to benefit breeding and migrating songbirds, waterfowl, and raptors as well as amphibians, reptiles, and mammals of conservation concern.

Our Visitor Services program will be enhanced to provide more opportunities for a wide variety of compatible wildlife-dependent activities. In 2005, the Northeast Region Visitor Services Review Team identified visitor programs of emphasis for each refuge. The programs identified for this refuge were interpretation and wildlife observation and photography, the same as Cape May NWR, which administers Supawna Meadows NWR. This determination was based on careful consideration of our natural resources, existing staff, operational funds, existing and potential facilities, and which programs we would be most effective in providing “quality” opportunities for visitors.

We have developed a habitat map (see map 4.1, p. 4-47) to help readers visualize how the refuge habitats, as broadly reflected by future vegetation cover, will look over the long term. Using GIS mapping tools and data sets, our habitat map is a graphic representation of the potential vegetation that will result. While the CCP describes potential vegetation management actions within a 15-year time frame, many of the habitat changes will not be visible until well beyond 15 years.

General Refuge Management

The actions presented in this section are actions required by law or policy, or represent actions that have undergone a separate NEPA analysis, public review, agency review, and approval. Or, they are administrative actions that do not necessarily require public review, but are actions we wanted to highlight in our implementation plan. Finally, most of the actions outlined in this part of chapter 4 support multiple goals and objectives and therefore do not lend themselves to the organization in the Goals, Objectives, and Strategies portion of this chapter.

Acquiring Land within the Current Refuge Acquisition Boundary

The Service will continue its policy of buying land from willing sellers and focus its land acquisition efforts on developable upland properties first. We will continue to purchase portions of the 1,257 acres of inholdings within the 4,527-acre acquisition boundary from willing sellers as funding allows.

Managing Conservation Easements

The refuge purchased a conservation easement in June 2009 on the 254.3-acre Davis Property. A conservation easement is a legal agreement voluntarily entered into by a property owner and a qualified conservation organization such as a land trust or a government agency. The easement contains permanent restrictions on the use or development of land in order to protect its conservation values. The owners have reserved certain rights on 20 acres of this easement.

Many refuges have utilized the Service’s “Partners for Fish and Wildlife Program” to work with private landowners to conduct annual invasive species control measures on private lands. The acquisition of this conservation easement has allowed refuge staff to take advantage of this type of opportunity at Supawna Meadows NWR as well. The refuge will continue to enforce and monitor the terms of the conservation easement. This includes consultation with the landowner, invasive species control, inventory and survey requirements, and law enforcement. Staff time for this effort amounts to one to two days annually.

Protecting Federally listed Threatened and Endangered Species

The following federally listed threatened or endangered species occur or have historically occurred on refuge lands or in the tidal Delaware River:

- Atlantic hawksbill
- Atlantic loggerhead
- Atlantic ridley
- Atlantic leatherback
- Shortnose sturgeon
- Sensitive joint-vetch

None of these species are known to currently utilize refuge lands or waters. Shortnose sturgeon occur in the Delaware River and refuge activities could have minimal effects on their habitat or prey. We will continue to work closely with our Ecological Service's New Jersey Field Office, NMFS, the Delaware Bay Estuary Project, and the New Jersey Department of Environmental Protection (NJDEP), if there are confirmed observations of these species or other federally listed species (for example, Indiana bats) in the future at the refuge and if we determine that actions taken on the refuge could be of value to their survival or recovery.

Distributing Refuge Revenue Sharing Payments to Salem County

As described in chapter 3, we pay Salem County refuge revenue sharing payments based on the acreage and the appraised value of refuge lands. These annual payments are calculated by a formula determined by Congress with funds appropriated by Congress. The Service will continue those payments in accordance with the law, commensurate with changes in the appraised market value of refuge lands or new appropriation levels dictated by Congress.

Protecting Cultural Resources

As a Federal land management agency, we are entrusted with the responsibility to locate and protect all cultural resources, specifically archaeological sites and historic structures listed or eligible for listing in the National Register of Historic Places. This applies not only to refuge lands, but also on lands affected by refuge activities.

We will conduct an evaluation of the potential for our projects to impact archaeological and historical resources; we will continue to consult with the Service's archaeologists, architectural historian, and the New Jersey SHPO. This will be especially important for those projects that include moving or displacing soil or removing buildings. A preproject evaluation of activities will ensure we comply with section 106 of the National Historic Preservation Act. That compliance may require any or all of the following: a State Historic Preservation Records survey, literature review, or field survey.

Animal Damage Control

We will take necessary actions to address animal damage that threatens to destroy refuge resources, jeopardizes public safety, or causes potential harm to neighboring properties. Refuge staff will either control these animal populations with refuge resources, invite State-licensed volunteers to control them, or hire commercial trappers.

Conducting a Wilderness Review

The refuge system planning policy requires that we conduct a wilderness review during the CCP process. We inventoried all refuge lands and waters the Service owns in fee simple. Our inventory of this refuge determined that no areas meet the eligibility criteria for a wilderness study area as defined by the Wilderness Act. Therefore, we did not further analyze the refuge's suitability for wilderness designation. See appendix D for the results of the wilderness inventory. The refuge will undergo another wilderness review in 15 years as part of the next comprehensive conservation planning process.

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|--|---|
| Issuing Special Use Permits | Special use permits (SUPs) may be issued for special or unique activities allowed on refuges. Each activity will be evaluated on a case-by-case basis. |
| Vegetation Mapping | Vegetation mapping will be conducted based on National Vegetation Classification System criteria and we will map all habitat types, vegetation communities, and the location of habitats of focal species as identified in this CCP. |
| Water Quality Inventory and Monitoring | Adequate supplies of clean water are critical to plants, wildlife, and people. The Refuge System has a legislative mandate under the National Wildlife Refuge System Administration Act, as amended by the Refuge Improvement Act, to help maintain adequate water quality and quantity to fulfill the mission of the Refuge System and the purposes of each refuge. To better address this, the Refuge System is currently in the process of developing an inventory and monitoring program to document the status, assess conditions, and detect changes in the system's resources, including water quality and quantity. We will implement guidance provided by this effort when completed, provided staffing and funding allow. In addition to this legal mandate, the refuge will also participate in Spill Prevention, Control, and Countermeasure (SPCC) Plans, or other environmental emergency action plans, to aid in the protection of the Delaware Bay and River as needed. |
| Public Use of Land within the Current Refuge Acquisition Boundary | As the Service continues to acquire the remaining 1,254 acres of inholdings within the 4,527-acre acquisition boundary, each individual parcel of property acquired will be subject to authorized public use activities (this includes priority and non-priority public uses), unless subject to specific deed restrictions. The added parcels of property will also be subject to all refuge and Service policies and regulations. The EA analysis and Compatibility Determinations for this CCP will apply to these additional parcels. |
| | <p>Priority Public Uses</p> <p>The 1997 Refuge Improvement Act designated six wildlife-dependent priority public uses on National Wildlife Refuges: hunting, fishing, wildlife observation and photography, and environmental education and interpretation. Per the General Guidelines for Wildlife-Dependent Recreation (605FW 1), we will strive to ensure that the wildlife-dependent recreation program:</p> <ol style="list-style-type: none"> 1. Promotes safety of participants, other visitors, and facilities. 2. Promotes compliance with applicable laws and regulations and responsible behavior. 3. Minimizes or eliminates conflict with fish and wildlife population or habitat goals or objectives in an approved plan. 4. Minimizes or eliminates conflicts with other compatible wildlife-dependent recreation. 5. Minimizes conflicts with neighboring landowners. 6. Promotes accessibility and availability to a broad spectrum of the American people. 7. Promotes resource stewardship and conservation. 8. Promotes public understanding and increases public appreciation of America's natural resources and our role in managing and conserving these resources. 9. Provides reliable/reasonable opportunities to experience wildlife. 10. Uses facilities that are accessible to people and blend into the natural setting. 11. Uses visitor satisfaction to help to define and evaluate programs. |

In 2005, the Northeast Region Visitor Services Review Team identified visitor programs of emphasis for each refuge. The two programs identified for this refuge were wildlife observation and photography, the same as Cape May NWR. This determination was based on careful consideration of our natural resources, existing staff, operational funds, existing and potential facilities, and which programs we would be most effective in providing “quality” opportunities for visitors. While all of the priority public uses are important and offered to some degree on this refuge, wildlife observation and photography will receive greater emphasis when prioritizing refuge resources. As always, we look to our partners, Friends of Supawna Meadows NWR, and other volunteers to develop and assist with all refuge public use programs.

Chapter 1 describes the requirements for appropriateness and compatibility determinations. Appendix B includes approved findings of appropriateness and compatibility determinations to support the activities described here. We will only allow activities determined appropriate and compatible to meet or facilitate refuge purposes, goals, and objectives.

Currently, the State does not issue permits to hunt black bear in black bear hunting area 6 (BHA 6) where Supawna Meadows NWR is located, and refuge staff is not aware of any conflicts with bears on the refuge. However, New Jersey’s black bear population is increasing, and it is possible that bears could become a nuisance on or near the refuge within the next 15 years. If the State changes hunting regulations to allow black bear hunting in BHA 6 and we receive enough interest, we will evaluate whether or not to authorize this activity on the refuge. Before opening the refuge to bear hunting, we would need to thoroughly evaluate the effects of this activity. This process would include, amongst other things, completing additional analyses, providing opportunities for public review and comment, and making an announcement in the *Federal Register*.

Although we are not proposing to open the refuge to turkey hunting at this time, we are willing to discuss opening the refuge to spring turkey season with assistance from the State. As with evaluating opening the refuge to bear hunting, we would need to complete additional analysis to evaluate the effects of allowing turkey hunting through a separate NEPA process.

Non-Priority Public Uses Allowed

In addition to the six priority recreational and educational uses, we have determined that some other activities, for example FPRRL visitation and scientific research are appropriate and compatible on refuge lands under certain circumstances. These activities are either discussed earlier in this section or described in detail in the next chapter. Findings of Appropriateness and Compatibility Determinations for these activities are in appendix B.

Non-Priority Public Uses Not Allowed

We have received several requests for permission to engage in non-priority, non-wildlife dependent activities on the refuge. Activities evaluated by the refuge manager and determined not to be appropriate on refuge lands include, but are not limited to: bicycling, geocaching, horseback riding, jogging, non-wildlife dependent group gatherings, and organized or facility-supported picnicking. Appendix B documents the refuge manager’s decision on appropriate activities. Most of these activities are sufficiently allowed elsewhere on other nearby ownerships, so the lack of access on the refuge does not eliminate the opportunity in the area. According to Service policy 603 FW 1, if the refuge manager

determines a use is not appropriate, it can be denied without determining compatibility.

Controlling Animal Pests

At times, certain wildlife species and pest animals interfere with management objectives. The Refuge Manual (7 RM 14.4A) defines a pest as “Any terrestrial or aquatic plant or animal which interferes, or threatens to interfere, at an unacceptable level, with the attainment of refuge objectives or which poses a threat to human health.” In this section, we describe some situations involving native species and under what conditions we will initiate control.

In controlling pests, we use an integrated approach. The Refuge Manual (7 RM 14.4C) defines integrated pest management as “A dynamic approach to pest management which utilizes a full knowledge of a pest problem through an understanding of the ecology of the pest and ecologically related organisms and through continuous monitoring of their populations. Once an acceptable level of pest damage is determined, control programs are carefully designed using a combination of compatible techniques to limit damage to that level.”

An integrated approach uses various methods, including natural, biological, cultural, mechanical, and chemical controls. Some examples and potential remedies of pest management follow.

We will use the following general strategies in pest management:

1. Determine the need for site-specific control based on the potential to affect our management objectives for a given area. Although we will employ an adaptive management strategy, we also expect the lethal control or removal of individual animals to be the exception rather than the rule. Unfortunately, to establish general thresholds for that action is difficult. Instead, we will determine our solution on a case-by-case basis.
2. Employ integrated pest management techniques when a species is having a significant impact on an area resulting in major habitat replacement and loss of valuable canopy trees.
3. Monitor results to ensure that pests do not exceed acceptable levels.

Mute Swans

Despite their aesthetic appeal, mute swans can cause problems. The mute swan is native to Europe and Asia, but is nonnative species in the United States. Mute swans are established throughout New Jersey and are responsible for excessive herbivory to submerged aquatic vegetation in wetland habitats during key portions of the growing season. Mute swans are well distributed throughout New Jersey but are most abundant in park ponds and small lakes in northern New Jersey, as well as coastal ponds and impoundments along both the Atlantic Coast and Delaware Bay. The New Jersey Wildlife Action Plan (NJWAP) goal (NJDFW 2008a) is to reduce the impacts of mute swan herbivory to native vegetation in wetlands and managed impoundments based on population objectives identified for New Jersey in the Atlantic Flyway Mute Swan Management Plan (Atlantic Flyway Council 2003). The New Jersey mute swan population objective is 500 swans statewide. Populations should be particularly reduced in coastal impoundments managed for migrant and wintering waterfowl. Population growth and range expansion of this species has increased the number of swan-related problems for people and native wildlife.

A major concern is the effect of interspecific competition between mute and tundra swans. Mute swans have been observed exhibiting aggression toward tundra swans, driving them from protected coves and feeding areas, which are important habitats for native tundra swans. Since the mid-1970s, Maryland's

wintering tundra swan population has declined by about 30 percent (Hindman 2010); however, research is needed to determine if this decline is related to an increase in competition between native tundra swans and exotic mute swans. New Jersey hosts a smaller population of wintering tundra swans than Maryland, and currently there is no evidence to suggest mute swans are outcompeting tundra swans in New Jersey (Nichols 2009 personal communication).

The Service worked with states in the Atlantic Flyway to develop the Atlantic Flyway Mute Swan Management Plan (Atlantic Flyway Council 2003). This plan established mute swan population goals for the Atlantic Flyway, along with strategies to begin reducing populations to those levels within the parameters of the Migratory Bird Treaty Act.

In partnership with NJDFW, the refuge's treatment goal is to prevent competition with native migratory waterfowl. Eradication is the definitive goal; however, this may be unachievable if adjacent landowners are not willing or able to control mute swans. It is important to be vigilant in management efforts and monitor all areas throughout the year.

We will:

1. visually monitor all areas throughout the year, and take appropriate actions to discourage mute swans from becoming established or congregating on the refuge; and
2. to the extent possible, eradicate mute swans found on the refuge to reduce competition with native waterfowl. We may limit swan reproduction by oiling or adding eggs and removing adult swans. We will coordinate control efforts with NJDFW and U.S. Department of Agriculture Animal and Plant Health Inspection Services (USDA APHIS).

Snow Goose Monitoring

The greater snow goose population in the Atlantic flyway has increased significantly over the past decade and continues to increase. Damage to winter grain and salt hay fields and marsh areas in New Jersey is also increasing. We are aware of concerns by Service and State waterfowl experts that greater snow geese may be changing their migrating and wintering habits in the Atlantic Flyway, and their use may dramatically increase on protected areas, such as the refuge, over the next 15 years. With completion of an Environmental Impact Statement (EIS), the Atlantic Flyway Council and individual states have implemented a Light Goose Conservation Order. Light goose is the collective name applied to greater snow geese, lesser snow geese, and Ross's geese. The principal action to be taken in the State of New Jersey is an extended hunting season on light geese. We will monitor for increased use of the refuge by snow geese in conjunction with the State mid-winter waterfowl survey.

Refuge marshes and impoundments provide valuable late winter habitat for black ducks and pintails. As snow goose use of the refuge increases, hunting of greater snow geese on designated areas of the refuge may be permitted after the close of the duck season for the southern zone of New Jersey to achieve population goals for greater snow geese or reduce damage to refuge habitats and surrounding marsh and agricultural areas. Hunting during late winter has the potential to disturb wintering ducks, particularly black ducks, and decrease the value of the refuge as wintering habitat. However, impacts to wintering waterfowl will be minimal because greater snow geese are currently found primarily in the marshes, not in the impoundments. Other actions that may be considered include select control of snow geese or other proposals to discourage snow goose, as recommended by Service and State waterfowl experts.

Resident Canada Geese

The Service's Division of Migratory Bird Management prepared an EIS for Resident Canada Goose Management (USFWS 2005b). This document discusses the problems associated with resident Canada geese along with strategies to begin reducing populations. The following information was taken from this document.

The number of Canada geese that nest and/or reside predominantly within the conterminous United States has increased dramatically in the past 20 years. It has increased to levels that are increasingly coming into conflict with people and causing personal and public property damage.

Most resident Canada goose populations exhibit consistently high annual production and survival because they live in temperate climates with relatively stable breeding habitat conditions and a low number of predators; tolerate human and other disturbances; have a relative abundance of preferred habitat (especially those located in urban and suburban areas with current landscape techniques); and fly relatively short distances to winter (compared to other Canada goose populations). The virtual absence of waterfowl hunting in urban areas provides additional protection to those urban portions of the resident Canada goose population. Given these characteristics, resident Canada goose populations are increasingly coming into conflict with human activities in many parts of the country, both in rural and urban areas. Conflicts between geese and people affect or damage several types of resources, including property, concerns about human health and safety, agriculture, and natural resources.

Agricultural and natural resource impacts include losses to grain crops, overgrazing of pastures, and degrading water quality. In heavy concentrations, goose droppings can overfertilize lawns and degrade water quality, resulting in eutrophication of lakes and excessive algae growth (Manny et al. 1994). This can lead to oxygen depletion and fish kills. Degradation of water quality also occurs by fecal contamination and by erosion from areas stripped of vegetation by goose grazing and trampling. Habitat impacts from overgrazing by resident Canada geese are also evidenced by the loss of natural vegetation in marshes and impoundments. Resident geese can impact natural wild rice beds, crops, and other habitat maintained as both food sources and cover for migrant geese and other waterfowl.

Concentrations of resident Canada geese threaten wildlife with disease. Local concentrations of resident Canada geese may congregate around impoundments where water levels have been lowered. The remaining stagnant pools can be contaminated by fecal material and are a potential source of avian diseases, especially when temperatures are high. Canada geese serve as a reservoir for the highly contagious disease duck virus enteritis and pose a serious threat to other birds utilizing the habitat.

We will:

1. visually monitor all areas throughout the year, and take appropriate actions to discourage resident Canada geese from becoming established or congregating on the refuge; and
2. to the extent possible, eradicate resident Canada geese found on the refuge to reduce competition with native waterfowl, limit goose reproduction by oiling or addling eggs and removing adult geese, and coordinate control efforts with NJDFW and USDA APHIS.

Furbearers and Predators

Furbearers such as muskrat, woodchuck, and beaver (*Castor canadensis*) may cause damage to refuge habitats. These animals may burrow into soils, undermining or otherwise damaging impoundment dikes. Beavers may also dam and flood creeks or other drainage areas, killing native trees or flooding roads and private property, therefore preventing access or threatening public safety.

Mammalian predators such as red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), coyote (*Canis latrans*), and raccoon, and avian predators such as crow, grackle, and gulls may cause unacceptable levels of predation on nesting birds. Domestic or house cats (*Felis catus*), both free ranging domestic and feral, also have negative effects on wildlife. Cats prey on wildlife, compete with native wildlife, and can transmit diseases to wildlife, pets, and people. Cat predation is an added stress to wildlife populations already struggling to survive habitat loss, pollution, pesticides, and other human impacts (American Bird Conservancy, 2009). The cumulative negative effects of cats on wildlife are impossible to quantify; however, the growing body of literature strongly indicates that domestic cats are a significant factor in the mortality of native small mammals, birds, reptiles, and amphibians (California Department of Fish and Game 2009).

We do not intend to initiate a public trapping program for furbearers at this time. Because we consider trapping on refuges a commercial activity, it must meet a higher standard of compatibility than priority wildlife-dependent public recreational uses or other non-commercial uses. We will consider opening the refuge to trapping if we determine it is needed to manage furbearers to achieve refuge purposes of the mission of the Refuge System. Prior to opening the refuge to trapping, we would need to determine if it is compatible and complete additional NEPA analysis and then include it as part of an approved Furbearer Management Plan.

