



U.S. Fish & Wildlife Service

Lake Umbagog National Wildlife Refuge

*Final Comprehensive Conservation Plan
and Environmental Impact Statement*

November 2008





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

The *U.S. Fish and Wildlife Service* is the principal Federal agency responsible for conserving, protecting, and enhancing fish, wildlife, plants, and their habitats for the continuing benefit of the American people. The Service manages the 95-million acre National Wildlife Refuge System comprised of more than 545 national wildlife refuges and thousands of waterfowl production areas. It also operates 65 national fish hatcheries and 78 ecological services field stations. The agency enforces Federal wildlife laws, manages migratory bird populations, restores nationally significant fisheries, conserves and restores wildlife habitat such as wetlands, administers the Endangered Species Act, and helps foreign governments with their conservation efforts. It also oversees the Federal Assistance Program which distributes hundreds of millions of dollars in excise taxes on fishing and hunting equipment to state wildlife agencies.

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



U.S. Fish & Wildlife Service

Lake Umbagog National Wildlife Refuge

Final Comprehensive Conservation Plan and Environmental Impact Statement

Refuge Vision Statement

“We envision Umbagog National Wildlife Refuge as an essential link in the network of conservation lands in the Northern Forests. We will showcase science-based, adaptive management in a working forest landscape and provide an outstanding center for research. We will achieve this through strong partnerships with State agencies, conservation organizations, land managers, and neighboring communities.

“Our management will perpetuate the diversity and integrity of upland spruce-fir and northern hardwood forests, boreal and riverine wetlands, and lake habitats for the continued health of native fish and wildlife populations. These habitats will provide an important regional breeding area for migratory land birds, waterfowl, and other species of regional significance, such as the common loon and bald eagle.

“Visitors of all ages will feel welcome to enjoy the full complement of priority wildlife-dependent public uses. We will foster their knowledge of and support for conserving northern forest habitats through exceptional outreach and visitor programs. We want all our visitors to return home filled with enthusiasm for promoting and practicing resource stewardship in their own communities.

“We hope residents of neighboring communities in Maine and New Hampshire will value the refuge for enhancing their quality of life. Within the National Wildlife Refuge System, the refuge will be treasured for conserving Federal trust resources and providing inspirational outdoor experiences for present and future generations of Americans.”

Lake Umbagog National Wildlife Refuge

Final Comprehensive Conservation Plan and Environmental Impact Statement

Abstract

Type of action:	Administrative
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Responsible official:	Marvin Moriarty, Regional Director, Region 5
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This Final Comprehensive Conservation Plan and Environmental Impact Statement (CCP/EIS) for the Lake Umbagog National Wildlife Refuge fully compares three management alternatives. Its 16 appendixes provide additional information supporting our analysis. Appendix O includes our responses to public comments on the Draft CCP/EIS.

Alternative A.— Current Management:

This “no action” alternative, required by regulations under the National Environmental Policy Act of 1969, would simply extend the way we now manage the refuge over the next 15 years. It also provides a baseline for comparing the two “action” alternatives. We would continue to protect the refuge from external threats, monitor its key resources, and conduct baseline inventories to improve our knowledge of its ecosystem. We would continue our public use programs for wildlife observation, hunting and fishing, allow snowmobiling and camping at their present capacities in designated areas, and offer limited environmental education and interpretation. We would continue to acquire from willing sellers 7,482 acres within the approved refuge boundary, adding to its current 21,650 acres.

Alternative B.— Management for Particular Habitats and Focal Species (Service-preferred):

We recommend this alternative for approval. Its highest priority is to protect the biological integrity, diversity, and environmental health of Umbagog Lake and its associated rivers and streams. Its second priority is to conserve the upland mixed forest and sustain those native species dependent on the forest. Management would focus on enhancing habitats for selected refuge focal species, including species of regional conservation concern whose habitat needs generally represent the needs of many other federal trust resources. Alternative B would improve the quality of our wildlife-dependent recreation programs and result in several new public uses being offered. We would also strengthen our partnerships with state and local entities offering similar recreational programs in the area. Another partnership would focus on developing a Land Management Research Demonstration (LMRD) program for applying the best available science in management decisions that affect wildlife resources in the Northern Forest. This alternative includes expanding the refuge as part of a network of conservation lands by acquiring 47,807 acres from willing sellers: 56 percent in fee simple and 44 percent in easements. These proposed additions to the refuge are important for conserving refuge focal species and other federal trust resources. Alternative B also proposes a new refuge headquarters and visitor contact facility. Refuge staffing and budgets would increase commensurately.