We will:

1. use predator guards on nest boxes;
2. to the extent possible, remove animals or concentrations of animals that may pose a problem, inviting State-licensed individuals, hiring commercial trappers, or working with partners such as USDA Wildlife Services;
3. endorse the Cats Indoors! campaign; and
4. implement a zero tolerance policy for feral cats by visually monitoring all areas of the refuge for feral cats throughout the year and take appropriate actions to euthanize cats found on the refuge.

Monitoring and Abating Wildlife Diseases

The Service Manual chapter on disease prevention and control is not yet published. Until it is, 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. Refuge Manual 7 RM 17.3 lists three objectives for disease prevention and control:

1. to manage wildlife populations and habitats so the likelihood of disease contraction and contagion are minimized;
2. to provide for early detection and identification of disease mortality when it occurs; and
3. to minimize losses of wildlife from disease outbreaks.

These objectives were published in 1982. Since that time, in addition to diseases that cause serious mortality among wildlife, more attention has been given to those diseases that are transmitted through wildlife to humans. One example is Lyme disease. In 2002, a Service Manual chapter on Lyme Disease Prevention

was published (242 FW 5) to make employees, volunteers, and national service workers on refuges aware of this disease and how to prevent and treat it.

Another serious wildlife disease receiving considerable attention worldwide is avian influenza. Of particular concern is the highly pathogenic Eurasian form (H5N1). In 2006, all refuges were instructed to prepare an Avian Influenza Surveillance and Contingency Plan. The Supawna Meadows National Wildlife Refuge Avian Influenza Surveillance and Disease Contingency Plan was approved in October 2007 (USFWS 2007b) and discusses methods for dealing with this disease.

Chronic Wasting Disease (CWD) is a fatal disease that attacks the brain and spinal cord of deer and elk. While the exact cause is unknown, it is believed to be caused by a prion, an altered protein that causes other normal proteins to change and cause sponge-like holes in the brain. CWD was first identified in the 1960s in a Colorado research facility. Since that time, it has been found in numerous states including New York and West Virginia. CWD has not been found in white-tailed deer (*Odocoileus virginianus*) in New Jersey. Prion diseases like CWD do not move easily between species. There is no scientific evidence that CWD has been transmitted to animals other than deer, elk, and moose. The Chronic Wasting Disease Surveillance and Contingency Plan for Supawna Meadows NWR was approved October 2007 (USFWS 2007c) and discusses early detection and response to any potential CWD occurrence at the refuge.

Supporting Biological and Ecological Research and Investigations

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

- to promote new information and improve the basis for, and quality of, refuge and other Service management decisions;
- to 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; and
- to provide the opportunity for students and others to learn the principles of field research.

In 2006, the Service Manual (603 FW 1.10D (4)) provided supplemental guidance in terms of the appropriateness of research on refuges as follows:

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

Unless it is determined to be a management activity, all research conducted on the refuge must be determined in writing to be both appropriate and compatible. We have found several research projects to be appropriate and compatible. We expect that additional opportunities to conduct research on the refuge will arise in the future. In making determinations on the appropriateness and compatibility of future research proposals, we will follow guidance in the Refuge and Service Manuals, and will employ the following general strategies:

1. Seek qualified researchers and funding to help answer refuge-specific management questions.

2. Participate in appropriate multi-refuge studies conducted in partnership with the U.S. Geological Survey.
3. Facilitate appropriate and compatible research by providing temporary housing and equipment, if available, for persons conducting field work.
4. Pursue peer-reviewed publications of research, and/or ensure the Service is acknowledged as a contributor in research conducted on the refuge by others.

Practicing Adaptive Management

We will employ adaptive management as a strategy to ensure we respond quickly to new information or events in adherence to the Department of the Interior's Technical Guide on Adaptive Management (Williams et al. 2009). According to this document, "adaptive management [is 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" (Williams et al. 2009). The need for adaptive management is very compelling today because our present information on refuge species and habitats is incomplete, provisional, and subject to change as our knowledge base improves.

We must adapt our strategies to respond to new information and spatial and temporal changes or environmental events that may or may not have been predicted. We will continually evaluate management actions, both formally and informally, through monitoring or research, to consider whether our original assumptions and predictions are still valid. In that way, management becomes a proactive process of learning what really works.

The refuge manager is responsible for changing management strategies if they do not produce the desired conditions. Significant changes may warrant additional NEPA analysis and public comment. Minor changes will warrant documentation in project evaluation reports, or in our annual reports.

Generally, we can increase monitoring and research that support adaptive management without additional NEPA analysis, and assuming the activities, if conducted by non-refuge personnel, are determined compatible by the refuge manager in a compatibility determination. Many of our objectives identify monitoring needs. Our 2004 Wildlife Inventory Plan has determined what is planned in the foreseeable future. We will update this plan based on the final objectives and strategies in the CCP. See discussion on additional NEPA analysis requirements below. Implementing this strategy supports all refuge goals.

Determining the Appropriateness and Compatibility of Refuge Public Uses

Chapter 1 describes the requirements for appropriateness and compatibility determinations. Appendix B includes approved appropriateness and compatibility determinations to support the activities on the refuge. We will only allow activities determined appropriate and compatible to meet or facilitate refuge purposes, goals, and objectives. Further appropriateness and compatibility determinations will be prepared if new refuge uses are requested by the public.

Conducting Additional NEPA Analysis

NEPA generally requires site-specific analysis and disclosure of impacts for all major Federal actions, which may result in either an EA or an EIS. Other routine activities are categorically excluded from the NEPA requirements to prepare detailed environmental documents. Those generally include administrative actions. Before we implement the new hunting and fishing actions proposed in this plan, we must complete additional NEPA analysis. This information will be made available to the public. A new compatibility determination will be completed at that time.

Wildlife Habitat Management

We will expand our management to benefit trust species and other species of conservation concern in all refuge habitats. We will focus management efforts on providing native tidal marsh habitat to benefit key Federal trust species and groups of species. Specifically, we will provide foraging habitat for Pea Patch Island wading birds during the breeding season and nesting, migratory, and wintering habitats for marsh birds, waterfowl, shorebirds, raptors, and songbirds. We will actively manage tidal marsh and grassland habitats and will maintain dikes and water levels on our impoundments with water control structures, but we will not actively manage other refuge habitats. We will permit compatible research programs requested by other entities on refuge lands, but will not directly support them. If we are successful in achieving our habitat management objectives, the habitat composition of the refuge will be that listed in table 4.1 (below) and illustrated in map 4.1 (see page 4-48).

We will expand our invasive plant management efforts to include more extensive control of phragmites in the tidal marsh and use of a variety of treatment methods for invasive plant control elsewhere on the refuge. Specifically, we will coordinate with the New Jersey Department of Agriculture's weevil release program to control mile-a-minute weed in some areas of the refuge.

Our primary tools will be mowing, prescribed burning, and use of herbicides to control phragmites and other invasive plant species and the continuation of hunting to control the white-tailed deer population.

Table 4.1. Land Use and Land Cover Acreage for Supawna Meadows NWR

| Land Use/Land Cover Type | Current Acreage | Acquisition Acreage | Total Acreage |
|------------------------------|--------------------------|---------------------|---------------|
| Tidal Marsh | | | |
| Native Marsh | 902 | 131 | 1033 |
| Phragmites-Dominated | 1029 | 231 | 1260 |
| Total Marsh | 1931 | 362 | 2293 |
| Developed | 26 | 97 | 123 |
| Forested Uplands | 242 | 174 | 416 |
| Forested Wetlands | 190 | 156 | 346 |
| Grassland | 123 | 409 | 532 |
| Herbaceous Wetland | 42 | 13 | 55 |
| Managed Impoundments | 86 | 1 | 87 |
| Unmanaged Impoundment | 4 | 1 | 5 |
| Scrub/Shrub Uplands | 36 | 19 | 55 |
| Scrub/Shrub Wetlands | 48 | 4 | 52 |
| Scrub/Shrub Wetlands (Tidal) | 28 | 2 | 30 |
| Open Tidal Waters | 492 | 42 | 534 |
| TOTAL | 3,247¹ | 1,280 | 4,527 |

¹ Includes 231 acres held under conservation easement by the refuge. An additional 20 acres held in easement have a future building clause and are not included.

We will:

1. monitor known infestation sites for significant adverse impacts on wildlife habitat;
2. seed or plant disturbed sites with native species;
3. control 60 percent of phragmites where native plants are inhibited or where fire hazards need to be reduced;
4. control phragmites in any area where water level and wildlife habitat is unacceptable due to phragmites growth;
5. maintain healthy stands of native plants; and

6. monitor the deer population and its effects on refuge habitats. If the herd needs to be further culled, we will work with the State to offer a doe-first season, a firearms season, or another method for taking more deer off the refuge.

Managing Invasive Plants

The establishment and spread of invasive plants is a significant problem that reaches across all habitat types on the refuge. We will pursue a broad program of invasive plant management based on Service principles. 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.

The unchecked spread of invasive plants threatens the biological diversity, integrity, and environmental health of all refuge habitats. In many cases, these plants have a competitive advantage over native plants and form dominant cover types, reducing the availability of native plants as food and cover for wildlife. Over the past several decades, government agencies, conservation organizations, and the general public have become more acutely aware of the negative effects of invasive species. There are many plans, strategies, and initiatives targeted toward more effective management of invasive species, including The National Strategy for Management of Invasive Species for the National Wildlife Refuge System (USFWS 2003a), Silent Invasion – A Call to Action by the National Wildlife Refuge Association (NWRA 2002), and Plant Invaders of Mid-Atlantic Natural Areas by the Service and the National Park Service (Swearingen et al. 2002). New information and updates on recent advances in control techniques are continually provided through the Refuge System biological discussion database and relevant workshops. There are also more funding sources, both within the Service’s budget and through competitive grants, to conduct inventories and control programs.

Guidance for managing invasive species on refuges is found in the Service Manual (620 FW 1.7G). These actions serve to define our general strategies on the refuge:

1. Manage invasive species to improve or stabilize biotic communities to minimize unacceptable change to ecosystem structure and function and prevent new and expanded infestations of invasive species.
2. Conduct refuge habitat management activities to prevent, control, or eradicate invasive species using techniques described through an integrated pest management plan, or other similar management plan, which comprehensively evaluates all potential integrated management options, including defining threshold/risk levels that will initiate the implementation of proposed management actions.
3. 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.
4. Refuge integrated pest management planning will address the abilities and limitations of potential techniques, including chemical, biological, mechanical, and cultural techniques.
5. Manage invasive species on refuges under the guidance of the National Strategy for Invasive Species Management and within the context of applicable policy.

More specific strategies for the refuge include:

1. Continue treatment of the most problematic species as funding and staffing permit.
2. Maintain early-detection/early-response readiness regarding new invasions.
3. Remove parent sources of highly invasive species (species that are high seed producers or vigorous rhizome producers) from along edges of management units.
4. Maintain accessibility to affected areas for control and monitoring.
5. Continue and increase efforts to involve the community in promoting awareness of invasive species issues and to seek assistance for control programs on and off the refuge.

In addition to these general strategies, we will refine our control program to address the most critical problems first. Further, our priorities may be adjusted to reflect regional Service priorities, new information, or resource availability. We will continue to track the spread and control of all invasive plants on the refuge using GIS, GPS, permanent vegetation monitoring plots, and photo points.

Staffing and Project Funding

We used the Refuge System 2008 national staffing model to guide proposed staffing. Staffing models were developed to answer the question, “What level of staffing is needed to operate and manage a station to achieve the station’s purpose, contribute to the mission and goals of the Refuge System, and comply with the Refuge Improvement Act and other laws, regulations, and policy?” Earlier efforts suggest there are 10 functional categories that describe the work we do or need to do on stations in the Refuge System. These are: wildlife and habitat, visitor services, facilities and equipment, maintenance, realty, planning, communications, business management, information technology, law enforcement, and fire management. The model gives a total number of full time employees needed at a station to do the work, but management must still decide the best mix of disciplines to do that work and whether to deploy part-time, seasonal, or permanent employees.

In addition to this national staffing model, the Refuge System and the International Association of Chiefs of Police began working together in 2003 on a law enforcement staffing and deployment model. The goal for this effort was to develop a defensible staffing model to quantify law enforcement resource needs for the Refuge System, help refuge managers deploy law enforcement resources, and justify budget requests. The result was a “Deployment Model for the National Wildlife Refuge System” (International Association of Chiefs of Police), completed in May 2005 and slated for updating every 5 years.

The refuge will continue to be administered as a satellite refuge with management responsibility residing at Cape May NWR. We used the national staffing model to help determine the appropriate level of non-law enforcement staffing and the law enforcement deployment model to determine the proposed number of law enforcement staff. Based on our priorities, we are proposing four full-time staff stationed at Supawna Meadows NWR, and one full-time staff person that will be stationed at Cape May NWR and shared between the Cape May NWR and Supawna Meadows NWR. Supawna Meadows NWR will have an assistant refuge manager, a wildlife biologist, a park ranger (law enforcement), and a maintenance worker. A park ranger (visitor services) position will be shared with Cape May NWR. While the staff at Supawna Meadows NWR will continue to be supported by the current and any new staff at Cape May NWR, we anticipate that the visitor services position will spend substantial time at Supawna Meadows NWR to improve and implement the public use programs. Please see appendix E for the proposed staffing chart.

Refuge Buildings and Facilities

We will operate and maintain the refuge office, both garages, (bat) barn, intern house on Route 49, and FPRRL. We propose demolition of all other buildings on refuge lands. We will work with the New Jersey SHPO and the Service's regional archaeologists to ensure compliance with applicable State and Federal laws and regulations. The demolition of refuge facilities will result in the conversion of developed land into wildlife habitat such as grassland and scrub/shrub upland habitat.

The refuge headquarters office will be used full time by refuge staff, will be available for use by the Friends group as requested, and will be open to the public on a regularly scheduled basis. The four-bay garage at the refuge office and the garage at the previous headquarters site will be maintained. The quarters on Route 49 will be maintained for occasional use as needed. The barn currently used by bats will also be maintained.

Resource Protection and Visitor Safety

As described under staffing and project funding, we will add one full-time law enforcement officer to enforce laws and regulations on Supawna Meadows NWR. New onsite staff and a visitor services professional stationed at Cape May NWR will help to install and maintain appropriate signage and prepare and distribute resource protection information as appropriate.

Land Protection

We will continue to purchase portions of the 1,257 acres of inholdings within the 4,527-acre acquisition boundary as funding allows. The Service will continue its policy of accepting donations and buying from willing sellers and will focus on acquiring developable upland properties first.

In addition, within 3 years of final approval of the CCP, we will begin to reevaluate the refuge's acquisition boundary through the Service's Preliminary Project Proposal process to address rising sea level caused by climate change because much of what is currently within the refuge boundaries will likely be under water in the next 50 to 100 years. Therefore, we need to start acquiring adjacent uplands to continue our stewardship of vital marsh habitat as the marsh gradually migrates inland. Additional impetus for land purchase will be:

1. to maintain the ecological integrity of the current refuge by protecting the natural resources on adjacent lands;
2. to acquire important nearby upland and wetlands areas that will expand our protection of those habitats and the trust resources and other sensitive species that rely on them; and
3. to expand opportunities for public uses, particularly wildlife observation and photography and interpretation.

We will apply appropriate management to benefit species of conservation concern to any newly acquired lands.

Baseline Plant and Animal Surveys

We will conduct surveys and develop comprehensive inventories of all plants and animals found on Supawna Meadows NWR, including data on species abundance and distribution as staff and funding is made available. A Wildlife Inventory Plan was developed for Supawna Meadows NWR in 2004 (USFWS 2004e). This plan identifies the priority surveys and monitoring that should be completed on the refuge based on enabling legislations, Service initiatives, unit objectives, management plans, and related management activities. We believe we will have the staffing and funding necessary to implement this plan. The surveys to be completed, ranked in order of importance, are shown below in table 4.2.

Table 4.2. Baseline Flora and Fauna Surveys to be Completed

| Surveys | Priority Species Involved |
|--|---|
| 1. Saltmarsh Sparrow Breeding Bird | coastal plain swamp sparrow seaside sparrow marsh wren |
| 2. Landbird Breeding | coastal plain swamp sparrow marsh wren wood thrush yellow-breasted chat Baltimore oriole |
| 3. Reptile and Amphibian Inventory | bog turtle eastern tiger salamander spotted turtle eastern box turtle northern diamondback terrapin Fowler's toad |
| 4. Marshbird Callback | black-crowned night-heron great blue heron king rail least bittern little blue heron yellow-crowned night-heron |
| 5. Nonbreeding Bird Use of Tidal Marshes | little blue heron yellow-crowned night-heron black rail |
| 6. Nonbreeding Bird Use of Grasslands | northern harrier short-eared owl horned lark vesper sparrow bobolink grasshopper sparrow savannah sparrow eastern meadowlark |
| 7. Grassland Breeding Bird | horned lark bobolink grasshopper sparrow savannah sparrow eastern meadowlark |
| 8. Wading Bird Impoundment | great blue heron little blue heron |
| 9. Shorebird Migration Impoundment | solitary sandpiper short-billed dowitcher |
| 10. Anuran Call Count | Fowler's toad |
| 11. Wintering Waterfowl Impoundment | American black duck |
| 12. Christmas Bird Count | migratory birds |
| 13. Butterfly and Dragonfly Inventory | dotted skipper Harris' checkerspot Hessel's hairstreak two-spotted skipper |
| 14. Fish Inventory | unknown |
| 15. Small Mammal Inventory | unknown |
| 16. Woodcock Singing Ground | American woodcock |
| 17. Muskrat Ground Dwelling | muskrat |

Other priority surveys identified during scoping meetings that should be conducted (not in order of importance) are shown in table 4.3.

Table 4.3. Other Priority Surveys Identified During Public Scoping

| Surveys | Priority Species Involved |
|---|---|
| Marsh Rice Rat | marsh rice rat |
| Bird Productivity in Phragmites Control Areas | clapper rail northern harrier marsh wren coastal plain swamp sparrow |
| Coastal Plain Swamp Sparrow | coastal plain swamp sparrow |
| Biological, Chemical, Sediment, and Contaminant (Contaminant Assessment Process) Baseline | tidal marsh habitat fish open water |
| Fish Inventory in Impoundments | alewife blueback herring Atlantic sturgeon Shortnose sturgeon |
| Native Animals and Plants in Scrub/Shrub Wetlands (Tidal) | northern harrier sedge wren |
| Plants | sensitive joint vetch |

Goals, Objectives, and Strategies

Introduction

As described in chapter 1, developing refuge goals was one of the first steps in the planning process. Goals are intentionally broad, descriptive statements of the desired future condition for refuge resources. By design, they are more prescriptive than quantitative in defining the targets of refuge management. They also articulate the principal elements of refuge purposes and our vision statement and provide a foundation for developing specific management objectives and strategies.

The next step was to consider a range of possible management objectives that will help us meet those goals. Objectives are essentially incremental steps toward achieving a goal; they further define the management targets in measurable terms. They provide the basis for determining more detailed strategies, monitoring refuge accomplishments, and evaluating our success. The Service guidance in “Writing Refuge Management Goals and Objectives: A Handbook” (USFWS 2004d) recommends that objectives possess five properties to be “SMART”: (1) specific; (2) measurable; (3) achievable; (4) results-oriented; and (5) time-fixed.

A rationale accompanies each objective to explain its context and why we think it is important. We will use the objectives in writing refuge step-down plans. We will measure our successes by how well we achieve those objectives.

We next identified strategies for each of the objectives. These are specific actions, tools, techniques, or a combination of those that we may use to achieve the objective. The list of strategies under each objective represents the potential suite of actions to be implemented. By design, most will be further evaluated as to how, when, and where they should be implemented in refuge step-down plans.

Lastly, for biological objectives we identified a specific subset of strategies as monitoring elements. Monitoring elements are intended to help us measure our success with respect to our objectives. The results may trigger adjustments to management strategies, a reevaluation or refinement of our objectives, or both.

The management direction that comprises the rest of this chapter is based on alternative B, presented in the draft CCP/EA. Alternative B was the Service's preferred alternative, and we believe it best fulfills the refuge's purposes, vision and goals, and responds to public issues. It emphasizes management of specific refuge habitats to support Federal trust resources and species of conservation concern in the area. In particular, the priority will be to protect and restore the refuge's native tidal marsh habitat to benefit Pea Patch Island colonial-nesting wading birds, as well as secretive marsh birds, migratory waterfowl, shorebirds, and other birds of conservation concern. The description of the management direction is followed by maps 4.1, 4.2, and 4.3, which illustrate the proposed habitat management and public use strategies.

Goal 1

Protect, enhance, and restore biological integrity, diversity, and environmental health of tidally influenced habitats to support native wildlife and plant communities including species of conservation concern.

Objective 1.1 Tidal Marsh

Maintain up to 2,293 acres of brackish tidal marsh, with primary management focus on the area northwest of Mill Creek, providing critical foraging habitat for Pea Patch Island wading birds (for example, little blue heron, glossy ibis, snowy egret, black-crowned night heron, least bittern), migrating shorebirds (for example, semi-palmated sandpiper, greater yellowlegs, dunlin), migrating and wintering waterfowl, and other species of conservation concern (for example, bald eagles).

- Increase cover to 60 percent native emergent plant cover such as smooth cordgrass, pickerelweed, water hemp, wild rice, and rice cutgrass.
- Reduce cover of phragmites so that it comprises less than 40 percent cover of the tidal marsh.

Rationale

Supawna Meadows NWR provides critical foraging habitat for more than 6,000 pairs of 9 species of wading birds that nest on Pea Patch Island, a Continentally Important Bird Area. It is home for the largest heronry of mixed species on the East Coast. The island supports significant populations of breeding pairs of nine species of wading birds, including great blue heron, great egret, little blue heron, snowy egret, cattle egret, yellow-crowned night-heron, black-crowned night-heron, glossy ibis, and tri-colored heron. Pea Patch Island and the surrounding area, including the refuge, have been designated a SMA by the States of New Jersey and Delaware in accordance with the Coastal Zone Management Act.

The refuge receives significant use by shorebirds during both spring and fall migrations. The refuge also provides habitat for the State-listed bald eagle as well as a number of other State-listed species and species of conservation concern.

The refuge is located in the Atlantic Flyway, where birds migrating from interior Canada and the coastal provinces merge to form the main stem of the flyway. The area not only serves as an important migration area but also provides wintering habitat for large numbers of waterfowl. The 2009 midwinter waterfowl inventory flights for the Salem River watershed averaged more than 2,100 dabbling ducks and more than 11,500 Canada geese.

Our principal management challenge in sustaining the refuge's tidal marsh is control of phragmites. Phragmites invades tidal and non-tidal brackish and freshwater marshes, river edges, shores of lakes and ponds, roadsides, and disturbed areas. Once introduced, phragmites spreads quickly and will crowd out

native plants, changing marsh hydrology, altering wildlife habitat, and increasing fire potential. Its high aboveground biomass blocks light to other plants and occupies much of the growing space belowground. Phragmites is also considered a hazardous fuel and easily ignites during arson or wildfire. Based on the 2009 National Vegetation Classification System, phragmites has invaded approximately 74 percent (1,438 of 1,931 acres) of the refuge's tidal marsh.

The hydrology of Supawna Meadows NWR tidal marsh has historically been influenced by humans and continues to be affected today. The tidal marsh west of Route 49 was diked and drained in the 18th century. The dike failed in the 1930s and the marsh reflooded. Originally, there was more sheet flow from the Delaware Bay to Mannington Meadow (to the east of Route 49), but flow is now restricted to a few points and Mannington Meadow is fresher than the marshes on the west side of Route 49. These hydrologic factors are thought to influence the degree to which phragmites has been able to colonize and supplant native marsh plants on major portions of the refuge.

The changes to tidal marsh habitat over the course of this CCP will be a decrease in the phragmites dominated tidal marsh. Due to control of phragmites in the 500 acres of tidal marsh habitat west of Mill Creek, 70 to 80 percent of the phragmites-dominated tidal marsh in that area will be restored to native tidal marsh habitat. Due to the control of phragmites in the 17 acres of tidal marsh west of Fort Mott Road, the area will be restored to native tidal marsh habitat.

Strategies

1. Purchase up to 362 additional acres of tidal marsh within the approved acquisition boundary.
2. Within 5 years of CCP approval, evaluate removal of the remnant farm dike to restore tidal flow and reestablish natural marsh function.
3. Develop an Adaptive Management Framework for phragmites control so that treatments are monitored and evaluated for effectiveness. The refuge will be using an integrated approach to phragmites control, which will consider restoration of natural processes, herbicides, prescribed burning, biological control, and other tools as they are developed.
4. Continue to ensure compliance with the ESA by coordinating with the Service's New England Field Office on phragmites control efforts annually.
5. Work with adjacent private landowners to reduce phragmites on their properties.

Monitoring Elements

Conduct appropriate monitoring and survey programs, as funding and staffing permit, to measure our success with respect to our objectives. The results may trigger adjustments to management strategies, such as prescribed burning and mowing to achieve structural and species diversity of native emergent wetland species. Results may trigger a reevaluation or refinement of our objectives.

Examples of monitoring or surveys that we may implement follow:

1. Begin collection of baseline data to evaluate the existing tidal marsh biological integrity, diversity, and environmental health and parameters related to sea level rise (vegetation, elevation, sediment accretion, salinity, tidal fluctuation, water quality, and mean sea level rise changes along the Delaware River). Utilize data and evaluate trends to assess the impact of climate change and/or management activities in order to appropriately adjust management as necessary.
2. Prevent new invasive species from becoming established within the tidal marsh by utilizing Early Detection Rapid Response Techniques that detect newly established invasive species and immediately address those

populations through the appropriate control measure. This strategy will incorporate a combination of plant identification and inventories, maintaining updates of new invasive species present in the region, as well as having knowledge of the appropriate management techniques prior to conducting control efforts.

3. Conduct inventories and monitoring of shorebird, waterfowl, waterbird, and wading bird use and abundance in the tidal marsh. Utilize data to document the effectiveness of management activities and adjust management protocols as necessary.
4. Conduct callback surveys for secretive marsh birds to monitor overall diversity, evaluate habitat use patterns and identify potential areas for habitat protection or enhancement projects for focal species.
5. Conduct baseline small mammal inventory to obtain baseline information on species diversity and habitat utilization.

Objective 1.2 Tidal Scrub/Shrub Wetlands

Manage up to 30 acres of tidal scrub/shrub habitat, containing a mix of shrub species including bayberry and marsh elder (*Iva frutescens*) consistent with local reference sites, to ensure that the quality and natural function of the marsh are sustained, provide breeding habitat for coastal plain swamp sparrow, and are comprised of less than 30 percent overall cover of invasive plants.

Rationale

Tidal scrub/shrub habitat is an important component of the refuge's tidal marsh complex that provides breeding habitat for birds of conservation concern. The coastal plain swamp sparrow is a subspecies of the swamp sparrow known to breed in Delaware, Maryland, and New Jersey tidal marshes. The refuge population of coastal plain swamp sparrows may constitute a significant portion of the total population of this unique subspecies of swamp sparrow that is being studied as a potential candidate species for listing under the ESA. The coastal plain swamp sparrow is restricted to an often narrow band of shrubby habitat at the interface of upland and high marsh. This habitat is particularly susceptible to recent changes such as rising sea level, ditching, impoundment, the invasion of phragmites, and the development of roads, farm fields, and housing tracts. Research indicates that these birds perch on phragmites; however, they do not nest in it. This species nests in dense grass at the base of shrubs, usually well concealed, and often anchored to the base of a high tide bush such as marsh elder. A dense tuft of salt hay such as salt meadow grass (*Spartina patens*) often camouflages the nest and provides some structural support (SMBC 2009).

The prairie warbler (*Dendroica discolor*) is a highest priority species in BCR 30, as well as being a high priority species in North America and in Partners in Flight Physiographic Area 44 (PIF 44). This species is experiencing relatively steep population declines. It uses moderately sized patches of shrubland and early successional forest. The PIF 44 report describing shrubland birds of highest conservation concern indicates that the prairie warbler utilizes a range of types from relatively young (abandoned) fields with scattered shrubs and trees to older fields with moderate shrub cover; however, it does not prefer later successional stages where shrubs and samplings form dense continuous tangles (Watts 1999).

The berry-producing shrubs of this habitat type are also beneficial to migrating birds. Other species of conservation concern that will benefit from our continued protection of the tidally influenced scrub/shrub habitat include the northern diamondback terrapin. These areas are difficult to access, but are currently maintained by naturally occurring processes.

Invasive plants are the greatest threat to this high quality habitat. Thickets contain autumn olive and phragmites. Maintaining scrub/shrub habitat on the refuge is problematic for a number of reasons that include

- ditches that drain the wetlands do not allow natural hydrology to support native plants;
- water level management options are limited due to concerns with flooding neighboring properties;
- woody trees are encroaching in scrub/shrub areas;
- scrub/shrub has historically comprised a small habitat area. The refuge cannot support much of this habitat due to approximately 75 percent of refuge habitat being tidal marsh; and
- there is overbrowse from deer limiting regeneration and exacerbating invasive plant species problems.

Within mid-Atlantic estuaries, coastal plain swamp sparrows are restricted to an often narrow band of shrubby habitat at the interface of upland and high marsh. This habitat is particularly susceptible to recent changes such as rising sea level, ditching, impoundment, the invasion of phragmites, and the development of roads, farm fields, and housing tracts. This is an important management consideration for the species (Beadell et al. 2003).

Management intervention may be necessary to enhance or restore habitat. Since poorly drained sections of tidal wetlands where medium-length cordgrass growth is favored, managers should consider blocking selected ditches on altered marshes to create additional habitat. Intervention that forms a mosaic of habitat patches consisting of favorable nesting substrate and suitable foraging sites should increase local populations significantly. Predator control may be necessary in some areas. On high marshes, shallow pools constructed near spoil deposits, which tend to be colonized by native shrubs, such as *Iva spp.*, should encourage sparrows to settle, albeit at relatively low densities (Greenlaw 1992, Post and Greenlaw 1994). Controlled burning during the August-November wet season maintains favorable habitat (Post and Greenlaw 1994). Densely vegetated areas should be burned every 5 years and less dense areas every 8 to 10 years, with no more than 10 percent of the available habitat for a population burned in any given year (NatureServe 2009).

Strategies

1. Purchase up to two additional tidal scrub/shrub wetland acres within the acquisition boundary.
2. Maintain scrub/shrub habitat through selective cutting and/or herbicide to set back succession and, if necessary, treat invasive plants so that 70 percent of scrub/shrub habitat is in native species. The exact number of acres treated will depend on funding and management capability. Keep records of treated areas in GIS.
3. Coordinate with regional efforts and initiatives where possible and applicable with respect to climate change and sea level rise.
4. Manage 16,000 linear feet of scrub/shrub habitat along the high-tide line specifically to benefit coastal plain swamp sparrow.

Monitoring Elements

Conduct appropriate monitoring and survey programs, as funding and staffing permit, to measure our success with respect to our objectives. The results may trigger adjustments to management strategies, such as selective cutting and herbicide treatments, to achieve structural and species diversity of tidal scrub/shrub wetland species. Results may trigger a reevaluation or refinement of our objectives. Examples of monitoring or surveys that we may implement include:

1. Prevent new invasive species from becoming established within tidal scrub/shrub wetlands by utilizing Early Detection Rapid Response Techniques that detect newly established invasive species and immediately address those populations through the appropriate control measure. This strategy will incorporate a combination of plant identification and inventories, maintaining updates of new invasive species present in the region, as well as having knowledge of the appropriate management techniques prior to conducting control efforts.
2. Conduct inventories and monitoring of priority passerine species, such as the coastal plain swamp sparrow, to establish a baseline and research use of habitat by these species.
3. Conduct inventories and monitoring of landbird and wading bird use and abundance in the scrub/shrub habitat. Utilize data to document the effectiveness of management activities and adjust management protocols as necessary.
4. Conduct callback surveys for secretive marsh birds to monitor overall diversity, evaluate habitat use patterns, and identify potential areas for habitat protection or enhancement projects for focal species.
5. Using SLAMM results, monitor and evaluate conditions in the marshes over the next 15 years with respect to climate change and sea level rise.
6. To evaluate the effectiveness of prescribed burning, conduct post-burn surveys to measure the area, the intensity, and the success of the burn.
7. To determine the effectiveness of the white-tailed deer hunting program, evaluate regeneration of native shrubs and forbs by conducting vegetation surveys to gather information on species composition, abundance, and diversity.

Objective 1.3 Open Tidal Waters

Maintain and improve water quality and available aquatic habitat of tidally influenced rivers and estuaries through an active role in local, State, and Federal partnerships in order to reduce contaminants and to continue to provide year-round habitat for northern diamondback terrapins, shortnose sturgeon, blue crabs, and other aquatic species of conservation concern in the area's tidal waters.

Rationale

The refuge's wetlands are bordered by and hydrologically connected to the tidal creeks and the Delaware River. Therefore, refuge habitats are affected by water quality and refuge management may affect water quality of these waterways. The refuge's tidal marsh supports a wide variety of aquatic organisms, many of which are of conservation concern. The waters of the Delaware River Estuary also support an important recreational fishery and shellfishery, which includes the blue crab. Fish and shellfish also serve as the food source for birds and other species of conservation concern. Fish in the tidal waters support local populations of osprey, bald eagle, and Forster's tern (*Sterna forsteri*). Thousands of waterfowl, including American black duck, American wigeon, Canada goose, blue-winged teal and green-winged teal, gadwall, mallard, northern pintail, snow goose, and tundra swan use the tidal marsh during winter and migration. The federally listed endangered shortnose sturgeon and the Atlantic sturgeon are fish species of concern near Supawna Meadows NWR. These waters also provide nursery habitat for interjurisdictional fish species such as menhaden, blueback herring, alewife, American shad, and striped bass. Also of concern are mussel species including the yellow lampmussel (*Lampsilis cariosa*), tidewater mucket (*Leptodea ochracea*), and triangle floater (*Alasmidonta undulata*), all of which are listed as threatened by the State of New Jersey (NJDFW 2009a).

As noted under objective 1.1, the human-altered hydrology of the marsh appears to be an important factor in the success of invasive phragmites. Numerous other factors influence the refuge marsh and the water quality of tidal waters, including personal watercraft impacts, lack of major flooding, siltation/sedimentation, contaminants in the water and soil from past usage, temperature changes, sea level rise, mosquito control both on and off the refuge, upstream non-point source contaminants, and oil and hazardous material spills along the Delaware River, the second largest oil transport channel on the East Coast.

Due to the regional scale of water quality impacts, the refuge is reliant on actively engaging in partnerships with local communities, anglers, watershed associations, conservation groups, and researchers in order to meet this habitat objective.

Strategies

1. Implement best management practices, such as adhering to instructional labels when applying herbicides, to protect against potential contamination of the tidal rivers and other open tidal waters that could be impacted by refuge management activities.
2. Actively engage in partnerships with local communities, anglers, watershed associations, conservation groups, and researchers to help address water quality and other issues in the watershed.
3. Using SLAMM analysis results, monitor and evaluate conditions at Supawna Meadows NWR over the next 15 years with respect to climate change and sea level rise. Coordinate with regional efforts and initiatives where possible and applicable.

Monitoring Elements

Conduct appropriate monitoring and survey programs, as funding and staffing permit, to measure our success with respect to our objectives. The results may trigger adjustments to management strategies, or may trigger a reevaluation or refinement of our objectives. Examples of monitoring or surveys that we may implement include:

1. Conduct inventorying and monitoring of biological elements, chemical elements, sedimentation, and contaminants to benefit tidal marsh habitat, fish and open water.
2. Work in partnership with local universities, as well as State and Federal agencies, to complete a series of fish inventories to obtain baseline biological information of fish species diversity and species health in order to evaluate impacts of tidal marsh water quality changes.
3. Work with NJDEP and other appropriate agencies to develop data on the presence and distribution of fish and other aquatic species within the refuge.

Goal 2

Protect, enhance, and restore biological integrity, diversity and environmental health of upland habitats to support native wildlife and plant communities with emphasis on migrating and wintering birds and other species of concern.

Objective 2.1 Early Successional Grassland Habitat

Manage up to 532 acres of grassland habitat to create a mix of cool and warm season grasses and forbs to provide habitat diversity, forage, and cover for migrating and wintering grassland birds, such as bobolink, vesper sparrow, eastern meadowlark, and savannah sparrow; raptors, such as northern harrier, common barn owl (*Tyto alba*), and short-eared owl; and habitat for pollinators, such as bronze copper butterfly (*Lycnaena hylus*). Focus grassland management on fields larger than 20 acres, with an emphasis on those fields with minimal edge, less surrounding forest, and more surrounding open habitats (old fields,

emergent wetlands), and where possible, maintain grasslands in close proximity to one another. Encourage cover of desirable grassland plants in the following ways:

- increase cover to 80 percent desirable grassland plant cover (for example, switch grass, goldenrod spp., eupatorium spp.).
- reduce cover of invasive species (for example, Canada thistle, autumn olive) so that they comprise less than 20 percent cover of grassland habitat.

Rationale

Birds that depend on early successional habitats, such as grasslands and shrublands, are one of the fastest declining bird groups due to habitat loss and changes in farming practices in the Northeast. Habitat loss, conversion of pasture to intensive row crops, increased frequency of mowing, and lack of fire are cited as the causes of population declines in grassland-dependent species (Vickery 1996). Grasslands on the refuge are used extensively by migrating and wintering obligate grassland birds. Bobolink, eastern meadowlark, northern harrier, savannah sparrow, and vesper sparrow are examples of grassland bird species that increase in abundance during migration and in the winter.

In addition, the refuge will also emphasize monitoring pollinators in early successional habitats (particularly butterflies, which play a crucial role in plant pollination) using the refuge as many of these species are of conservation concern due to losses in habitat and nectar corridors that facilitate migration. A recent study of the status of pollinators in North America by the National Academy of Sciences found that populations of some native pollinators are declining, which may in part result from habitat loss, degradation, fragmentation, non-target effect of pesticides, competition from invasive species, and introduced diseases (National Academy of Sciences 2007). Flower-visiting Lepidoptera, many of which are actual or potential pollinators, currently dominate the list of endangered species: 17 species of butterfly and 3 species of moth constitute more than half of all insect species listed as endangered (USFWS 2010a). The State-listed endangered bronze copper butterfly, State-listed threatened frosted elfin butterfly, and a number of other moths and butterflies have been documented in the refuge's grassland habitat.

The northern diamondback terrapin is not federally listed; however, it is a State species of concern. While not traditionally considered a grassland species, members of the refuge staff have observed individuals in this habitat. It is possible that terrapins are attempting to use the grassland habitat for nesting purposes, which may negatively affect reproductive success. Terrapin nests in grassland areas may be subject to increased predation associated with increased predator access, as well as decreased hatch rates because of suboptimal hatching conditions (for example, nest temperature, environmental exposure).

Although total acres and patch sizes are less stringent during migration and winter, larger blocks (more than 20 acres) of grassland are recognized as optimal for grassland bird species survival requirements. Service biologists consider the grasslands at Supawna Meadows NWR to be limited in quality for breeding birds, so management measures will be employed to continue to provide grassland habitat for migrating and wintering birds.

Grasslands, being an early successional community type, require significant maintenance and time inputs to be maintained over a long-term period. In some areas, it will be more economically and ecologically beneficial to manage existing grassland habitats in a successional trajectory toward shrubland and ultimately

coastal or floodplain forest. Each individual grassland patch will require evaluation based on existing and potential habitat benefits.