Alternative C.— Management to Create Natural Landscape Composition, Patterns and Processes:

This alternative focuses on sustaining natural ecological communities, rather than selected species. It would result in passively or actively manipulating vegetation to create or hasten the development of natural communities, landscape patterns and processes. Similar to alternative B, it would improve wildlife-dependent recreation, strengthen our partnerships, develop the LMRD program, and add a new headquarters and visitor contact facility. It would expand the refuge by 74,414 acres, which we would purchase in fee simple from willing sellers. Our target would be to create contiguous blocks of hydrologically connected conservation habitat greater than 25,000 acres: the size we estimate as the minimum necessary to facilitate the natural progression of ecological processes in the Northern Forest conservation network.

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Chapter 1

Carolina Ferro Vasconcelos/USFWS



Umbagog Lake

Purpose of and Need for Action

Introduction

The Lake Umbagog National Wildlife Refuge (NWR; refuge) consists of 21,650 acres in Coos County, New Hampshire, and Oxford County, Maine. Established in 1992 with the first land purchase, its purposes are to provide long-term protection for unique wetlands, threatened or endangered species and migratory birds of conservation concern, and sustain regionally significant concentrations of wildlife. Approximately half of the refuge consists of forested and non-forested wetland habitats and water, and half of forested upland habitat typical of the Northern Forest ecosystem.

This final plan combines two documents required by federal law:

- a comprehensive conservation plan, required by the National Wildlife Refuge System Administration Act of 1996 (16 U.S.C. 668dd-668ee), as amended by the National Wildlife Refuge System Improvement Act of 1997 (Pub. L. 105-57; 111 Stat. 1253).
- an environmental impact statement, required by the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.; 83 Stat. 852), as amended.

Chapter 1 explains the purpose and need for preparing a Final CCP/EIS, and sets the stage for 5 subsequent chapters and 16 appendixes. It

- defines our planning analysis area,
- presents the mission, policies and mandates affecting the development of the plan,
- identifies other conservation plans we used as references,
- lists the purposes for which the refuge was established and its land acquisition history,
- clarifies the vision and goals that drive refuge management,
- describes our planning process and its compliance with NEPA regulations, and
- identifies public issues or concerns that surfaced during plan development.

Chapter 2, “Description of the Alternatives,” presents three management alternatives with different strategies for meeting refuge goals and objectives and addressing public issues, for example, continuing our present management of the refuge unchanged, or managing it according to our Service-preferred alternative. It fully evaluates three reasonable alternatives for achieving the goals and addressing the public issues below. Following public review of this Final CCP/EIS, our Regional Director’s decision on the management alternatives will be documented in a Record of Decision indicating which management alternative is being adopted as the CCP that will guide refuge management decisions over the next 15 years. We will also use the final plan to promote understanding and support for refuge management among state agencies in New Hampshire and Maine, our conservation partners, tribal governments, local communities and the public.

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

The Purpose of and Need for Action

Chapter 4, “Environmental Consequences,” evaluates the environmental consequences of implementing each of the three management alternatives. That is, it predicts their foreseeable benefits and consequences for the socioeconomic, physical, cultural, and biological environments described in chapter 3.

Chapter 5, “List of Preparers,” credits this plan’s contributors.

Chapter 6, “Consultation and Coordination with Others,” summarizes how we involved the public and our partners in the planning process. Their involvement is vital for the future management of the refuge.

Sixteen appendixes provide additional supporting documentation and references.

We propose to develop the CCP for the refuge that, in the Service’s best professional judgment, best achieves the purposes, goals, and vision of the refuge and contributes to the National Wildlife Refuge System’s mission, adheres to Service’s policies and other mandates, addresses identified issues of significance, and incorporates sound principles of fish and wildlife science.

NEPA regulations require us to evaluate a reasonable range of alternatives, including our preferred action and no action. The no-action alternative can mean either (1) not managing the refuge, or (2) not changing its present management. In this plan, alternative A is the latter.

The *purpose* of a CCP is to provide each refuge with strategic management direction for the next 15 years, by

- stating clearly the desired future conditions for refuge habitat, wildlife, visitor services, staffing, and facilities;
- explaining clearly to state agencies, refuge neighbors, visitors, and partners the reasons for management actions;
- ensuring that refuge management conforms to the policies and goals of the Refuge System and legal mandates;
- ensuring that present and future public uses are compatible with the purposes of the refuge;
- providing long-term continuity and direction in refuge management; and,
- justifying budget requests for staffing, operating and maintenance funds.

There are several reasons we identify a *need* for this CCP. First, the Refuge Improvement Act requires us to write a CCP for every national wildlife refuge to help fulfill the mission of the Refuge System.

Second, the Lake Umbagog Refuge lacks a master plan to accomplish the actions above, yet its environment has changed dramatically over the past decade. For example, the economy and land ownership patterns in local communities have changed; pressures for public access have continued to grow; and new ecosystem and species conservation plans bearing directly on refuge management have been developed.

Third, we need to evaluate locations for a proposed new refuge headquarters and visitor contact facility.

Fourth, we have developed strong partnerships vital for our continued success, and we must convey our vision for the refuge to those partners and the public.

Finally, we need a CCP to guide us in conserving land to protect federal trust species in the Northern Forest. The refuge has acquired most of its land in the last 5 years.

All of those reasons clearly underscore the need for the strategic direction a CCP provides. To help us resolve management issues and public concerns, our planning process incorporates input from the natural resource agencies of New Hampshire and Maine, affected communities, individuals and organizations, our partners and the public.

Regional Context and Project Analysis Area

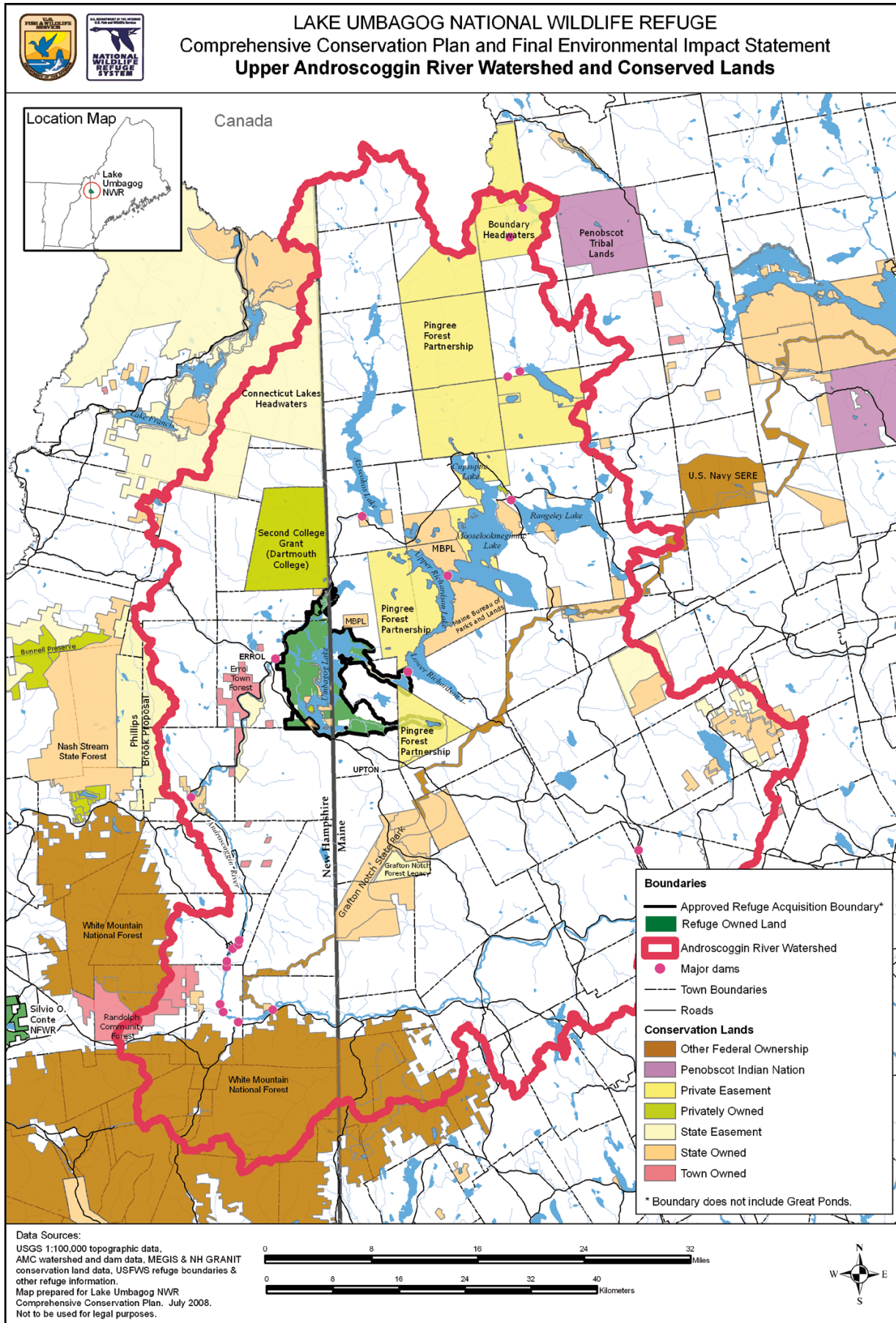
The regional context for our analysis is the Upper Androscoggin River watershed (map 1-1). Our analysis uses the definition of the watershed developed by the Appalachian Mountain Club (AMC; Publicover and Weihrauch 2003). The AMC defines a larger watershed than does the U.S. Geological Survey (USGS). The AMC-defined watershed includes an area below Shelburne Dam draining south of the Mahoosuc Range and Elephant Mountain that shares many of the “north country” characteristics north of the Mahoosuc Range (Publicover and Weihrauch 2003).