Strategies

1. Purchase up to 409 additional grassland acres within the acquisition boundary.
2. Actively manage grasslands through the use of mowing and prescribed fire. Mow or burn 50 percent of the grassland acreage every 3 years.
3. Evaluate the potential for allowing managed grasslands, particularly those less than 20 acres in size, to succeed through natural processes to scrub/shrub habitat for priority migratory species.
4. Determine the value of grassland habitats to wintering and migrating birds using an adaptive management approach.
5. Use information gathered from Christmas Bird Counts and other non-standardized but repeated observations to determine habitat use and distribution.
6. Control Canada thistle, autumn olive, and other invasive plants to establish 80 percent cover of native species. The exact number of acres treated will depend on funding and management capability. Keep records of treated areas in GIS.
7. Provide a shrubland component to the fields, for migrating and breeding shrubland species, by creating a softer transition zone from grass to shrubs to forest at the edges of fields. Cull woody and invasive plants periodically to ensure native shrub species dominate.
8. Determine the value of grasslands for butterflies and other pollinators using refuge grassland habitat and incorporate surveys and/or monitoring efforts.

Monitoring Elements

Conduct appropriate monitoring and survey programs, as funding and staffing permit, to measure our success with respect to our objectives. The results may trigger adjustments to management strategies, or may trigger a reevaluation or refinement of our objectives. Examples of monitoring or surveys that we may implement include:

1. Conduct winter grassland transect surveys for measuring composition and relative abundance of grassland birds and raptors in grassland fields.
2. Prevent new invasive species from becoming established within early successional grassland habitats by utilizing Early Detection Rapid Response Techniques that detect newly established invasive species and immediately address those populations through the appropriate control measure. This strategy will incorporate a combination of plant identification and inventories, maintaining updates of new invasive species present in the region, as well as having knowledge of the appropriate management techniques prior to conducting control efforts.
3. To evaluate quality of grasslands for migrating grassland-dependent songbirds, conduct periodic vegetation surveys at landbird point counts for height, density measurements, and species composition or grass-forb ratio.
4. To evaluate achievement of the objective for migrating and wintering birds, conduct migration and winter bird counts.
5. Conduct baseline inventories of butterflies and other pollinator species to determine species abundance, density, and diversity as needed.
6. Conduct baseline small mammal inventory to obtain baseline information on species diversity and habitat utilization.
7. To evaluate the effectiveness of prescribed burning on grassland habitats, conduct post-burn surveys to measure the area, the intensity, and the success of the burn.

8. Monitor grasslands to determine if northern diamondback terrapins are using this habitat. If terrapins are using refuge grasslands, monitor individuals to determine how they are using this habitat and determine if management activities are appropriate to help protect this species.
9. Monitor presence of mute swans and Canada geese and work with USDA APHIS or other licensed agent to control these species as necessary to meet objectives.

Objective 2.2 Early Successional Scrub/Shrub Habitat

Protect and manage up to 55 acres of upland scrub/shrub habitat to benefit migrating landbirds (for example, blue-winged warblers, American woodcock), breeding landbirds (for example, American Woodcock, prairie warblers), and other species of conservation concern with the following habitat attributes:

- >70 percent of a mixture of desirable native fruit-producing shrubs, such as blackberry (*Rubus* spp.), Viburnum spp., and bayberry; forbs, such as goldenrods; vines, such as grapevines and greenbrier (*Smilax laurifolia*); and tree species, such as sweetgum and black cherry < 20 feet in height;
- >50 percent of unmanipulated residual cover remaining annually for nesting species; and
- <30 percent cover of invasive species (for example, autumn olive, multiflora rose, Japanese honeysuckle, mile-a-minute weed).

Rationale

American woodcock is a high priority upland game bird that is of conservation concern at the continental, BCR 30, and PIF 44 scales. There is significant interest in managing early successional habitats for this species. Meeting these habitat requirements will also provide good habitat for many other migratory species that use this habitat type. The refuge may also be as important for migratory stopover habitat as it is for breeding habitat for this species. American woodcock nesting habitat varies geographically, including drier woodland sites, young open woodlands, low shrubby cover, old fields, tall herbage bordering clearings, thickets, scrub oaks or pines, open woodland with dead leaf cover on the ground, and flat bottomlands near water. High shrub stem density and presence of edge habitat may be important in nest site selection in some areas.

The prairie warbler is also a high priority species at the continental, BCR 30, and PIF 44 geographic levels. The prairie warbler became a focal species in this CCP because of its geographic importance and its steep population declines. This species uses moderate sized patches of shrubland and early successional forest, which the refuge can be managed to sustain. It usually nests in a shrub, sapling, thicket, or fern clump from 0.3 to 3 meters above ground and occasionally higher.

The blue-winged warbler is a 2008 Service listed bird of conservation concern in BCR 30. During migration and winter, blue-winged warblers occur in brushy areas, scrub, and open woodland.

The New Jersey Wildlife Action Plan identifies the protection, maintenance, enhancement, and/or restoration of scrub/shrub habitats as a conservation goal necessary to maintain viable populations of declining scrub/shrub species (NJDFW 2008a). Shrub habitat comprised of various shrub species, or a diverse mix of young trees, provides an abundance of insect food for breeding birds and fruit for fall migrating birds. Many species of birds rely on shrub habitats at various times throughout the year. Because of this, responsibility for providing quality shrubland bird habitat is not limited to their breeding season.

The refuge lies in an important migratory bird pathway along the Atlantic flyway and provides an important stopover site for many migrating bird species.

Many scrub/shrub plant species bear fruit in the fall, which helps boost the fat reserves for migrating or wintering birds. During migration, vegetation structure, microhabitat conditions, and landscape context are the most important habitat features for these birds, rather than specific plant species (Dettmers 2003). In a study in Central New Jersey, Suthers et al. (2000) found that of the different successional habitat types, the one most frequently used by fall migrating birds were shrublands. Factors that contributed to the selection or abandonment of these habitats included vegetation structure and abundance and quality of resources. The study showed that migrant birds abandoned habitats that were shaded out by invading trees. It also showed that migrant birds were attracted to areas by abundance and quality of fruits.

As shrub habitats are transitional in nature, active management is necessary to periodically set back succession through mechanical treatments (for example, selective cutting) to provide a continued source of shrub habitat. Management actions even on smaller tracts can be effective as shrub-dependent birds are not typically sensitive to habitat patch size and many will use small patches of shrub habitat (Watts 2000).

Strategies

1. Purchase up to 19 additional scrub/shrub acres within the acquisition boundary.
2. Maintain scrub/shrub habitat through selective cutting and/or herbicide to set back succession.
3. Conduct invasive species control on scrub/shrub habitat so that 70 to 80 percent of habitat is in native species. The exact number of acres treated will depend on funding and management capability. Keep records of treated areas in GIS.
4. Continue the use of biological control measures to control invasive plant species.

Monitoring Elements

Conduct appropriate monitoring and survey programs, as funding and staffing permit, to measure our success with respect to our objectives. The results may trigger adjustments to management strategies, or may trigger a reevaluation or refinement of our objectives. Examples of monitoring or surveys that we may implement include:

1. Prevent new invasive species from becoming established within early successional scrub/shrub habitats by utilizing Early Detection Rapid Response Techniques that detect newly established invasive species and immediately address those populations through the appropriate control measure. This strategy will incorporate a combination of plant identification and inventories, maintaining updates of new invasive species present in the region, as well as having knowledge of the appropriate management techniques prior to conducting control efforts.
2. To evaluate achievement of the objective for breeding and migrating birds, conduct landbird surveys and migration and winter bird counts.
3. To evaluate achievement of the objective for migrating landbirds, conduct surveys during peak migration to determine bird abundance, density, and diversity. Surveys include area searches, constant-effort mist-netting and banding, and activity budgets.
4. Conduct woodcock singing ground surveys to evaluate habitat quality and utilization and species abundance on the refuge.
5. To evaluate quality of shrubland habitat for migrating landbirds, conduct periodic vegetation surveys for plant species composition, community structure, and berry production.

6. Gather baseline data on butterflies and other pollinators using refuge scrub/shrub habitat, and incorporate annual surveys and/or monitoring efforts.

Objective 2.3 Upland Forest Habitat

Maintain 2 additional acres of upland forest beyond those currently managed (up to 416 acres) benefiting breeding wood thrush, northern flicker, migrating black-and-white warblers and Kentucky warblers, migrating and wintering rusty blackbirds (*Euphagus carolinus*), roosting bats, and other forest-dependent species of conservation concern. Upland forest habitats are characterized by the following attributes:

1. Canopy cover of mixed deciduous forest >75 percent (including sweetgum, sour gum, black cherry, black oak, southern red oak, persimmon, American holly, and red maple);
2. Native deciduous shrubs and small sub-canopy trees <15 feet tall (highbush blueberry and southern arrowwood) and vines (common greenbriar) collectively cover >30 percent;
3. >30 percent native ground cover consisting of forbs and ferns with a major native component of flowering perennial herbaceous plants; and,
4. <20 percent cover of invasive plants (for example, Japanese stiltgrass, multiflora rose, Japanese honeysuckle) in understory/herbaceous layer.

Rationale

A large number of forest-dependent bird species are becoming increasingly rare because their habitats are diminishing in acreage or being broken into smaller blocks that do not provide optimal conditions for survival. The refuge does not provide sufficient unbroken forest to sustain forest interior birds; however, more tolerant species such as the wood thrush and flicker would benefit from active forest management, particularly control of invasive plants and white-tailed deer overbrowse.

The wood thrush is a high priority species at the continental, BCR, and PIF 44 scales. According to the Breeding Bird Survey, the wood thrush declined during the period of 1966 to 2007 (Sauer et al. 2008). The mid-Atlantic region is generally a stronghold for wood thrush, and this species is a good representative of many other species needing a structurally diverse understory within mature deciduous forest conditions.

The BBS data indicate a significant northern flicker population decrease in eastern North America between 1966 and 1989 (Sauer and Droege 1990). BBS data for 1966 to 1993 indicate large declines throughout eastern North America and the prairies. The flicker requires open forest (both deciduous and coniferous), open woodland, open situations with scattered trees and snags, riparian woodland, pine-oak association, and parks (AOU 1983). It nests in dead tree trunks or stumps, or the dead top of a live tree; it sometimes nests in a wooden pole, building, or earth bank. Northern flickers either dig a nest cavity or reuse an old one.

The black-and-white warbler and Kentucky warbler are listed as BCR30 species of high concern and New Jersey non-game birds of conservation concern. Both species require forest habitats for feeding during migration (NatureServe 2009). During migration and winter, rusty blackbird habitat is primarily wooded wetlands and riparian areas, but also includes various open woodlands, scrub, pastures, and cultivated lands (AOU 1983).

Major threats to the refuge's forest health and condition are overbrowse caused by white-tailed deer overabundance and infestation of invasive plant species. White-tailed deer thrive in fragmented non-urban areas and the resulting

overbrowse in forested landscape severely limits forest regeneration (NJDFW 2008c). White-tailed deer selectively browse native vegetation, giving invasive species (for example, mile-a-minute weed, etc.) a competitive edge in the forest understory (NJDFW 2008c). Deer browse pressure significantly impacts the regeneration of native woody species. Regeneration is essential to the success of the development of Supawna Meadow NWR's forest understory. Numerous studies have found that when white-tailed deer browse pressure is high, it can alter the growth, reproduction (Knight 2003), diversity (Lathan et al. 2005), and ultimately survival of plants within a specific population (Alverson and Waller 1997, Cote et al. 2004). In areas where deer density exceeds 20 deer per square mile, deer herbivory is related to declines in mid-story bird species (deCalesta 1994).

Supawna Meadows NWR has a severe infestation problem with the non-native mile-a-minute weed. This plant is an herbaceous trailing vine that is native to India and Eastern Asia. It is an aggressive plant that grows over native vegetation, which blocks light from penetrating to the plant. This reduces photosynthesis capability and may kill native plants (Okay et al. 2010). We will continue to work with New Jersey Department of Agriculture to maintain this habitat by using an Asian weevil (*Rhinoncomimus latipes*) to control mile-a-minute weed.

Based on results of host-range tests, a limited amount of native foliage was consumed by weevils (between 0.1 and 2.3 cm² over 30 days). However, none of the non-target plant species were consumed when the weevils were given a choice between them and mile-a-minute weed. Additionally, no eggs were laid on non-target plant species (Colpetzer 2003). The conclusions from field studies indicate the weevil establishes easily, produces multiple generations per year, and that adults can kill mile-a-minute plants through foraging (Hough-Goldstein 2008). The intention of the releases is that the weevils will consume mile-a-minute weed stems and leaves, which would result in reducing the spread of and, eventually, killing the plants.

The refuge includes an old barn that provides important habitat for bats and owls, wildlife that are dependent on upland forest habitat. A maternity colony of more than 1,500 bats, primarily little brown bats, roosts in a barn on the refuge. The federally listed, endangered Indiana bat is known to form small colonies within large little brown bat colonies. Indiana bats have been documented within the Highlands region of New Jersey, but little survey work has taken place within the southern portion of the State and it is not yet known if the species is present within the Coastal Plain (USFWS 2007a). Regardless of whether or not Indiana bats use the barn, the Service believes the barn should be maintained to support the maternity colony of little brown and big brown bats. If the barn is torn down, displaced bats may make their way into nearby homes and may be susceptible to harm by homeowners not willing to tolerate their presence. The barn would also support common barn owls, which is a New Jersey species of concern. Maintaining the barn would allow us to sustain this unique environment on the refuge as a resource for bats, owls, and other wildlife and as a component of refuge diversity in general.

Forested uplands provide important habitat for many species of bats. Quality habitats include the following: trees with shingle-like or shaggy bark ≥ 9 inches dbh, snags or diseased trees ≥ 5 meters tall, trees with cavities, habitat patches of mature trees ≥ 50 acres, and an open understory (Scherer 2009 personal communication). Indiana bats, a federally listed and endangered species and a trust resource of the U.S. Fish and Wildlife Service, have been confirmed breeding and hibernating in the State of New Jersey but are not documented on

the refuge. Typically, Indiana bats utilize trees or snags with exfoliating bark for maternity roosts; however, roosting Indiana bats have been documented in structures. The refuge's barn, adjacent to refuge grasslands and tidal marsh, provides artificial roosting habitat that houses the largest maternity colony of little brown bats and big brown bats in Salem County, New Jersey. Given the known range and maternity roost requirements of the Indiana bat, it is possible, although unlikely, that Indiana bats might use the barn for maternity roosting.

If Indiana bats are using the refuge for foraging and roosting, protecting, maintaining, and improving habitat quality on the refuge would contribute to the viability of the species and its recovery. Gathering more information about use of the refuge by this endangered species, in addition to other species of bats, would allow more informed management decisions and, if necessary, ensure the protection and improvement of habitats used as roost or maternity colonies.

The scrub/shrub habitat off Xmas Tree Lane and the Forest Habitat Trail was previously hydro-axed to maintain it in early successional habitat. This area will be restored to forested uplands to create a large block of forested habitat to benefit forest birds such as the red shouldered hawk. The scrub/shrub habitat off Lighthouse Road, east of the refuge office, would also be converted to forested upland habitat to create a larger forested block in that area and to benefit forest birds.

Strategies

1. Continue to coordinate with New Jersey Department of Agriculture's weevil release program to control mile-a-minute weed in some areas of the refuge, as described in the refuge's 2006 Compatibility Determination (USFWS 2006), and the accompanying U.S Department of Agriculture. Environmental Assessment (Firko 2004) that were completed for this activity. A more recent version of that compatibility determination is in appendix B.
2. Expand invasive species control on current and additional acreage on mile-a-minute weed, Japanese stiltgrass, multiflora rose, and Japanese honeysuckle so that 70 to 80 percent native vegetation is achieved. The exact number of acres treated would depend on funding and management capability. Keep records of treated areas in GIS.
3. Purchase up to 174 additional upland forest acres within the acquisition boundary.
4. Work with State and other partners to conduct limited surveys for bat species of conservation concern and implement appropriate action if white-nose syndrome is discovered in the colony.
5. Identify, locate, and manage additional native bat habitat.
6. Maintain and improve the structural integrity of the barn, located adjacent to the refuge's grasslands and tidal marshes, to continue to provide maternity roosting habitat for little brown and big brown bats, common barn owls, and other species of conservation concern.
7. Work with partners to monitor the barn owl nest box in the barn.

Monitoring Elements

Conduct appropriate monitoring and survey programs, as funding and staffing permit, to measure our success with respect to our objectives. The results may trigger adjustments to management strategies, or may trigger a reevaluation or refinement of our objectives. Examples of monitoring or surveys that we may implement include:

1. Prevent new invasive species from becoming established within upland forest habitats by utilizing Early Detection Rapid Response Techniques that detect newly established invasive species and immediately addresses those populations through the appropriate control measure. This strategy would incorporate a combination of plant identification and inventories, maintaining updates of new invasive species present in the region, as well as having knowledge of the appropriate management techniques prior to conducting control efforts.
2. Conduct landbird surveys, migration and winter bird counts to evaluate achievement of the objective for breeding, migrating, and wintering birds.
3. Conduct reptile and amphibian inventories to obtain baseline information on species diversity and habitat utilization.
4. Conduct acoustical monitoring surveys to determine presence of Indiana bats during their breeding season and detect occurrences of Indiana bats during migration.
5. Conduct acoustical monitoring surveys to determine species diversity and composition of bats on the refuge during breeding and migration.
6. Conduct baseline small mammal inventory to obtain baseline information on species diversity and habitat utilization.
7. In the barn, conduct comprehensive surveys for bat species of conservation concern and implement appropriate action if white-nose syndrome is discovered in the colony.
8. In the barn, monitor the barn owl nest box to determine use and hatching success.
9. To determine the effectiveness of the white-tailed deer hunting program, evaluate regeneration of native trees, shrubs, and forbs by conducting vegetation surveys to gather information on species composition, abundance, and diversity.
10. Work with the State on white-tailed deer control.
11. Monitor presence and impact of beaver in adjacent habitat, which impacts forested uplands, and work with USDA APHIS or other licensed agents to control these species as necessary to protect public safety and refuge resources.

Goal 3

Protect, enhance, and restore biological integrity, diversity, and environmental health of non-tidal wetland habitats to support native wildlife and plant communities with emphasis on breeding, migrating, and overwintering birds and other species of conservation concern.

Objective 3.1 Non-tidal Scrub/Shrub Wetlands

Protect and manage up to 52 acres of non-tidal scrub/shrub wetland habitat to benefit migrating landbirds such as eastern towhee (*Pipilo erythrophthalmus*), gray catbird (*Dumetella carolinensis*), brown thrasher (*Toxostoma rufum*), and other species of conservation concern with the following attributes

- >75 percent cover of native fruit-bearing shrubs (for example, dangleberry (*Gaylussacia frondosa*), southern arrowwood);
- <20 percent cover of native moist soil grasses and forbs (for example, coast cockspur, spike-rush (*Elocharis* spp.), smartweed (*Polygonum* spp.), switch grass); and
- <30 percent cover of invasive plants (for example, mile-a-minute weed, common velvet grass [*Holcus lanatus* L.], autumn olive).

Rationale

Scrub/shrub habitat is essential in supporting a number of bird species of conservation concern. The yellow-breasted chat, a year-round resident of Supawna Meadows NWR, is listed in the NJWAP as a species of concern in the Southern Piedmont Plains region (NJDFW 2008a). It nests in bushes, brier

tangles, vines, and low trees, generally in dense vegetation less than 2 meters above ground. In winter, it establishes territories in young second-growth forest and scrub. Early successional habitat is essential to its survival. The prairie warbler, another species of concern, has been described in objective 2.2 above (see page 4-25).

Scrub/shrub habitats are becoming increasingly rare in the Delaware Estuary region and correspondingly less able to sustain healthy populations of birds and other species of conservation concern. See objective 2.2 for additional rationale for scrub/shrub habitat management.

It is anticipated that management of shrublands for migrating landbirds will continue to provide habitat for breeding landbirds, such as gray catbirds and eastern towhees, and other species of conservation concern dependent on shrublands.