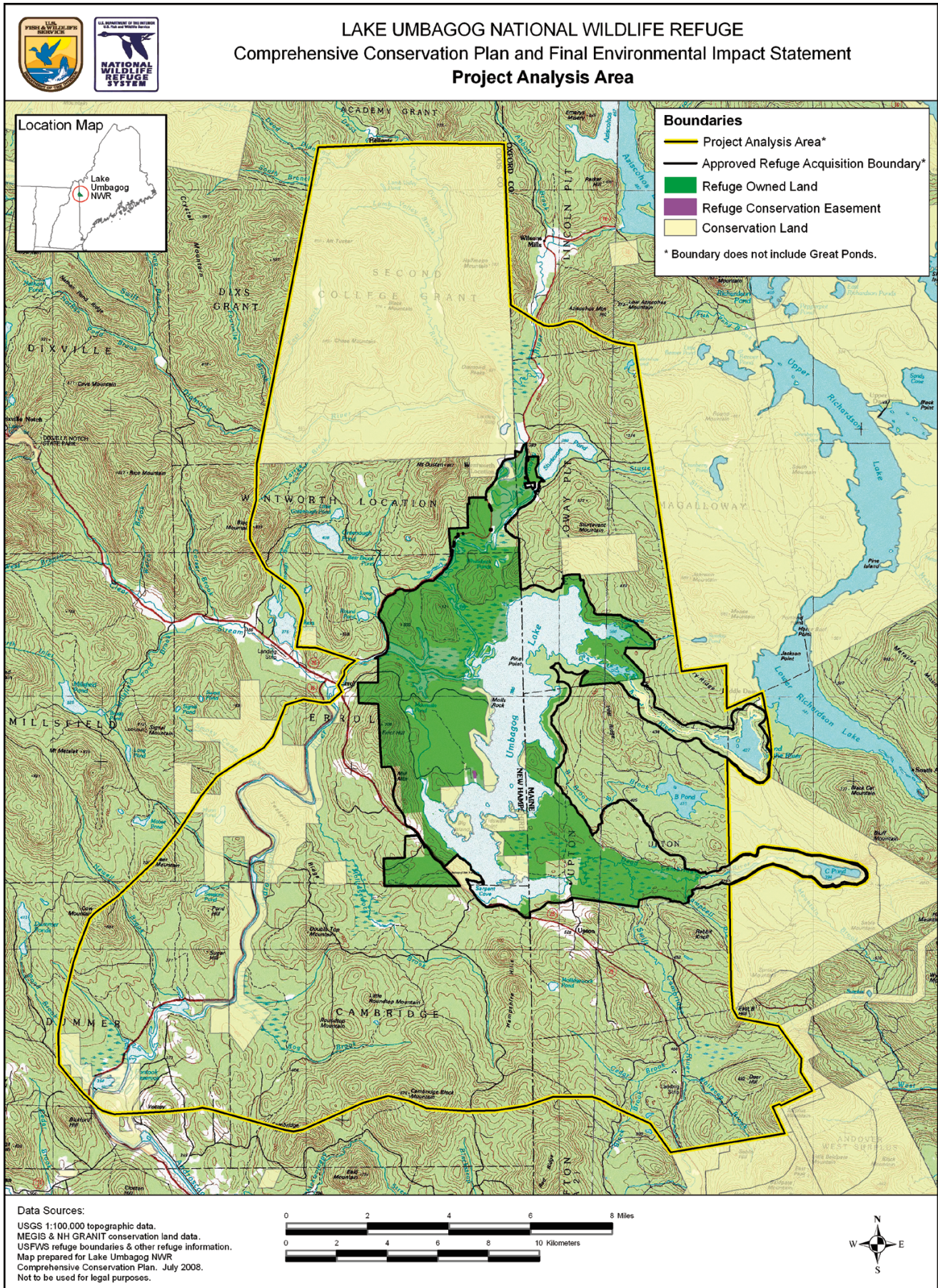
The watershed boundary on map 1-1 defines the socioeconomic and ecological context for evaluating the relationship of the refuge to regional resources of concern. The land ownership, land use or management patterns in that political, social, and ecological environment may affect our management of the refuge. Of particular note, map 1-1 also depicts the regional land conservation network in and around the watershed. More than a dozen partners cooperate in that network, of which the refuge lands form an integral part.