Strategies

1. Purchase up to 4 additional scrub/shrub acres within the acquisition boundary.
2. Maintain scrub/shrub habitat through selective cutting and herbicide application to set back succession.
3. Control invasive plants so that 70 percent of scrub/shrub habitat is comprised of native species. The exact number of acres treated will depend on funding and management capability. Keep records of treated areas in GIS.
4. Continue the use of biological control measures to control mile-a-minute weed.

Monitoring Elements

Conduct appropriate monitoring and survey programs, as funding and staffing permit, to measure our success with respect to our objectives. The results may trigger adjustments to management strategies, such as selective cutting and herbicide treatments to achieve structural and species diversity of non-tidal scrub/shrub wetland habitat. Results may trigger a reevaluation or refinement of our objectives. Examples of monitoring or surveys that we may implement include:

1. Prevent new invasive species from becoming established within non-tidal scrub/shrub habitat by utilizing Early Detection Rapid Response Techniques that detect newly established invasive species and immediately address those populations through the appropriate control measure. This strategy will incorporate a combination of plant identification and inventories, maintaining updates of new invasive species present in the region, as well as having knowledge of the appropriate management techniques prior to conducting control efforts.
2. To evaluate achievement of the objective for breeding and migrating birds, conduct landbird surveys, migration and winter bird counts.
3. To evaluate achievement of the objective for migrating landbirds, conduct surveys during peak migration to determine bird abundance, density, and diversity every 5 years. Surveys include area searches, constant-effort mist-netting and banding, and activity budgets.
4. To evaluate quality of scrub/shrub habitat for migrating landbirds, conduct periodic vegetation surveys for plant species composition, community structure, and berry production every 3 to 5 years.
5. Gather baseline data on butterflies and other pollinators using refuge non-tidal scrub/shrub wetland habitat and incorporate annual surveys and/or monitoring efforts within 5 to 10 years.

Objective 3.2
Non-tidal Herbaceous Wetlands

Protect up to 55 acres of non-tidal herbaceous wetland habitat to benefit marsh wrens, southern bog lemmings, and other species of conservation concern with the following attributes

- >70 percent cover of herbaceous wetland species, such as rice cutgrass, *Polygonum* spp., *Juncus* spp., *Drosera* spp., and *Serracenia* spp; and
- <30 percent cover of invasive plants, such as phragmites and reed canary grass (*Phalaris arundinacea*).

Rationale

Non-tidal herbaceous wetlands at Supawna Meadows NWR provide habitat for species of conservation concern, including the marsh wren, which inhabits freshwater and brackish marshes in cattails, tule, bulrush, and reeds. Its success may be greatest in marshes with relatively dense vegetation and deep water. Though no longer listed by the Service as a bird of conservation concern in the region, it is considered a non-game species of conservation concern by the State of New Jersey (NJDFW 2008a). The southern bog lemming is also listed by New Jersey as a non-game species of conservation concern (NJDFW 2008a).

Non-tidal herbaceous wetlands are a small but important habitat component of the refuge because of the relative scarcity of this type of habitat in the vicinity of the refuge and the diversity of vertebrate and invertebrate species and plant life these wetlands typically support. Overbrowse from white-tailed deer limits regeneration of native herbaceous plants and exacerbates invasive plant species problems.

Strategies

1. Purchase up to 13 additional non-tidal herbaceous wetland acres within acquisition boundary.
2. Develop an Adaptive Management Framework for phragmites control so that treatments are monitored and evaluated for effectiveness. The refuge will be using an integrated approach to phragmites control, which will consider restoration of natural processes, herbicides, prescribed burning, biological control, and other tools as they are developed.
3. Monitor habitat destruction impacts of white-tailed deer. Implement population control measures on white-tailed deer if significant habitat destruction is observed.

Monitoring Elements

Conduct appropriate monitoring and survey programs, as funding and staffing permit, to measure our success with respect to our objectives. The results may trigger adjustments to management strategies, such as prescribed fire and herbicide treatments to achieve structural and species diversity of non-tidal herbaceous wetland habitat. Results may trigger a reevaluation or refinement of our objectives. Examples of monitoring or surveys that we may implement include:

1. Prevent new invasive species from becoming established within non-tidal scrub/shrub habitat by utilizing Early Detection Rapid Response Techniques that detect newly established invasive species and immediately address those populations through the appropriate control measure. This strategy will incorporate a combination of plant identification and inventories, maintaining updates of new invasive species present in the region, as well as having knowledge of the appropriate management techniques prior to conducting control efforts.

2. To determine the effectiveness of the white-tailed deer hunting program, evaluate regeneration of native shrubs and forbs by conducting vegetation surveys to gather information on species composition, abundance, and diversity.
3. Work with the State on white-tailed deer control.

Objective 3.3 Freshwater Impoundments

Manage the existing five impoundments, consisting of up to 87 acres, using existing water control structures and up to 5 acres of non-tidal open water impoundments (without water control structures) to enhance habitat available for shorebirds, waterfowl, marsh birds, and wading birds during their peak spring and fall migration periods while maintaining essential habitat for other species of management concern, such as amphibians and dragonflies, through a combination of water level management, wetland restoration, and invasive species control. These measures will include:

- Annually provide high quality foraging habitat for wading and marsh birds, specifically black-crowned night-herons, glossy ibis, least bitterns, snowy egrets, and little blue herons (summer: July-late August). This habitat will consist of open, shallow water (2 to 10 inches water depth) with patches of emergent wetland plants that support fish, invertebrates, and amphibians.
- Annually support migratory shorebirds through a mix of shallow water (<6 inches water depth), mudflat with sparse vegetation (<10 percent cover), and mudflats with no vegetation at times of peak migration (spring: May; and fall: mid-August through September).
- Annually support migratory waterfowl through a mix of shallow (6 to 24 inches water depth) flooded vegetation (*Carex*, *Polygonum*, *Peltandra*) at times of peak migration (spring: late March, and fall: late October).
- Annually support migratory wading birds through a mix of shallow remnant pools (6 to 12 inches water depth) at times of peak migration (spring: late March, and fall: late August).

Rationale

Supawna Meadows NWR's impoundments and emergent wetlands provide important foraging habitats for wading birds nesting on Pea Patch Island, which is the largest wading bird colony in the mid-Atlantic and one of the largest colonies on the East Coast. Managing these wetlands to provide the necessary food for a subset of these birds will result in resources available to a larger suite of wading birds, such as black-crowned night herons, glossy ibis, least bitterns, snowy egrets, and little blue herons, which are priority species within BCR 30. Also, created wetland environments can provide key life cycle components for a variety of birds and aquatic species.

Invasive plant species, such as phragmites, purple loosestrife, Canada thistle, and mile-a-minute weed, are increasingly displacing native species in the impoundments and along the dikes. Water levels are controlled using water control structures. An increase in water levels can occur from allowing tidal water to flow into the impoundment, rainfall, and natural springs. The water levels in impoundments without water control structures are influenced by rainfall, natural springs, and drying conditions such as drought. Prescribed fire can be used to control vegetation in the impoundments. Mowing, prescribed fire, and flooding can be used to reduce overcrowding vegetation.

The Service has a policy emphasizing restoring the biological integrity, diversity, and environmental health of refuges (601 FW 3). We also need to think about creating and restoring natural systems that have resilience (that is, the capacity to absorb disturbance while retaining basic structure and function) to help

address predicted sea level rise and other climate change issues. As sea level rises, management and maintenance of coastal wetland impoundments will become increasingly challenging and expensive. Due to the continued high cost of managing impoundments and maintaining associated infrastructure and coupled with the natural forces that strive to eliminate them, Supawna Meadows NWR will continue to study the feasibility of whether or not to continue individual impoundment management. Returning impoundments to more natural hydrological regimes will result in impoundments and the surrounding habitats becoming slightly brackish.

Strategies

1. For each impoundment, evaluate potential for restoring or reverting to non-impounded natural marsh or forested wetland habitats (natural hydrology) rather than continuing impoundment management. Participate in a Northeast Region structured decisionmaking study to determine the highest conservation value for each impoundment. Where restoring natural processes is not feasible, the refuge will strive to mimic natural processes within impoundments.
 - Begin evaluation with Tract 11C impoundment for potential to restore natural hydrologic conditions.
 - In impoundments without water control structures, evaluate potential for creating vernal pool-like shallow waters for amphibians and implement if feasible.
2. Until the HMP is developed, actively manage Tract 11 and Tract 11D Lighthouse Road Impoundments. Vary water level management schemes on each impoundment year-to-year to benefit priority species, particularly Pea Patch Island wading birds.
3. Develop an Adaptive Management Framework for phragmites control so that treatments are monitored and evaluated for effectiveness. The refuge will be using an integrated approach to phragmites control, which will consider restoration of natural processes, herbicides, prescribed burning, biological control, and other tools as they are developed.
4. Actively manage impoundments using mowing, prescribed fire, flooding, and biological control for purple loosestrife and mile-a-minute weed as needed to achieve objectives.
5. Maintain dike and water control structures as needed. Mow and reduce woody vegetation on Tract 11 dike.
6. Collect data and assess habitat and dikes to determine damage by furbearers, such as muskrat and groundhog. Determine threshold that requires species management. Issue a Special Use Permit if trapping is needed.
7. In impoundments without water control structures, maintain nearby nest boxes for wood ducks and eastern screech owls.
8. In Tract 11D Xmas Tree Lane Impoundment, determine appropriate water level management of impoundment and implement control measures.
9. In Tract 11D Xmas Tree Lane Impoundment, monitor habitat destruction of beaver. Implement beaver population control measures if significant habitat destruction is observed.

Monitoring Elements

Conduct appropriate monitoring and survey programs, as funding and staffing permit, to measure our success with respect to our objectives. The results may trigger adjustments to management strategies, or trigger a reevaluation or refinement of our objectives. Examples of monitoring or surveys that we may implement include:

1. Prevent new invasive species from becoming established within impoundments by utilizing Early Detection Rapid Response Techniques that detect newly established invasive species and immediately address those populations through the appropriate control measure. This strategy will incorporate a combination of plant identification and inventories, maintaining updates of new invasive species present in the region, as well as having knowledge of the appropriate management techniques prior to conducting control efforts.
2. Conduct inventories and monitoring of shorebirds, waterfowl, waterbirds, and wading birds use and abundance within the impoundments. Utilize data to document the ongoing effectiveness of water level management activities and adjust management protocols as necessary.
3. Conduct fish inventories to obtain baseline information of fish species diversity.
4. To evaluate habitat use and monitor overall diversity of anuran species, conduct call count surveys to evaluate impoundment protection and management.
5. In early spring, identify and map areas of concentration of amphibians and impoundments to ensure their conservation and protection.
6. Monitor habitat destruction of Canada goose, mute swan, and beaver, and work with USDA APHIS or other licensed agents to control these species as necessary to protect public safety and refuge resources.

Objective 3.4 Forested Wetlands

Protect up to 346 acres of forested wetland habitat to benefit breeding wood thrush and wood ducks, migrating and wintering rusty blackbird, breeding and wintering eastern screech owls, and other forest-dependent species of conservation concern. Forested wetland habitat is characterized by the following attributes

- understory with 30 to 50 percent cover of native shrubs (3 to 12 feet tall), such as southern arrowwood and sweet pepperbush, with scattered openings containing native herbaceous species, such as New York fern and false nettle;
- <20 percent cover of invasive plants (for example, Japanese stiltgrass) in understory/herbaceous layer; and
- >90 percent canopy cover of native trees (>12 feet tall), such as red maple, willow oak, sweetgum, and sour gum.

Rationale

The wood duck is a refuge focal species because it is a high priority species both within the Atlantic Flyway and at the regional scale, and it is a good representative of forest wetland habitat types. Wood duck populations began declining in the late nineteenth century because of overharvest, deforestation, and loss of wetland habitats. Populations have since stabilized but not recovered, even though harvest rates have declined. Wood ducks prefer quiet inland waters, such as wooded swamps, flooded forest, ponds, marshes, along streams where they nest in holes in large trees in forested wetlands, and in bird boxes, usually within 0.5 kilometers of water and near forest canopy openings. They winter on freshwater and brackish marshes, ponds, streams, and estuaries.

The rusty blackbird breeds in Canada and Alaska and migrates to New Jersey and other Eastern and Central States to winter. During migration and winter, habitat is primarily wooded wetlands and riparian areas but also includes various open woodlands, scrub, pastures, and cultivated lands (American Ornithologists' Union 1983). A significant, range-wide decline of approximately 90 percent over the past four to five decades is indicated by data from the Breeding Bird Survey, Christmas Bird Counts, and Quebec Checklist Program

(Greenberg and Droege 1999, Niven et al. 2004, Savignac 2004, Sauer et al. 2005). Analyses of abundance classifications in bird distribution books and annotated checklists reveal a long-term decline dating back to at least the early part of the 1900s (Greenberg and Droege 1999).

The eastern screech owl, a non-game species of conservation concern in the State of New Jersey (NJDFW 2008a), is common year round at Supawna Meadows NWR. It prefers open woodland, deciduous forest, woodland/forest edge, swamps, scrub, and riparian woodland. It roosts in tree hollows, among foliage close to trunk, in nest boxes, under eaves, or at similar sites.

A large number of bird species, including the wood duck, rusty blackbird, and eastern screech owl, use forested wetlands. Birds use the refuge's forested wetlands for breeding, migration, and wintering. The refuge's mature forested wetland habitat represents an excellent example for the area of great quality and size class diversity. A water control structure is located within forested wetland habitat along the Forest Habitat Trail. Managing the water levels here will provide additional forested wetland habitat, as in a Green-tree Reservoir. The forest has been ditched in some areas, thus altering the original hydrology. Encroachment of invasive species threatens this habitat. Also, the habitat north of the Tract 11 impoundment contains a wooded section within the scrub/shrub habitat that will be converted to forested wetlands for the benefit of short-eared owls. Additional management actions will allow us to better sustain this important habitat type.

Major threats to the refuge's forest health and condition are overbrowse caused by white-tailed deer overabundance and infestation of invasive plant species. White-tailed deer thrive in fragmented non-urban areas, and the resulting overbrowse in forested landscape severely limits forest regeneration (NJDFW 2008c). White-tailed deer selectively browse native vegetation, giving invasive species (for example, mile-a-minute weed, etc.) a competitive edge in the forest understory (NJDFW 2008c). Deer browse pressure significantly impacts the regeneration of native woody species. Regeneration is essential to the success of the development of Supawna Meadow NWR's forest understory. Numerous studies have found when white-tailed deer browse pressure is high, it can alter the growth, reproduction (Knight 2003), diversity (Lathan et al. 2005), and ultimately survival of plants within a specific population (Alverson and Waller 1997, Cote et al. 2004). In areas where deer density exceeds 20 deer per square mile, deer herbivory is related to declines in mid-story bird species (deCalesta 1994).

Strategies

1. Purchase up to 156 additional acres of forested wetlands within the acquisition boundary.
2. Conduct an adaptive management study to determine if natural hydrology should be restored.
3. Remove wood duck nest boxes as boxes fall into disrepair.
4. Expand invasive species control on current and additional acreage of Japanese stiltgrass and other dominant invasive species so that 70 to 80 percent native vegetation cover is achieved. The exact number of acres treated will depend on funding and management capability. Keep records of treated areas in GIS
5. Continue the use of biological control measures to control mile-a-minute weed.
6. Monitor habitat destruction by white-tailed deer and beaver. Implement population control measures on white-tailed deer and beaver if significant habitat destruction is observed.

Monitoring Elements

Conduct appropriate monitoring and survey programs, as funding and staffing permit, to measure our success with respect to our objectives. The results may trigger adjustments to management strategies, or a reevaluation or refinement of our objectives. Examples of monitoring or surveys that we may implement include:

1. Prevent new invasive species from becoming established within forested wetland habitat by utilizing Early Detection Rapid Response Techniques that detect newly established invasive species and immediately address those populations through the appropriate control measure. This strategy will incorporate a combination of plant identification and inventories, maintaining updates of new invasive species present in the region, as well as having knowledge of the appropriate management techniques prior to conducting control efforts.
2. Conduct amphibian and reptile inventories to obtain baseline information on species diversity and habitat utilization.
3. To evaluate habitat use and monitor overall diversity of anuran species, conduct call count surveys to evaluate vernal pool protection and management.
4. In early spring, identify and map areas of concentration of amphibians and vernal pools to ensure their conservation and protection.
5. Monitor habitat destruction of Canada goose, mute swan, and beaver, and work with USDA APHIS or other licensed agents to control these species as necessary to protect refuge resources.

To determine the effectiveness of white-tailed deer hunting program, evaluate regeneration of native trees, shrubs, and forbs by conducting vegetation surveys to gather information on species composition, abundance, and diversity.

Goal 4**Provide opportunities for compatible, high-quality, wildlife-dependent public uses.****Objective 4.1
Hunting**

Expand hunting opportunities for deer and waterfowl hunters.

Rationale

Hunting in southern New Jersey is a traditional outdoor past time and is deeply rooted in our American heritage. A quality hunt program helps develop an appreciation for fish and wildlife. It is also a tool to assist in deer population control and habitat management efforts on the refuge.

Opportunities for public hunting are decreasing with increasing private land development. Refuge lands thus become increasingly important in the region as a place to engage in this activity.

We will strive to meet the following guiding principles for a refuge hunting program identified in new Service policy (605 FW 2)

- Manage wildlife populations consistent with 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 recreational and educational experiences.
- Encourage participation in this tradition; and
- Minimize conflicts with visitors participating in other compatible wildlife-dependent recreational activities.

The refuge hunt program is implemented consistent with State regulations and additional refuge regulations stipulated in Code of Federal Regulations 50 (50 CFR). Included in our deer hunt plan objectives is the intent to maintain the deer population at a level commensurate with available habitat, in order to maintain the health of the herd, and prevent habitat degradation that accompanies overpopulation. Included in our waterfowl hunt plan objectives is the intent to provide opportunities for compatible wildlife-dependent recreation as required by the National Wildlife Refuge Improvement Act of 1997, permit use of a sustainable natural resource, and permit hunting as a management strategy to meet state, flyway, and national population goals for non-migratory Canada goose and greater snow goose populations.

Our current deer hunt program is archery-only. Our deer and waterfowl hunts follow State seasons. In general, we believe the extent of our current programs meets the needs of our public and provides a quality experience. However, we will continue to evaluate the programs on an annual basis and modify them, as warranted, given new biological or visitor data.

The refuge will rely on State hunting regulations to define hunting safety zones. We believe that State regulations are adequate for ensuring safety. Since the refuge owns a limited amount of upland habitat, this will allow safe hunting on additional lands inhabited by deer. To be consistent with State regulations and management actions at Cape May NWR (which is in the same state and under the same refuge manager) we will not post or maintain signs marking safety areas. To address risks of trespass onto neighboring property, refuge staff will continue to post and maintain refuge boundary signs.

We are proposing some changes to the authorized hunting and fishing areas (map 4.2). The open water in the Tract 11 Impoundment will be closed to hunting as well as all other public use. This will provide undisturbed habitat for waterfowl, while allowing public use in the upland portion of this area, which was previously only open to hunters.

Portions of the Supawna Meadows NWR were designated, acquired, reserved, or set apart as an inviolate sanctuary; therefore, we may only allow hunting of migratory game birds on no more than 40 percent of the refuge. The waterfowl hunting zone will be reconfigured and 1,206 acres will be open to waterfowl hunting. During scoping meetings, the NJDFW asked the refuge to open tidal streams with a 150-foot buffer to allow hunting from the marsh habitat. In order to protect resources of concern while allowing adequate hunting areas, a new waterfowl hunting zone was delineated.

Providing new hunting opportunities on Tract 48 (AID) and any other new properties will be accomplished by updating the 2006 White-Tailed Deer Hunt Management Plan and the 2000 Waterfowl Hunting Plan and conducting additional NEPA analysis.

Strategies

1. Continue deer and waterfowl hunting on the refuge according to State regulations. Only archery deer hunting is allowed on the refuge for all four of New Jersey's bow hunting seasons according to the State Deer Management Zone 63 regulations.
2. Monitor the deer population and its effects on refuge habitats. If the herd needs to be further culled, work with the State to offer a doe-first season, a firearms season, or another method for taking more deer off the refuge. Continue to keep the upland areas of Tract 11 Impoundment open to archery deer hunting according to State seasons. The open water habitat and dike around the open water will be closed to hunters.