The watershed covers more than 2,300 square miles in northern New Hampshire and western Maine. At its northernmost point, it drains the south slopes of the mountains along the Canadian border. It includes all areas that drain into the Androscoggin River upstream of its confluence with the Web River in Dixfield, Maine. The Androscoggin River starts at the outlet of Umbagog Lake.

Forest covers most of the rugged mountains, steep slopes and narrow valleys in the watershed landscape. Human population densities there are relatively low; many of the northern reaches lack permanent populations. The AMC “Ecological Atlas of the Upper Androscoggin Watershed” (Publicover and Weihrauch 2003) provides more details on the land use history, land ownership patterns, natural history, habitat types, and conservation challenges in the watershed.

In cooperation with our state partners, we also developed a project analysis area within the watershed: an area of influence immediately around the refuge (map 1-2). Management or other activities in our project analysis area could directly affect refuge resources or influence our ability to achieve its purposes, vision, or goals. We did not distinguish among the types of private land ownership or land development within that boundary. It includes the incorporated towns of Errol, New Hampshire, and Magalloway and Upton, Maine; the unincorporated towns of Wentworth Location and Cambridge, New Hampshire; private land trusts, undeveloped lands owned by timber companies, and conservation lands owned by state or federal agencies.





The Service and the Refuge System Policies and Mandates Guiding Planning

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

The Service is part of the Department of the Interior. Our mission is “*Working with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people.*” Congress entrusts to the Service the conservation and protection of these national natural resources: migratory birds and fish, federal-listed endangered or threatened species, inter-jurisdictional fish, wetlands, certain marine mammals, and national wildlife refuges. We also enforce federal wildlife laws and international treaties on importing and exporting wildlife, assist states with their fish and wildlife programs, and help other countries develop conservation programs.

The Service manual, available online at <http://www.fws.gov/policy/manuals>, contains the standing and continuing directives on fulfilling our responsibilities. The 600 series of the Service manual addresses land use management, and sections 601-609 specifically address management of national wildlife refuges.

We publish special directives that affect the rights of citizens or the authorities of other agencies separately in the Code of Federal Regulations (CFR); the Service manual does not duplicate them (see 50 CFR 1–99 online at <http://www.access.gpo.gov/nara/cfr/index.html>).

The National Wildlife Refuge System and its Mission and Policies

The Refuge System is the world’s largest collection of lands and waters set aside specifically for the conservation of wildlife and the protection of ecosystems. More than 545 national wildlife refuges encompass more than 95 million acres of lands and waters in all 50 states and several island territories. Each year, more than 40 million visitors hunt, fish, observe and photograph wildlife, or participate in environmental education and interpretation on refuges.

In 1997, President William Jefferson Clinton signed into law the Refuge Improvement Act. That act establishes a unifying mission for the Refuge System.

“The mission of the 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

It also establishes a new process for determining the compatibility of public uses on refuges, and requires us to prepare a CCP for each refuge. The act states that the Refuge System must focus on wildlife conservation. It also states that the mission of the Refuge System, coupled with the purposes for which each refuge was established, will provide the principal management direction on that refuge.

The Refuge System Manual contains policy governing the operation and management of the Refuge System that the Service Manual does not cover, including technical information on implementing refuge polices and guidelines on enforcing laws. You can review that manual at refuge headquarters. These are a few noteworthy policies instrumental in developing this CCP.

Policy on Refuge System Planning

This policy (602 FW 1, 2, and 3) establishes the 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 that, when implemented, will help



Marvin Moriarty/USFWS

Umbagog Lake in winter

- achieve refuge purposes;
- fulfill the Refuge System mission;
- maintain and, where appropriate, restore the ecological integrity of each refuge and the Refuge System;
- achieve the goals of the National Wilderness Preservation System and the National Wild and Scenic Rivers System; and,
- conform to other mandates.

That planning policy provides guidance, systematic direction, and minimum requirements for developing all CCPs, and provides a systematic decision-making process that fulfills those requirements. Among them, we are to review any existing special designation areas or the potential for such designations (e.g., wilderness and wild and scenic rivers); and, incorporate a summary of those reviews into each CCP (602 FW 3).

Policy on Maintaining Biological Integrity, Diversity, and Environmental Health

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 in refuge ecosystems. It provides refuge managers with a process for evaluating the best management direction to prevent the additional degradation of environmental conditions and restore lost or severely degraded 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).

Policy on Appropriateness of Refuge Uses

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

- 1) The use is a wildlife-dependent recreational use as identified in the Refuge Improvement Act.
- 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 Refuge Improvement Act was signed into law.
- 3) The use involves the take of fish and wildlife under State regulations.
- 4) The use has been found to be appropriate after concluding a specified findings process using 10 criteria.

This policy can be viewed on-line at <http://www.fws.gov/policy/library/06-5645.pdf>.

Policy on Compatibility

This policy (603 FW 2) complements the appropriateness policy. The refuge manager must first find a use is appropriate before undertaking a compatibility review of that use. If the proposed use is not appropriate, the refuge manager will not allow the use and will not prepare a compatibility determination.

This policy and its regulations, including a description of the process and requirements for conducting compatibility reviews, can be viewed on-line at <http://policy.fws.gov/library/00fr62483.pdf>. Our summary follows.

- The Refuge Improvement Act and its regulations require an affirmative finding by the refuge manager on the compatibility of a public use before we allow it on a national wildlife refuge.
- A compatible use is one “that will not materially interfere with or detract from the fulfillment of the mission of the Refuge System or the purposes of the refuge.”
- The act defines six wildlife-dependent uses that are to receive our enhanced consideration on refuges: hunting, fishing, wildlife observation and photography, and environmental education and interpretation.
- The refuge manager may authorize those priority uses on a refuge when they are compatible and consistent with public safety.
- When the refuge manager publishes a compatibility determination, it will stipulate the required maximum reevaluation dates: 15 years for wildlife-dependent recreational uses; or 10 years for other uses.
- However, the refuge manager may reevaluate the compatibility of any use at any time: for example, sooner than its mandatory date, or even before we complete the CCP process, if new information reveals unacceptable impacts or incompatibility with refuge purposes (602 FW 2.11, 2.12).
- The refuge manager may allow or deny any use, even one that is compatible, based on other considerations such as public safety, policy, or available funding.

Other Mandates

Although Service and Refuge System policy and the purposes of each refuge provide the foundation for its management, other federal laws, executive orders, treaties, interstate compacts, and regulations on conserving and protecting natural and cultural resources also affect how we manage refuges. A centralized library of Service-wide policies, executive orders, director’s orders, and the “Digest of Federal Resource Laws of Interest to the U.S. Fish and Wildlife Service” can be viewed at <http://www.fws.gov/policy/>.

Federal laws also require the Service to identify and preserve its important historic structures, archaeological sites, and artifacts. NEPA mandates our consideration of cultural resources in planning federal actions. The Refuge Improvement Act requires that the CCP for each refuge identify its archaeological and cultural values.

The National Historic Preservation Act (Pub. L. 102–575; 16 U.S.C. 470) requires federal agencies to locate and protect historic resources—archaeological sites and historic structures eligible for listing or listed in the National Register of Historic Places and museum property—on their land or on land affected by their activities. It also requires agencies to establish a program for those activities and carry them out in consultation with State Historic Preservation Offices (SHPOs).

The NHPA also charges federal agencies with locating, evaluating, and nominating sites on their land to the National Register of Historic Places. We maintain an inventory of known archaeological sites and historic structures in the Northeast Regional Office and file copies of the sites at each refuge. Our regional historic preservation officer in Hadley, Massachusetts, oversees our compliance with the NHPA and our consultations with state SHPOs. We must also comply with the Archaeological Resources Protection Act (Pub. L. 96–95, 16 U.S.C. 470aa-mm). It requires that we protect our archaeological sites from vandalism or looting and issue permits for site excavation.

The Service also owns and cares for museum properties. The most common are archaeological collections, art, zoological and botanical collections, historical photographs, and historic objects. Each refuge maintains an inventory of its museum property. Our museum property coordinator in Hadley, Massachusetts, guides the refuges in caring for that property, and helps us comply with the Native American Graves Protection and Repatriation Act (25 U.S.C. 3001, et seq.) and federal regulations governing federal archaeological collections. Our program ensures that Service collections will continue to be available to the public for learning and research.

Chapter 4, “Environmental Consequences,” evaluates this plan’s compliance with the cultural and historic acts cited above, as well as the Clean Water Act, Clean Air Act, and Endangered Species Act (ESA). We designed this Final CCP/EIS to fulfill our NEPA compliance.

Conservation Plans and Initiatives Guiding the Project

Birds of Conservation Concern 2002 Report

The Service developed this report (USFWS 2002) in consultation with the leaders of ongoing bird conservation initiatives and partnerships such as Partners In Flight (PIF), the North American Waterfowl Management Plan (NAWMP) and Joint Ventures, the North American Waterbird Conservation Plan (NAWCP), and the U.S. Shorebird Conservation Plan. The report fulfills the mandate of the 1988 amendment to the Fish and Wildlife Conservation Act (16 U.S.C. §§2901 et seq.) requiring the Secretary of the Interior, through the Service, to “identify species, subspecies, and populations of all migratory non-game birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973.”