3. Remove hunting closure signage; rely on State hunting regulations to define hunting safety zones.
4. Reconfigure the waterfowl hunting zone so that 1,206 acres will be open to hunting. Access will be from the water. No blinds will be allowed to be built on the marsh.
5. Within 3 years of completing the final CCP, conduct additional NEPA analysis to open Tract 48 (AID) property, and any other new properties as identified in the CCP, to deer and waterfowl hunting.

Objective 4.2

Fishing and Crabbing

Expand fishing and crabbing opportunities for the public.

Rationale

Fishing and crabbing are popular recreational activities along the Delaware Estuary and Salem River shorelines, and the refuge can be accessed by an extensive series of tidal channels that support both activities. Fishing and crabbing have been historical, consumptive recreational uses on the refuge that we believe are compatible with our resource objectives.

We will strive to meet these guiding principles for a refuge recreational fishing program identified in Service policy (605 FW3 and 4):

- 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 as defined in 605 FW 1.6.
- 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 activities.

In 2009, approximately 750 fishing and crabbing visits were made to the refuge; however, this number tends to fluctuate with the quality and availability of crabbing. We believe that onsite staff and additional funding will allow us to expand fishing and crabbing on the refuge.

In order to protect resources of concern and set aside 60 percent of the refuge as an inviolate sanctuary to wildlife, fishing and crabbing will occur in the same areas as waterfowl hunting so as to keep the sanctuary areas free of disturbance from fishing and hunting. Also, we will open Tract 11D Xmas Tree Lane impoundment (XTL) to freshwater fishing and conduct additional NEPA analysis, as needed, within 1 year of the final CCP. This will be the only freshwater fishing site available at Supawna Meadows NWR. Finally, we will prohibit fishing at Lighthouse Road due to safety concerns, such as the lack of parking and the lack of suitable habitat for bank fishing.

We will open fishing and crabbing opportunities on Tract 48 (AID), and any other new areas as identified in this CCP, within 3 years of the adoption of this final CCP and only after updating the 2000 Sport Fishing Plan and conducting any additional NEPA analysis.

Strategies

1. Rezone fishing and crabbing to coincide with waterfowl hunting areas. Conduct additional NEPA analysis, as needed, within 3 years of the final CCP. Areas open for saltwater fishing and crabbing will be open in accordance with State regulations. Open Tract 11D XTL impoundment to freshwater fishing and conduct NEPA analysis within 1 year of final CCP.
2. Close fishing at Tract 11D Lighthouse Road impoundment because of safety hazards associated with access.
3. Continue to host the one-day refuge youth fishing event at the Tract 18 impoundment. Seek assistance from the Friends and/or volunteers.

Expand wildlife observation, photography, and interpretation opportunities.

Rationale

The refuge's Public Use Plan was approved on August 3, 2000. It states that through the public use program, visitors and local residents will be introduced to the role of the Service as a land management agency. Visitors will be encouraged to visit and learn more about other Service field areas, including refuges in New Jersey, Pennsylvania, and Delaware. Visitors will be introduced to the basic concepts of wildlife management and sustainable public use of natural resources. The public use program will be used to increase visitor understanding of refuge

management objectives and programs and to foster support for fulfilling its mandated mission.

We will strive to meet these guiding principles for refuge wildlife observation and photography programs identified in Service policy (605 FW 4 & 5):

- Provide safe, enjoyable, and accessible wildlife viewing and photography 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 conflicts with visitors participating in other compatible wildlife-dependent recreation activities.

While our primary mission is to protect wildlife and promote wildlife conservation, the 1997 Refuge Improvement Act directs us to provide six priority wildlife-dependent recreational uses in the Refuge System: hunting, fishing, wildlife observation and photography, and environmental education and interpretation where it is compatible. By providing the public with safe, accessible quality opportunities and well-maintained facilities for those uses, we hope to raise public awareness, understanding, appreciation, and stewardship of the Delaware Estuary ecosystem and the benefits of its conservation for fish, wildlife, and people. Ultimately, these will contribute to the mission of the refuge and the Refuge System. Wildlife observation, photography, and interpretation are major public uses of the refuge throughout the year. Over 15,000 people visit the refuge each year and, given our informal monitoring, most come to the refuge on the land side to view and photograph wildlife. Maintaining quality infrastructure and providing some new facilities will enhance visitor opportunities to view the relationships among resource management, wildlife, habitat, and people. Our facilities for public visitation include parking, information kiosks, nature trails, photo blinds, boardwalks, and interpretive literature/signs.

We will work with partners to facilitate quality wildlife observation and photography opportunities. The boat trail will be eliminated since all of the tidal

Objective 4.3 Wildlife Observation, Photography and Interpretation

creeks are open to public use and there is no need to highlight a specific area for boating. Upland habitat surrounding the Tract 11 impoundment will be opened to the public to permit viewing of this habitat. An observation platform will be constructed so visitors could also view the open water in the impoundment without disturbing the wildlife that utilize the impoundment.

We will open Tract 48 (AID) property to wildlife observation within 3 years of completing the final CCP. This may require additional NEPA analysis.

Strategies

1. Continue to provide wildlife viewing, photography, and interpretation opportunities along existing refuge trails.
2. Continue to provide interpretive signs at all existing refuge public use sites, including the family plot cemetery along the Grassland Trail.
3. Improve the observation blinds along the Grassland Trail.
4. Continue to seasonally close bald eagle area.
5. Install/upgrade signs along Highway 49 directing motorists to the refuge.
6. Consider extending the current trail system onto newly acquired lands and providing observation blinds along new trails. Conduct additional NEPA analysis as necessary.
7. Expand refuge boundary signage on newly acquired lands.
8. Develop new brochures specific to trails.
9. Update Web site.
10. Construct a spur trail from the Grassland Trail into the wetland, with help from the Friends group if needed.
11. Eliminate the designation of a boat trail and remove trail markers, but continue to allow public boat access in the tidal streams.
12. Improve or install additional observation facilities on the refuge, for example:
 - Install an observation platform for wildlife observation and photography at the impoundment at Tract 11 and upgrade the nearby grassy parking area to accommodate 8 to 10 vehicles. The open water portion of the Tract 11 impoundment and the dike surrounding the open water will remain closed to the public all year. Gates will be installed to define the closed area.
 - Construct a wheelchair accessible photo-blind and other amenities to improve facilities for wildlife photographers at the Grassland Trail.
13. Construct a trail linking the FPRRL site to the Grassland Trail to connect visitors to wildlife viewing areas.
14. Use FPRRL to expand opportunities for refuge interpretation with panels and brochures on ground level and in the interior of FPRRL, if approved by SHPO. Take advantage of landscape view from FPRRL to interpret refuge marshlands, invasive plants, and a mosaic of other cover types as well as viewing birds in flight on the refuge.
15. Work with a neighboring private landowner to enhance viewing opportunities at the Sinnickson Landing boat ramp site for eagle viewing.
16. Seek year-round local New Jersey residents for volunteer-based interpretative programs.

Open Tract 48 (AID) property to wildlife observation, photography, and interpretation within 1 year of completing the final CCP. Conduct additional NEPA analysis as necessary.

**Objective 4.4
Environmental Education
and Outreach**

Expand and enhance environmental education and outreach programs.

Rationale

The refuge offers a unique opportunity to explore, in close proximity, tidal and non-tidal wetlands, grassland, and forested habitats, as well as to learn about managing those landscapes to benefit wildlife. We believe we can facilitate other educators to use the refuge and offer excellent environmental education opportunities without expending significant refuge staff or funding resources.

County school districts at other refuges in the region have curricula that include field trips to the refuge for elementary grade students. In recent years, no staff has been available to assist at Supawna Meadows NWR for these types of visits. Development of environmental education lessons tailored to State curricula will provide programs and activities for schools and other groups while increasing public understanding of wildlife needs, ecosystems, conservation, and habitat management for wildlife. Using our educational partners to assist in this endeavor has many benefits. These partners also act as supporters of the refuge and natural resource conservation, advocates for environmental education, and help us conduct outreach to the local community.

Service policy identifies six guidelines on which to base environmental educational programs. These guidelines include connecting people's lives to the natural world, strengthening conservation literacy and knowledge, stressing the role of the Refuge System in conservation, and instilling a sense of stewardship and understanding of our conservation history.

In order to build a stronger base of public understanding, support, and activism beyond the portion of the American public who visit refuges, the Service has actively supported nationwide strategies, partnerships, legislation, and departmental mandates with a strong emphasis on community outreach. These include the 100-On-100 Outreach Campaign, the National Outreach Strategy: A Master Plan for Communicating in the U.S. Fish and Wildlife Service, the Cooperative Alliance for Refuge Enhancement (CARE), the Volunteer and Community Partnership Act, and the Challenge Cost-Share Program.

We are particularly interested in outreach to the local communities in Salem County. Our desire is to be a welcomed and valued asset to these communities. A positive community relationship is a crucial link between public support for refuges and effective management of the Refuge System. We are aware that there are many residents who either do not know that a national wildlife refuge is nearby or do not recognize its regional importance to the Delaware Estuary ecosystem.

We are striving for a well-rounded program of public outreach to enable large and diverse segments of the public to learn about the importance of refuge wetland and upland habitats, species of conservation concern, cultural resources, refuge management, and the refuge's role in the Refuge System. An effective public outreach program can also help win friends and proactively deal with controversial refuge management activities. Outreach can be used to anticipate and avoid potential conflicts between the needs of wildlife and other refuge uses.

We believe that regular communications within the community are very important. News articles and personal appearances inform our neighbors about what we are doing and why, which will lead to increased understanding, appreciation, and support of our programs. Feedback we will receive from these

outreach efforts allows us to better understand issues that are important in our communities and how our management may affect them.

We also believe that actively engaging people in meaningful refuge programs or projects will make a more lasting impression. We will offer many opportunities for people to get involved. Partners, volunteers, and members of the Friends of Supawna Meadows NWR are vital to accomplishing our outreach activities. They will assist us in community events and refuge visitor programs as well as support data gathering and maintenance projects. This assistance will support us in meeting the refuge's goals and objectives, supporting the missions of the Refuge System and the Service, and fostering good community relationships.

Visitors will be introduced to the concept of ecosystem management and the role of the refuge in the Delaware River and Bay Ecosystem. The Visitor Services program will be used to enhance local interest in wildlife and to increase understanding of the social and economic benefits that wildlife and open space bring to the area.

Strategies

1. Actively work with schools and other organizations to develop and encourage onsite programs.
2. Refuge staff will actively participate in off-site outreach activities.
3. Expand volunteer base and Friends group programs.
4. Open Tract 48 (AID) property to environmental education and outreach within 3 years of completing the final CCP. Conduct additional NEPA analysis as necessary.

Goal 5

Protect cultural resources on the refuge.

Objective 5.1: Finns Point Rear Range Light

Maintain and protect Finns Point Rear Range Light.

Rationale

We believe it will become feasible and beneficial to retain ownership of the FPRRL and to integrate it into the interpretive program for the refuge. As mentioned in chapter 2, FPRRL is on the National Register of Historic Places and is well-known in the area as an historic resource of interest. It can receive substantial visitation.

Strategies

1. Continue to maintain the FPRRL in compliance with the National Historic Preservation Act.
2. Pursue expanding public access to and interpretative use of the FPRRL to promote refuge values.
3. Prioritize repair/restoration of the FPRRL in SAMMS in concert with recordation and demolition of other deteriorated structures on the refuge.
4. Consider entering an agreement with New Jersey Lighthouse Society (NJLHS) to assist the refuge in supporting the use of FPRRL and associated interpretative programs.
5. Coordinate with Friends of Supawna Meadows NWR to integrate history of FPRRL into interpretive programs.
6. Repair FPRRL catwalk to allow public access.
7. Incorporate history of FPRRL into staff-led interpretive programs.
8. Update FPRRL information and enhance interpretive signage.
9. With assistance from the NJLHS and Friends of Finns Point Lighthouse (FOFPL), seek to stabilize, protect, and interpret FPRRL lens, if possible, in the refuge office.

**Objective 5.2
Other Cultural Resources**

Maintain and protect cultural sites and artifacts.

Rationale

Besides FPRRL, there are other cultural resources on the refuge, such as a family cemetery and the Yerkes farmstead. While not actually listed, New Jersey Historical Preservation Office staff determined that the Yerkes farmstead is eligible for listing on the National Register of Historic Places under the National Historic Preservation Act. There may be other historical or archaeological resources that come to light in the course of refuge management in the future. By law, we must consider the effects of our actions on archaeological and historic resources. Service-initiated actions likely to affect archaeological sites are routinely reviewed and assessed under the provisions of Section 106 of the NHPA. To date, projects requiring such review on the refuge have been confined to the location of facilities and impoundments. We will continue to comply with

Section 106 of the NHPA before disturbing any ground. Refuge lands have never had a systematic archaeological survey in their entirety.

Strategies

1. Allow Friends of Supawna Meadows NWR to continue maintaining the family cemetery located on refuge lands.
2. Hire a contractor to conduct a paleo-environmental review of the refuge. This review will include in-depth discussions of the refuge's archaeological sites and past history.

Goal 6

Enhance refuge management through partnerships, friends, volunteers, and community outreach.

Citizen involvement is critical to the well-being of the Refuge System and to the natural resources that depend on those lands. Working in partnership with other government agencies, academic institutions, organizations, and individuals is vital to our operations. When local citizens and other stakeholders of a refuge can see firsthand our conservation work, they become an informed constituency on behalf of conservation.

Working in partnership with others also provides additional resources with which we can achieve our refuge goals and objectives. Our volunteers, Friends Group, and other conservation partners provide valuable assistance in accomplishing refuge projects in all our program areas.

**Objective 6.1:
Refuge Partnerships**

Maintain active involvement in partnerships among all public land management agencies in South Jersey and the Lower Delaware River and Estuary to achieve refuge habitat and public use management objectives.

Rationale

Achieving refuge goals in many instances is feasible only through successful partnering with other agencies and groups.

Strategies

1. Communicate and coordinate regularly with the other agencies to discuss common goals, issues and concerns, share technical information, and identify opportunities for cooperative management with other agencies.
2. Pursue formal Memorandum of Understanding/Memorandum of Agreements (MOU/MOA) and cooperative agreements with partnering agencies, where warranted, to facilitate sharing of resources and implementation of programs.
3. Maintain the existing MOU with Salem County to share in law enforcement.

4. Evaluate opportunities for new partnerships with conservation organizations, educators, research and academic institutions, and other State and Federal agencies who share similar missions and goals.
5. With existing and future partners, make a greater effort to highlight our programs, opportunities, and successes through the use of media links (for example, Web sites) and the development of quality outreach materials that contain clear and consistent messages.

Objective 6.2
Refuge Friends Group

Enhance our relationship with the Friends of Supawna Meadows NWR to ensure we have a mutually beneficial working relationship and one that cooperatively promotes an appreciation of natural and cultural resource conservation and facilitates the implementation of priority refuge projects.

Rationale

There are over 50 Friends groups in the Northeast Region of the Service. These groups are private non-profit organizations formed and managed by local citizens to support the mission of a refuge and advocate for their local refuge and the National Wildlife Refuge System. The work these groups do is invaluable to our wildlife mission as well as the public activities that take place on refuges, fish hatcheries, and other Service stations.

Friends group members enjoy a variety of benefits depending on the group. Benefits include interacting with other people who share a common interest in wildlife and conservation, engaging in opportunities to learn more about refuge management and conservation practices, and notification of upcoming Friends and refuge events.

The Friends of Supawna Meadows NWR have been valuable supporters of the refuge purposes and the Refuge System mission. Many important programs and projects get accomplished each year through their hard work, dedication, and fundraising. Since many members live in the local community, they are also very effective in helping us conduct outreach about opportunities on the refuge and in providing us feedback from the community.

Strategies

1. Conduct monthly information and strategy meetings.
2. Contribute information to the Friends' newsletter and Web site.
3. Support the Friends' efforts at sponsoring community events and programs.
4. Encourage the Friends to work with other local citizens groups as an extension of the refuge's community outreach program.
5. Work with the Friends of Supawna Meadows NWR to seek outside support for refuge projects, develop public use programs, coordinate refuge projects, plan and conduct public events, conduct community outreach, promote national Service initiatives as they develop, and respond to public inquiries about the refuge.
6. Appoint a primary liaison between the Friends of Supawna Meadows NWR and the Service.
7. Provide resources, as needed, to help the Friends create and distribute their regular newsletter. Provide photographs illustrating habitat management and visitor services programs to include in the newsletter.
8. Work with the Friends of Supawna Meadows NWR on a regular basis to seek alternative funding sources and partnerships for various projects to benefit the refuge.

Objective 6.3
Refuge Volunteers

Encourage and facilitate an active, quality volunteer program that supports biological, maintenance, and visitor services priorities.

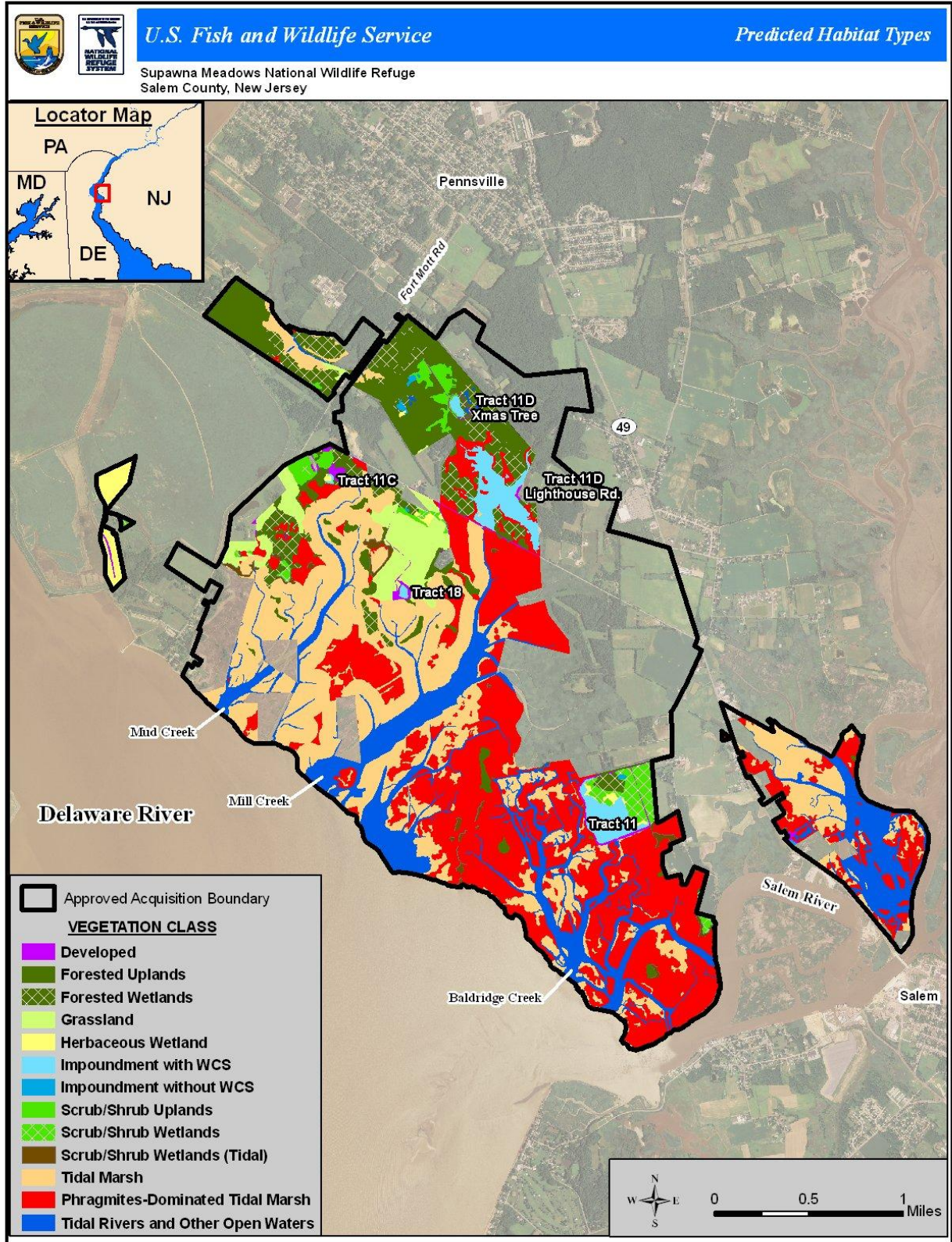
Rationale

The Fish and Wildlife Act of 1956, as amended by the Fish and Wildlife Improvement Act of 1978, and the National Wildlife Refuge System Volunteer and Community Partnership Enhancement Act of 1988 authorize the Service to accept volunteer services. Volunteers help the Service in a variety of ways. Some work full-time, while others assist a few hours per week or month or during a special event. Many volunteers conduct fish and wildlife population surveys, band ducks, lead tours, provide information to school groups and other visitors, work on cultural resources projects, perform clerical and administrative duties, work with computers and other technical equipment, and much more.