The 2002 report contains 45 lists that identify bird species of conservation concern at national, regional, and landscape scales. It includes a principal national list, seven regional lists corresponding to the seven regional administrative units of the Service, and species lists for each of the 37 Bird Conservation Regions designated by the North American Bird Conservation Initiative (NABCI) in the United States. NABCI defined those Bird Conservation Regions (BCRs) as ecologically based units in a framework for planning, implementing, and evaluating bird conservation. The refuge lies in the Atlantic Northern Forest Bird Conservation Region (BCR 14; see additional discussion below).

Our agency’s overarching goal in developing that report is to stimulate federal, state, and private agencies to coordinate, develop, and implement integrated approaches for conserving and managing the birds deemed most in need of conservation. The report is available online at <http://www.fws.gov/migratorybirds/reports/BCC02/BCC02.pdf>.

North American Bird Conservation Initiative: Blueprint for the Design and Delivery of Bird Conservation in the Atlantic Northern Forest- Bird Conservation Region 14 (2005)

The Atlantic Coast Joint Venture partnership created this blueprint in response to the NABCI challenge of building on existing partnerships to plan, implement, and evaluate cooperative bird conservation across North America. You may read the entire text of this document, “Blueprint for the Design and Delivery of Bird Conservation in the Atlantic Northern Forest,” online at http://www.acjv.org/documents/bcr14_blueprint.pdf. It presents a strategic design of the key components that this BCR initiative will need to implement to maintain healthy populations of birds native to the Atlantic Northern Forest BCR, more commonly referred to as BCR 14. Specifically, it establishes a series of goals for moving BCR 14 toward a vision of sustained bird populations; it presents the biological foundation for its recommendation; and, it lays out a framework for implementing and evaluating them (Dettmers 2004).

The BCR 14 blueprint identifies 53 bird species designated “highest” or “high” conservation priority in the region, and 15 habitat types important for supporting one or more of those priority bird species during at least one of their life stages. Those habitats either need critical conservation attention, or are crucial in long-term planning to conserve continentally and regionally important bird populations. Of the 53 highest and high-priority birds, 21 breed on the refuge, and several others migrate through. The refuge offers them 9 of the 15 priority habitat types. We considered each of those species and habitats in writing appendix B, “Species and Habitats of Conservation Concern,” and in developing our habitat goals, objectives, and strategies. Some examples of priority species identified in the plan for different habitat types include:

- Mixed forest: Canada warbler, wood thrush (highest); black-throated blue warbler (high); blackburnian warbler, black-throated green warbler (moderate)
- Coniferous forest: Bay-breasted warbler, Canada warbler (highest), boreal chickadee (high), black-backed woodpecker (moderate)
- Deciduous and Mixed Forest: Canada warbler, wood thrush (highest); black-throated blue warbler (high); ovenbird (moderate)
- Shrub-scrub: Canada warbler, American woodcock (highest), rusty blackbird (high), palm warbler, yellow-bellied flycatcher (moderate)
- Forested wetland: American black duck (highest), common goldeneye, rusty blackbird (high); wood duck (moderate)
- Palustrine emergent marsh: American black duck (highest); northern harrrier, Wilson’s snipe, American bittern (moderate)
- Freshwater lakes, rivers, and streams: American black duck (highest), common goldeneye (high); wood duck, bald eagle (moderate)

Partners In Flight Bird Conservation Plans

In 1990, PIF began 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 and “keeping common birds common.” The foundation of its long-term strategy is a series of scientifically based bird conservation plans using physiographic areas as planning units.

The goal of each PIF plan is to ensure the long-term maintenance of healthy populations of native birds, primarily non-game birds. 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 in habitat loss, population trends, and the vulnerability of a species and its habitats to regional and local threats.

Physiographic Area 28—Eastern Spruce-Hardwood Forest (Draft June 2000).—Our project area lies in Physiographic Area 28, The Eastern Spruce-Hardwood Forest. The Partners in Flight Bird Conservation Plan for Physiographic Area 28- Eastern Spruce-Hardwood Forest, represents a bird conservation plan for the subsection of Bird Conservation Region 14 in which the Refuge is located.

In developing our habitat goals and objectives, we referred to its draft plan, now online at http://www.blm.gov/wildlife/plan/pl_28_10.pdf.

The plan (Rosenberg and Hodgman 2000) includes objectives for the following habitat types and associated species of conservation concern on the refuge.