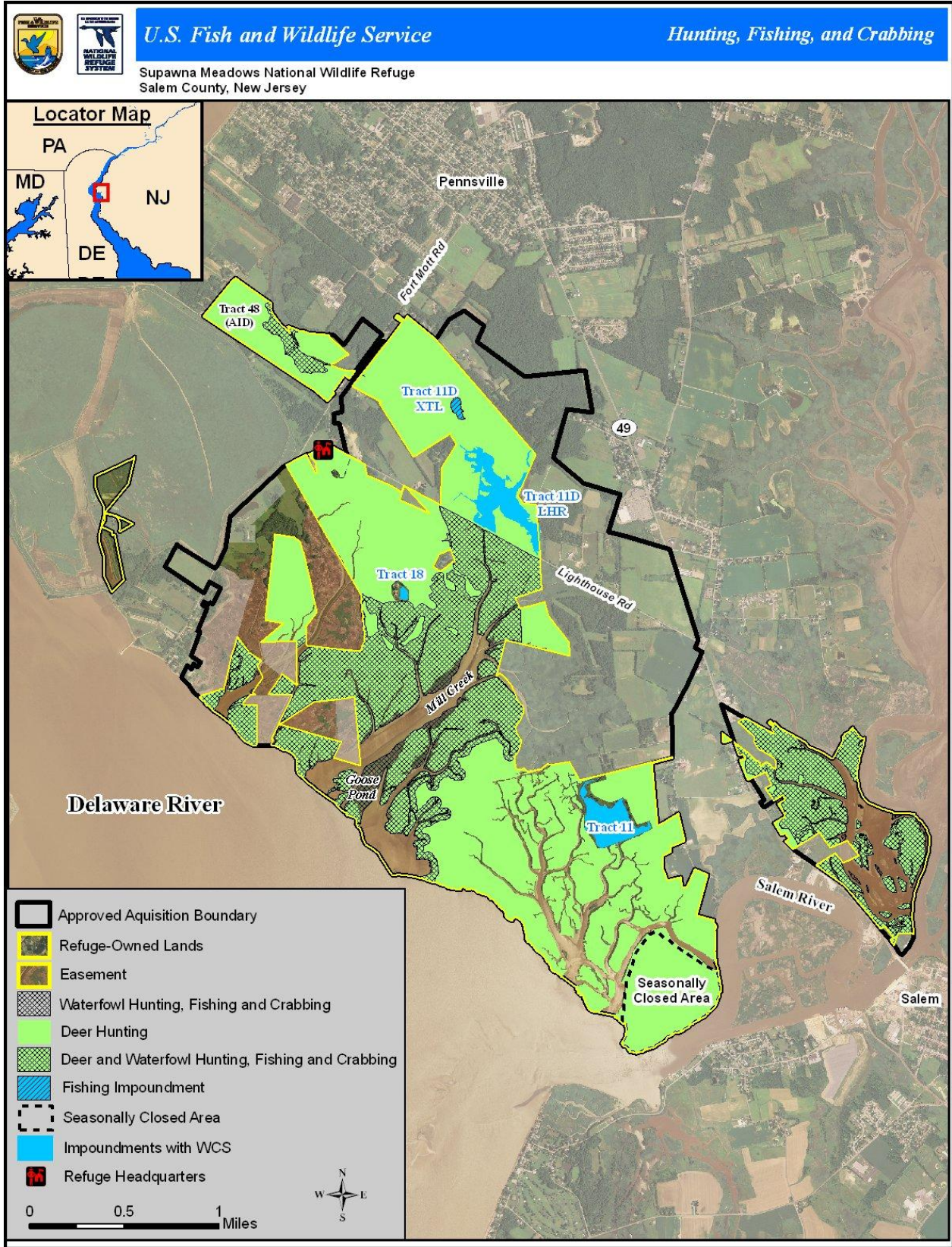
Volunteers are integrated into all aspects of refuge management including maintenance, habitat management, and visitor services and outreach programs. Their hard work and enthusiasm enhances which programs we can offer. In fact, many of the Service's visitor use programs at Supawna Meadows NWR are run by volunteers, thus making it feasible for the refuge to offer these programs at all.

Strategies

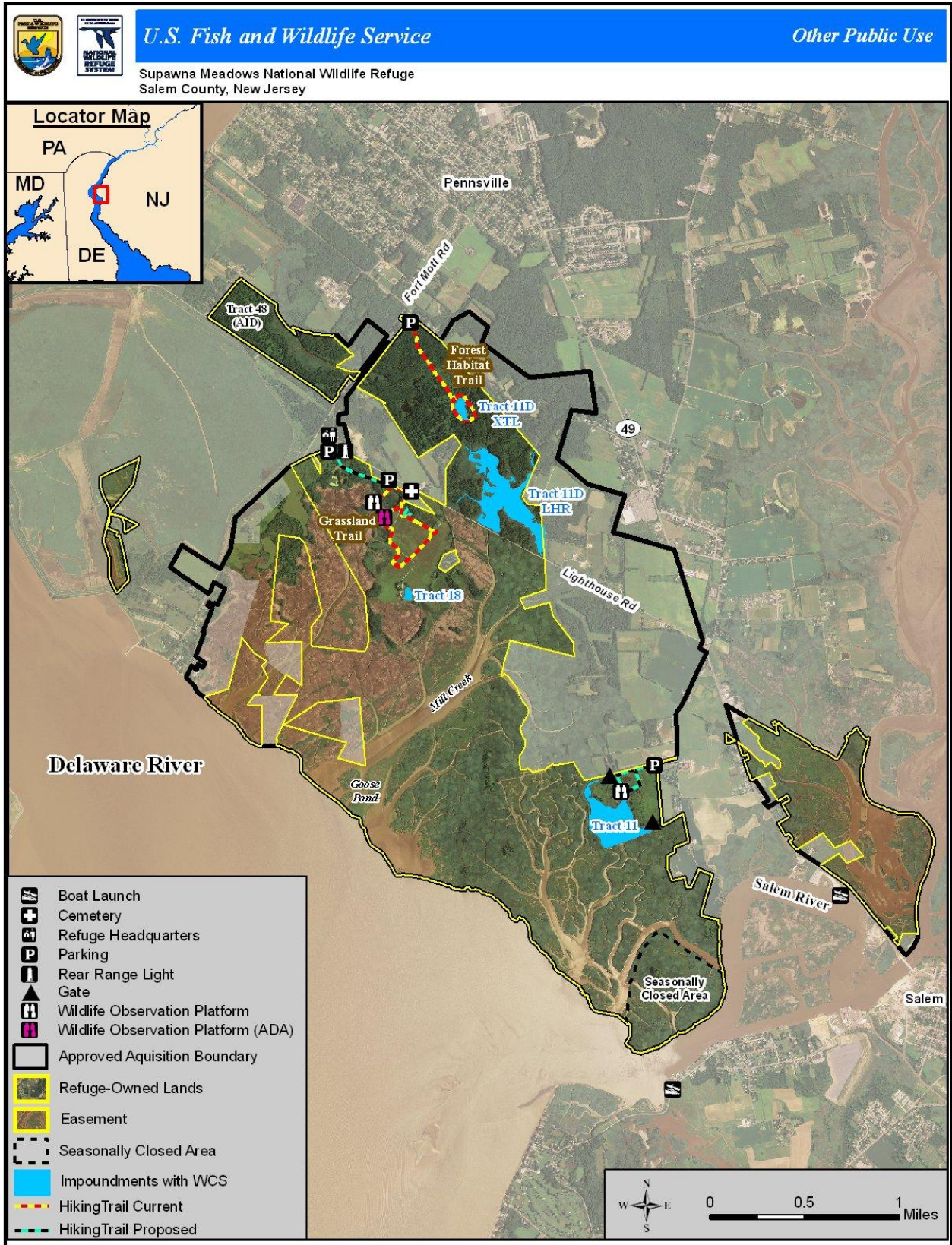
1. Actively recruit volunteers at events, through existing partners, the media, and the refuge Web site.
2. Develop and implement annual volunteer recruitment, training, and appreciation/recognition events.
3. Utilize volunteers in annual community events as deemed necessary and appropriate.
4. Utilize volunteers in meaningful refuge work, such as performing various biological surveys, assisting with maintenance, and visitor services activities.



Map 4.1. Predicted habitat types under proposed habitat management at Supawna Meadows National Wildlife Refuge. Map is for illustrative purposes only.



Map 4.2. Future hunting and fishing areas at Supawna Meadows National Wildlife Refuge.



Map 4.3. Current and proposed trails and other facilities for Supawna Meadows National Wildlife Refuge.

Chapter 5



Mark Wilson

Black Duck

Consultation and Coordination

- Introduction
- Planning to Protect Land and Resources
- Contact Information
- Planning Team
- Assistance from Other Service Personnel

Introduction

This chapter describes how we included others in developing the draft CCP and EA and how we plan to continue consulting and coordinating with others in the future. It details how we first invited, and will continue to encourage the partnership of other Federal and State agencies, civic, public, and private conservation and education organizations, and the affected public in our decisions about managing the refuge.

As we mentioned in chapters 1 through 4, we must comply with NEPA in seeking public input on proposed Federal actions. A 30-day period for public review followed our release of this draft CCP and EA. We encouraged the public and other agencies to give us responses and ideas about the plan. As before, we hosted open houses near the refuge to gather your opinions and answer your questions about its future management. We carefully weighed the responses we received before completing the final CCP.

Planning to Protect Land and Resources

We began the CCP process for Supawna Meadows NWR in May 2007 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 team to include refuge managers and staff from Cape May NWR, Service regional planners, and a NJDFW representative.

We held an internal scoping meeting, site visit, and field review in July 2007 to identify issues, concerns, management ideas, and data sources for the development of the CCP and analysis of management strategies.

We published and distributed our first newsletter in August 2007.

On September 7, 2007, we held two public scoping meetings at the Pennsville Public Library 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 published an official notice in the *Federal Register* that we were preparing a CCP/EA on September 24, 2007.

On April 15, 2008, we held a biological workshop with representatives of the Service, the NJDFW and Delaware Division of Parks to discuss management objectives for the array of refuge habitats.

On May 6, 2008, we held a public use objectives meeting that addressed hunting, access to Finns Point Light, and a variety of other public use opportunities, issues, and concerns.

We distributed a second newsletter in July 2008.

We held a review meeting with senior Northeast Region staff in June 2008 and formulated a revised series of biological and public use objectives.

We completed the draft CCP/EA and announced its availability for public review and comment by publishing our NOA in the *Federal Register* on September 27, 2010. During a 30-day period of public review, we distributed a third newsletter and a press release and held two public meetings to obtain comments. We also received comments by regular mail, electronic mail, and at the refuge. After the comment period expired, we reviewed and summarized all of the substantive comments we have received and prepared our responses. These are presented in appendix H.

We sent copies of the draft CCP/EA to NJDFW, the New Jersey Historic Preservation Office, and the Service's New Jersey Ecological Services field office for review.

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Planning Team

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Shelley Small, Regional Historic Preservation Officer, Northeast Regional Office

Glossary and Acronyms



Phil Sezerenie/Mangi Environmental Group

Finns Point Rear Range Light

Glossary and Acronyms

GLOSSARY

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| accessibility | the state or quality of being easily approached or entered, particularly as it relates to complying with the Americans With Disabilities Act. |
| adaptive management | <p>focuses on learning and adapting, through partnerships of managers, scientists, and other stakeholders who learn together how to create and maintain sustainable ecosystems.</p> <p>Adaptive management:</p> <ul style="list-style-type: none"> • helps science managers maintain flexibility in their decisions, knowing that uncertainties exist and provides managers the latitude to change direction • will improve understanding of ecological systems to achieve management objectives • is about taking action to improve progress towards desired outcomes. <p>(source: Williams, B. K., R. C. Szaro, and C. D. Shapiro. 2007. Adaptive Management: The U.S. Department of the Interior Technical Guide. Adaptive Management Working Group, U.S. Department of the Interior, Washington, DC.)</p> |
| aggregate | many parts considered together as a whole. |
| alternative | a reasonable way to fix an identified problem or satisfy a stated need [40 CFR 1500.2 (cf. “management alternative”).] |
| appropriate use | <p>a proposed or existing use on a refuge that meets at least one of the following three conditions:</p> <ol style="list-style-type: none"> 1. the use is a wildlife-dependent one; 2. 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 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 which 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 Refuge System until the Service buys them or they are placed under an agreement that provides for their management as part of the System. |
| anadromous fish | from the Greek, literally “up-running”; fish that spend a large portion of their life cycle in the ocean and return to freshwater to breed. |
| aquatic | growing in, living in, or dependent upon water. |

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| avian | of or having to do with birds. |
| basin | the land surrounding and draining into a water body (cf. “watershed”). |
| best management practices | land management practices that produce desired results. [N.b. Usually describing forestry or agricultural practices effective in reducing non-point source pollution, like reseeding skidder trails or not storing manure in a flood plain. In their broader sense, practices that benefit target species.] |
| biological diversity or biodiversity | the variety of life and its processes and includes 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 the natural biological processes that shape genomes, organisms, and communities. |
| biota | the plant and animal life of a region. |
| breeding habitat | habitat used by migratory birds or other animals during the breeding season. |
| candidate species | plants and animals for which the U.S. Fish and Wildlife Service has sufficient information on their biological status and threats to propose them as endangered or threatened under the Federal Endangered Species Act (ESA), but for which development of a proposed listing regulation is precluded by other higher priority listing activities. (Source: http://www.fws.gov/endangered/esa-library/pdf/candidate_species.pdf , accessed June 2011). |
| 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. |
| community | the locality in which a group of people resides and shares the same government. |
| community type | a particular assemblage of plants and animals, named for its dominant characteristic. |
| compatibility determination | a required determination for wildlife-dependent recreational uses or any other public uses of a refuge. |

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| compatible use | “The term ‘compatible use’ means a wildlife-dependent recreational use or any other use of a refuge that, in the sound professional judgment of the Director, will not materially interfere with or detract from the fulfillment of the mission of the System or the purposes of the refuge.”—National Wildlife Refuge System Improvement Act of 1997 [Public Law 105-57; 111 Stat. 1253] |
| Comprehensive Conservation Plan | mandated by the 1997 Refuge Improvement Act, a document that provides a description of the desired future conditions and long-range guidance for the project leader to accomplish purposes of the refuge system and the refuge. CCPs establish management direction to achieve refuge purposes. [P.L. 105-57; FWS Manual 602 FW 1.4] |
| concern | cf. “issue.” |
| conservation | managing natural resources to prevent loss or waste. [N.b. Management actions may include preservation, restoration, and enhancement.] |
| conservation agreement | a written agreement among two or more parties for the purpose of ensuring the survival and welfare of unlisted species of fish and wildlife or their habitats or to achieve other specified conservation goals. Participants voluntarily commit to specific actions that will remove or reduce threats to those species. |
| conservation easement | a non-possessory interest in real property owned by another imposing limitations or affirmative obligations with the purpose of returning or protecting the property’s conservation values. |
| conservation status | assessment of the status of ecological processes and of the viability of species or populations in an ecoregion. |
| consultation | a type of stakeholder involvement in which decision makers ask stakeholders to comment on proposed decisions or actions. |
| cooperative agreement | a usually long-term habitat protection action, which can be modified by either party, in which no property rights are acquired. Lands under a cooperative agreement do not necessarily become part of the National Wildlife Refuge System. |
| critical habitat | according to U.S. Federal law, the ecosystems upon which endangered and threatened species depend. |
| database | a collection of data arranged for ease and speed of analysis and retrieval, usually computerized. |

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| dbh | (diameter at breast height) — 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. |
| degradation | the loss of native species and processes due to human activities such that only certain components of the original biodiversity persist, often including significantly altered natural communities. |
| desired future condition | the qualities of an ecosystem or its components that an organization seeks to develop through its decisions and actions. |
| disturbance | any relatively discrete event in time that disrupts ecosystem, community, or population structure and changes resources, substrate availability, or the physical environment. |
| donation | a citizen or group may wish to give land or interests in land to the Service for the benefit of wildlife. Aside from the cost factor, these acquisitions are no different than any other means of land acquisition. Gifts and donations have the same planning requirements as purchases. |
| easement | a non-possessory interest in real property that permits the holder to use another's land for a specified purpose. It may also impose limitations or affirmative obligations on the holder of the land subject to the easement. An agreement by which landowners give up or sell one of the rights on their property. [e.g., landowners may donate rights-of-way across their properties to allow community members access to a river (cf. "conservation easement").] |
| 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 processes | a complex mix of interactions among animals, plants, and their environment that ensures maintenance of an ecosystem's full range of biodiversity. Examples include population and predator-prey dynamics, pollination and seed dispersal, nutrient cycling, migration, and dispersal. |
| ecological system | dynamic assemblages of communities that occur together on the landscape at some spatial scale of resolution, are tied together by similar ecological processes, and form a cohesive, distinguishable unit on the ground. Examples are spruce-fir forest, Great Lakes dune and swale complex, Mojave desert riparian shrublands. |

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| ecoregion | an area defined by a combination of biological, social, and geographic criteria, rather than geopolitical considerations; generally, a system of related, interconnected ecosystems. |
| ecosystem | a natural community of organisms interacting with its physical environment, regarded as a unit. |
| emergent wetland | wetlands dominated by erect, rooted, herbaceous plants. |
| endangered species | a federally or state listed protected species in danger of extinction throughout all or a significant portion of its range. |
| environment | the sum total of all biological, chemical, and physical factors to which organisms are exposed. |
| Environmental Assessment (EA) | a public document that discusses the purpose and need for an action, its alternatives, and provides sufficient evidence and analysis of its impacts to determine whether to prepare an environmental impact statement or a finding of no significant impact (q.v.) [cf. 40 CFR 1508.9]. |
| environmental education | curriculum-based education aimed at producing a citizenry that is knowledgeable about the biophysical environment and its associated problems, aware of how to help solve those problems, and motivated to work toward solving them. |
| 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. |
| Environmental Impact Statement (EIS) | a detailed, written analysis of the environmental impacts of a proposed action, adverse effects of the project that cannot be avoided, alternative courses of action, short-term uses of the environment versus the maintenance and enhancement of long-term productivity, and any irreversible and irretrievable commitment of resources [cf. 40 CFR 1508.11]. |
| evaluation | examination of how an organization's plans and actions have turned out — and adjusting them for the future. |
| exotic species | a species that is not native to an area and has been introduced intentionally or unintentionally by humans; not all exotics become successfully established. |

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| extinction | the termination of any lineage of organisms, from subspecies to species and higher taxonomic categories from genera to phyla. Extinction can be local, in which one or more populations of a species or other unit vanish but others survive elsewhere, or total (global), in which all the populations vanish (Wilson 1992). |
| fauna | all animal life associated with a given habitat, country, area or period. |
| Federal land | public land owned by the Federal Government, including national forests, national parks, and national wildlife refuges. |
| federally listed species | a species listed either as endangered, threatened, or a species at risk (formerly, a “candidate species”) under the Federal Endangered Species Act of 1973, as amended. |
| fee-title acquisition | the acquisition of most or all of the rights to a tract of land; a total transfer of property rights with the formal conveyance of a title. While a fee-title acquisition involves most rights to a property, certain rights may be reserved or not purchased, including water rights, mineral rights, or use reservation (e.g., the ability to continue using the land for a specified time period, such as the remainder of the owner’s life). |
| Finding of No Significant Impact | (FONSI) supported by an environmental assessment, a document that briefly presents why a Federal action will have no significant effect on the human environment, and for which an environmental impact statement, therefore, will not be prepared [40 CFR 1508.13]. |
| fire regime | the characteristic frequency, intensity, and spatial distribution of natural fires within a given ecoregion or habitat. |
| floodplain | flat or nearly flat land that may be submerged by floodwaters; a plain built up or in the process of being built up by stream deposition. |
| flora | all the plants found in a particular place. |
| flyway | any one of several established migration routes of birds. |
| focal species | a species that is indicative of particular conditions in a system (ranging from natural to degraded) and used as a surrogate measure for other species of particular conditions. An element of biodiversity selected as a focus for conservation planning or action. The two principal types of targets in Conservancy planning projects are species and ecological communities. |

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| focus areas | cf. “special focus areas.” |
| forested land | land dominated by trees. [For impacts analysis in CCP’s, we assume all forested land has the potential for occasional harvesting; we assume forested land owned by timber companies is harvested on a more intensive, regular schedule.] |
| fragmentation | the disruption of extensive habitats into isolated and small patches. Fragmentation has two negative components for biota: the loss of total habitat area and the creation of smaller, more isolated patches of habitat remaining. |
| geographic information system | (GIS) a computerized system to compile, store, analyze and display geographically referenced information [e.g., GIS can overlay multiple sets of information on the distribution of a variety of biological and physical features.] |
| groundwater | water in the ground that is in the zone of saturation, from which wells and springs and groundwater runoff are supplied. |
| habitat | the place or type of site where species and species assemblages are typically found and/or successfully reproduce. [N.b. An organism’s habitat must provide all of the basic requirements for life, and should be free of harmful contaminants.] |
| habitat conservation | protecting an animal or plant habitat to ensure that the use of that habitat by the animal or plant is not altered or reduced. |
| 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. |
| hydrology | the science of waters of the earth: their occurrences, distributions, and circulations; their physical and chemical properties; and their reactions with the environment, including living beings. |
| impoundment | a body of water, such as a pond, confined by a dam, dike, floodgate, or other barrier, which is used to collect and store water for future use. |
| indigenous | native to an area. |

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| indigenous species | a species that, other than a result as an introduction, historically occurred or currently occurs in a particular ecosystem. |
| interjurisdictional fish | populations of fish that are managed by two or more states or national or Tribal governments because of the scope of their geographic distributions or migrations. |
| invasive species | an alien species whose introduction causes or is likely to cause economic or environmental harm or harm to human health. |
| inventory | a list of all the assets and liabilities of an organization, including physical, financial, personnel, and procedural aspects. |
| invertebrate | any animal lacking a backbone or bony segment that encloses the central nerve cord. |
| issue | any unsettled matter that requires a management decision. [e.g., a Service initiative, an opportunity, a management problem, a threat to the resources of the unit, a conflict in uses, a public concern, or the presence of an undesirable resource condition.] [N.b. A CCP should document, describe, and analyze issues even if they cannot be resolved during the planning process (FWS Manual 602 FW 1.4).] |
| Land Protection Plan | (LPP) a document that identifies and prioritizes lands for potential Service acquisition from a willing seller and also describes other methods of providing protection. Landowners within project boundaries will find this document, which is released with environmental assessments, most useful. |
| Land trusts | organizations dedicated to conserving land by purchase, donation, or conservation easement from landowners. |
| landform | the physical shape of the land reflecting geologic structure and processes of geomorphology that have sculpted the structure. |
| landscape | a heterogeneous land area composed of a cluster of interacting ecosystems that are repeated in similar form throughout. |

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| large patch | communities that form large areas of interrupted cover. Individual occurrences of this community type typically range in size from 50 to 2,000 hectares. Large patch communities are associated with environmental conditions that are more specific than those of matrix communities, and that are less common or less extensive in the landscape. Like matrix communities, large-patch communities are also influenced by large-scale processes, but these tend to be modified by specific site features that influence the community. |
| long-term protection | mechanisms like fee title acquisition, conservation easements, or binding agreements with landowners that ensure land use and land management practices will remain compatible with maintaining species populations over the long term. |
| management alternative | a set of objectives and the strategies needed to accomplish each objective. [FWS Manual 602 FW 1.4] |
| management concern | cf. “issue.” |
| management plan | a plan that guides future land management practices on a tract. [N.b. In the context of an environmental impact statement, management plans may be designed to produce additional wildlife habitat along with primary products like timber or agricultural crops (cf. “cooperative agreement”).] |
| management strategy | a general approach to meeting unit objectives. [N.b. A strategy may be broad, or it may be detailed enough to guide implementation through specific actions, tasks, and projects (FWS Manual 602 FW 1.4).] |
| marshlands | areas interspersed with open water, emergent vegetation (hydrophytes), and terrestrial vegetation (phreatophytes). |
| mitigation | actions to compensate for the negative effects of a particular project. [E.g., wetland mitigation usually restores or enhances a previously damaged wetland or creates a new wetland]. |
| mosaic | an interconnected patchwork of distinct vegetation types. |
| National Environmental Policy Act of 1969 | (NEPA) requires all Federal agencies to examine the environmental impacts of their actions, incorporate environmental information, and use public participation in planning and implementing environmental actions. [Federal agencies must integrate NEPA with other planning requirements, and prepare appropriate NEPA documents to facilitate better environmental decision-making (cf. 40CFR1500).] |

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| National Wildlife Refuge System | (Refuge System) all lands and waters and interests therein administered by the Service as wildlife refuges, wildlife ranges, wildlife management areas, waterfowl production areas, and other areas managed to preserve a national network for the conservation and management of fish, wildlife, and plant resources of the United States, for the benefit of present and future generations (National Wildlife Refuge System Improvement Act, 16 U.S.C. 668dd). |
| native | a species that, other than as a result of an introduction, historically occurred or currently occurs in a particular ecosystem. |
| native plant | a plant that has grown in the region since the last glaciation, and occurred before European settlement. |
| Neotropical migrant | birds, bats, or invertebrates that seasonally migrate between the Nearctic and Neotropics. |
| non-consumptive, wild-life-oriented recreation | wildlife observation and photography and environmental education and interpretation (cf. “wildlife-oriented recreation”). |
| nonnative species | See “exotic species.” |
| non-point 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. |
| nonpoint source | a diffuse form of water quality degradation produced by erosion of land that causes sedimentation of streams, eutrophication from nutrients and pesticides used in agricultural and silvicultural practices, and acid rain resulting from burning fuels that contain sulfur. |
| objective | cf. “unit objective.” |
| partnership | a contract or agreement among two or more individuals, groups of individuals, organizations, or agencies, in which each agrees to furnish a part of the capital or some service in kind (e.g., labor) for a mutually beneficial enterprise. |
| passive management | protecting, monitoring key resources, and conducting baseline inventories to improve our knowledge of the ecosystem. |

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| point source | a source of pollution that involves discharge of waste from an identifiable point, such as a smokestack or sewage-treatment plant. |
| population | an interbreeding group of plants or animals. The entire group of organisms of one species. |
| prescribed fire | the application of fire to wildland fuels, either by natural or intentional ignition, to achieve identified land use objectives. [FWS Manual 621FW1.7] |
| priority general public use | a compatible wildlife-dependent recreational use of a refuge involving hunting, fishing, wildlife observation and photography, or environmental education and interpretation. |
| private land | land owned by a private individual or group or non-government organization. |
| private organization | any non-government organization. |
| protection | mechanisms like fee title acquisition, conservation easements, or binding agreements with landowners that ensure land use and land management practices will remain compatible with maintaining species populations at a site (cf. “long-term ~”). |
| public | individuals, organizations, and non-government groups; officials of Federal, state, and local government agencies; Native American Tribes, and foreign nations—includes anyone outside the core planning team, those who may or may not have indicated an interest in the issues, and those who do or do not realize that our decisions may affect them. |
| public involvement | offering an opportunity to interested individuals and organizations whom our actions or policies may affect to become informed; soliciting their opinions. We thoroughly study public input, and give it thoughtful consideration in shaping decisions about managing refuges. |
| public land | land owned by the local, state, or Federal Government. |
| rare species | species identified for special management emphasis because of their uncommon occurrence within a watershed. |
| refuge goals | “descriptive, open-ended, and often broad statements of desired future conditions that convey a purpose but do not define measurable units.” (Writing Refuge Management Goals and Objectives: A Handbook, FWS January 2004) |

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| refuge lands | lands in which the Service holds full interest in fee title or partial interest like an easement. |
| refuge purposes | “the terms ‘purposes of the refuge’ and ‘purposes of each refuge’ mean the purposes specified in or derived from the law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or refuge subunit.” (National Wildlife Refuge System Improvement Act of 1997) |
| relatively stable | the conservation status category between vulnerable and relatively intact in which extensive areas of intact habitat remain, but local species declines and disruptions of ecological processes have occurred. |
| restoration | management of a disturbed or degraded habitat that results in the recovery of its original state. [e.g., restoration may involve planting native grasses and forbs, removing shrubs, prescribed burning, or reestablishing habitat for native plants and animals on degraded grassland.] |
| riparian | referring to the interface between freshwater habitats and the terrestrial landscape. |
| riparian habitat | habitat along the banks of a stream or river [cf. note above]. |
| runoff | water from rain, melted snow, or agricultural or landscape irrigation that flows over a land surface into a water body (cf. “urban runoff”). |
| scale | the magnitude of a region or process. Refers to both spatial size—for example, a (relatively small-scale) patch or a (relatively large-scale) landscape; and a temporal rate—for example, (relatively rapid) ecological succession or (relatively slow) evolutionary speciation. |
| shrublands | habitats dominated by various species of shrubs, often with many grasses and forbs. |
| small patch | communities that form small, discrete areas of vegetation cover. Individual occurrences of this community type typically range in size from 1 to 50 hectares. Small patch communities occur in very specific ecological settings, such as on specialized landform types or in unusual microhabitats. The specialized conditions of small patch communities, however, are often dependent on the maintenance of ecological processes in the surrounding matrix and large patch communities. In many ecoregions, small patch communities contain a proportionately large percentage of the total flora, and also support a specific and restricted set of associated fauna (e.g., invertebrates or herpetofauna) dependent on specialized conditions. |

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| special focus area | <p>an area of high biological value. [N.b., We normally direct most of our resources to special focus areas that were delineated because of</p> <ol style="list-style-type: none"> 1. the presence of federally listed endangered and threatened species, species at risk (formerly, “candidate species”), rare species, concentrations of migrating or wintering waterfowl, or shorebird stopover habitat; 2. their importance as migrant landbird stopover or breeding habitat; 3. the presence of unique or rare communities; or, 4. the presence of important fish habitat.] |
| species | <p>the basic category of biological classification intended to designate a single kind of animal or plant. Any variation among the individuals may be regarded as not affecting the essential sameness which distinguishes them from all other organisms.</p> |
| species assemblage | <p>the combination of particular species that occur together in a specific location and have a reasonable opportunity to interact with one another.</p> |
| species at risk | <p>A general term referring to species listed under the Federal Endangered Species Act (ESA), as well as for unlisted species that are declining in population. Sometimes the term is used interchangeably with “species of concern.” Such species, unless already listed under ESA, receive no legal protection and use of the term does not necessarily imply that a species will eventually be proposed for listing (Source: http://www.fws.gov/endangered/about/glossary.html, accessed June 2011).</p> |
| species diversity | <p>usually synonymous with “species richness,” but may also include the proportional distribution of species.</p> |
| species of concern | <p>an informal term referring to a species that might be in need of conservation action. This may range from a need for periodic monitoring of populations and threats to the species and its habitat, to the necessity for listing as threatened or endangered under the Endangered Species Act. Such species receive no legal protection and use of the term does not necessarily imply that a species will eventually be proposed for listing (Source: http://www.fws.gov/endangered/about/glossary.html, accessed June 2011).</p> |
| species richness | <p>a simple measure of species diversity calculated as the total number of species in a habitat or community (Fiedler and Jain 1992).</p> |
| state agencies | <p>natural resource agencies of state governments.</p> |
| state land | <p>state-owned public land.</p> |
| state-listed species | <p>cf. “federally listed species.”</p> |

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| step-down management plan | a plan for dealing with specific refuge management subjects, strategies, and schedules, e.g., cropland, wilderness, and fire. [FWS Manual 602FW1.4] |
| stopover habitat | habitat where birds rest and feed during migration. |
| strategy | a specific action, tool, technique, or combination of actions, tools, and techniques for meeting unit objectives. |
| strategic management | the continual process of inventorying, choosing, implementing, and evaluating what an organization should be doing. |
| 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. |
| surface water | all waters whose surface is naturally exposed to the atmosphere, or wells or other collectors directly influenced by surface water. |
| terrestrial | living on land. |
| threatened species | a federally listed, protected species that is likely to become an endangered species in all or a significant portion of its range. |
| trust resource | a resource that the Government holds in trust for the people through law or administrative act. [N.b., A Federal trust resource is one for which responsibility is given wholly or in part to the Federal Government by law or administrative act. Generally, Federal trust resources are nationally or internationally important no matter where they occur, like endangered species or migratory birds and fish that regularly move across state lines. They also include cultural resources protected by Federal historic preservation laws, and nationally important or threatened habitats, notably wetlands, navigable waters, and public lands like state parks and national wildlife refuges.] |
| understory | the lower layer of vegetation in a stand, which may include short trees, shrubs, and herbaceous plants. |

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| unit objective | desired conditions that must be accomplished to achieve a desired outcome. [N.b., Objectives are the basis for determining management strategies, monitoring refuge accomplishments, and measuring their success. Objectives should be attainable, time-specific, and stated quantitatively or qualitatively (FWS Manual 602 FW 1.4).] |
| upland | dry ground (i.e., other than wetlands). |
| urban runoff | water from rain, melted snow, or landscape irrigation flowing from city streets and domestic or commercial properties that may carry pollutants into a sewer system or water body. |
| vernal pool | a type of seasonal wetland formed by isolated depressions in the landscape that hold water in the winter and spring and are usually dry by midsummer or fall. There are no permanent surface connections to flowing water. Water sources include rainfall, snowmelt, and elevated water tables. Although fish are usually absent, vernal pools in riparian floodplains may contain fish periodically. Vernal pools are important breeding sites for amphibians. The woody debris and emergent grasses provide attachment sites for egg masses. (Source: Mitchell, J.C., A.R. Breisch, and K.A. Buhlmann. 2006. Habitat Management Guidelines for Amphibians and Reptiles of the Northeastern U.S. Partners in Amphibian and Reptile Conservation, Technical Publication HMG-3, Montgomery, Alabama, 108 pp) |
| vision statement | a concise statement of what the unit could achieve in the next 10 to 15years. |
| 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. |
| wetlands | lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. These areas are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted to life in saturated soil conditions. “Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water.”—Cowardin et al. 1979 |
| wilderness | cf. “designated wilderness.” an area designated by Congress as part of the National Wilderness Preservation System. [FWS Manual 610 FW 1.5 (draft)] |

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| wilderness study areas | lands and waters identified by inventory as meeting the definition of wilderness and being evaluated for a recommendation they be included in the Wilderness System (cf. “recommended wilderness”). [N.b.A wilderness study area must meet these criteria <ol style="list-style-type: none">1. generally appears to have been affected primarily by the forces of nature, with the imprint of man’s work substantially unnoticeable;2. has outstanding opportunities for solitude or a primitive and unconfined type of recreation;3. has at least 5,000 contiguous, roadless acres, or sufficient size to make practicable its preservation and use in an unimpaired condition. (FWS Manual 610FW1.5 (draft)).] |
| wildfire | a free-burning fire requiring a suppression response; all fire other than prescribed fire that occurs on wildlands. [FWS Manual 621FW1.7] |
| wildlife-dependent recreational use | a use of a national wildlife refuge involving hunting, fishing, wildlife observation and photography, or environmental education and interpretation (National Wildlife Refuge System Administration Act of 1966). |
| wildlife management | manipulating wildlife populations, either directly by regulating the numbers, ages, and sex ratios harvested, or indirectly by providing favorable habitat conditions and alleviating limiting factors. |
| wildlife-oriented recreation | recreational activities in which wildlife is the focus of the experience. [“The terms ‘wildlife-dependent recreation’ and ‘wildlife-dependent recreational use’ mean a use of a refuge involving hunting, fishing, wildlife observation and photography, or environmental education and interpretation.”—National Wildlife Refuge System Improvement Act of 1997] |

Acronyms

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| ACJV | = Atlantic Coast Joint Venture |
| AID | = Tract 48 |
| ARPA | = Archaeological Resources Protection Act of 1960 |
| ATV | = All-terrain vehicle |
| BCC | = Birds of Conservation Concern |
| BCR | = Bird Conservation Region |
| CCMP | = Comprehensive Conservation and Management Plan |
| CCP | = Comprehensive Conservation Plan |
| CFR | = Code of Federal Regulations |
| CWD | = Chronic Wasting Disease |
| DRBC | = Delaware River Basin Commission |
| EA | = Environmental Assessment |
| EIS | = Environmental Impact Statement |
| ENSP | = Endangered and Nongame Species Program |
| EPA | = U.S. Environmental Protection Agency |
| ESA | = Federal Endangered Species Act |
| FONSI | = Finding of No Significant Impact |
| FPRRL | = Finns Point Rear Range Light |
| GIS | = Geographic information system |
| HMP | = Habitat Management Plan |
| IPCC | = Intergovernmental Panel on Climate Change |
| LWCF | = Land and Water Conservation Fund |
| MANEM | = Mid-Atlantic/New England/Maritimes Region |
| MOA | = Memorandum of Agreement |
| MOU | = Memorandum of Understanding |
| NABCI | = North American Bird Conservation Initiative |
| NAWCP | = North American Waterbird Conservation Plan |
| NAWMP | = North American Waterfowl Management Plan |
| NEPA | = National Environmental Policy Act of 1969 |
| NHCR | = National-State Agency Herpetological Conservation Report |
| NHPA | = National Historic Preservation Act of 1966 |
| NJDEP | = New Jersey Department of Environmental Protection |
| NJDFW | = New Jersey Division of Fish and Wildlife |
| NJLHS | = New Jersey Light House Society |
| NJWAP | = New Jersey Wildlife Action Plan |
| NMFS | = National Marine Fisheries Service |
| NOA | = <i>Federal Register</i> Notice of Availability |
| NOAA | = National Oceanic and Atmospheric Administration |
| NWR | = National Wildlife Refuge |
| NWRS | = National Wildlife Refuge System |
| PARC | = Partners in Amphibian and Reptile Conservation |
| PIF | = Partners in Flight |

Acronyms

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| RONs | = Refuge Operations Needs System |
| SAMMS | = Service Assist Maintenance System |
| SAMP | = Special Area Management Plan |
| SHPO | = State Historic Preservation Office |
| SLAMM | = Sea Level Affecting Marshes Model |
| SMA | = Special Management Area |
| SWG | = State Wildlife Grant programs |
| USDA | = U.S. Department of Agriculture |
| USDA APHIS | = USDA Agriculture Animal and Plant Health Inspection Services |
| USFWS | = U.S. Fish and Wildlife Service |
| USGS | = U.S. Geological Survey |
| WAP | = Wildlife Action Plan |
| WCS | = Water Control Structure |
| WMA | = Watershed Management Area |
| XTL | = Xmas Tree Lane |

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Phil Szczerzenie/Mangi Environmental Group

Interpretive sign on the refuge

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