- Northern hardwood and mixed forest: Canada and black-throated blue warbler, wood thrush, and veery;
- Mature conifer (spruce-fir) forest: bay-breasted, Cape May and blackburnian warbler, spruce grouse, and red crossbill;
- Boreal peatland: spruce grouse and olive-sided flycatcher;
- Early successional forest/edge: American woodcock and olive-sided flycatcher; and,
- Freshwater wetland/rivers/lakes: American black duck

North American Waterfowl Management Plan (NAWMP; update 2004)

Originally written in 1986, the NAWMP Plan describes a 15-year strategy for the United States, Canada, and Mexico to restore and sustain waterfowl populations by protecting, restoring and enhancing habitat. The plan committee, including representatives from Canada, the United States, and Mexico, has modified the 1986 plan twice to account for biological, sociological, and economic changes that influenced the status of waterfowl and the conduct of cooperative habitat conservation. The most recent modification in 2004 updates the latest needs, priorities, and strategies for the next 15 years, and guides partners in strengthening the biological foundation of North American waterfowl conservation and stakeholder confidence in the direction of the plan. You may review it online at <http://www.fws.gov/birdhabitat/NAWMP/images/implementationframework.pdf>

To convey goals, priorities, and strategies more effectively, that 2004 modification comprises two separate documents: Strategic Guidance and Implementation Framework, the former for agency administrators and policy makers who set the direction and priorities for conservation. The latter includes supporting technical information for use by biologists and land managers.

American black duck in flight



© Mark Wilson

The plans are implemented at the regional level in 14 habitat Joint Ventures and 3 species Joint Ventures: Arctic Goose, Black Duck, and Sea Duck. Our project area lies in the Atlantic Coast Joint Venture, which includes all the Atlantic Flyway states from Maine to Florida and Puerto Rico. The part of the refuge in Maine lies in the “Inland Wetlands” focus area; the part in New Hampshire lies in the “Lake Umbagog Focus Area,” an indication of the importance of the refuge. You may view a map of focus areas for New Hampshire and Maine online at <http://www.acjv.org/>.

North American Waterbird Conservation Plan (Version 1, 2002)

The waterfowl goal for the Atlantic Coast Joint Venture is “Protect and manage priority wetland habitats for migration, wintering, and production of waterfowl, with special consideration to black ducks, and to benefit other wildlife in the joint venture area.”

The Black Duck Joint Venture plan also relates to our project. Black ducks use the refuge during their breeding season and fall migration. The Black Duck Joint

Venture Plan, Final Draft Strategic Plan (USFWS/CWS 1993) resides online at <http://www.pwrc.usgs.gov/bd/v/>. We used both plans in developing the objectives and strategies in goals 1 and 2.

This plan (Kushlan et al. 2002) is an independent partnership among individuals and institutions interested in or responsible for conserving water birds and their habitats. The plan is just one element of a multi-faceted conservation program. The primary goal of the plan is to ensure that the distribution, diversity, and abundance of populations and habitats of breeding, migratory, and non-breeding water birds are sustained or restored throughout the lands and waters of North America, Central America, and the Caribbean. It provides a framework for conserving and managing colonially nesting water-dependent birds. In addition, it will facilitate continent-wide planning and monitoring, national, state, and provincial conservation, regional coordination, and local habitat protection and management.

A Mid-Atlantic/New England/Maritimes Regional Working Group has been established. It is a regional partnership of organizations and individuals working to facilitate waterbird conservation in this region. Their overarching goal is to help local resource managers within the region protect waterbirds and their habitats. This will be accomplished by facilitating the development and distribution of information on the status and conservation needs of waterbirds and habitats, and by building partnerships between wildlife managers, scientists, conservationists and supporters.

You can access the continental plan online at <http://www.nawcp.org/pubs/ContinentalPlan.cfm>. You can access information on Mid-Atlantic/New England/Maritimes Regional planning online at <http://www.fws.gov/birds/waterbirds/MANEM/>. We used information from both those sources in developing our objectives and strategies for goals 1 and 2.

U.S. Shorebird (2001, 2nd ed.) and North Atlantic Regional Shorebird Plans

Concerns about shorebirds led to the creation of the U.S. Shorebird Conservation Plan in 2000. Brown, et al. published a second edition in May 2001. Developed under a partnership of individuals and organizations throughout the United States, the plan develops conservation goals for each U.S. 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 was also drafted to step down the goals of the continental plan to smaller scales to identify priority species and habitat and species goals, and prioritize implementation projects. You may read the U.S. Shorebird Plan online at <http://www.fws.gov/shorebirdplan/>

[USShorebird/downloads/USShorebirdPlan2Ed.pdf](http://www.fws.gov/shorebirdplan/RegionalShorebird/RegionalPlans.htm) The North Atlantic Regional Shorebird Plan appears online at <http://www.fws.gov/shorebirdplan/RegionalShorebird/RegionalPlans.htm>. We used both plans in developing our objectives and strategies for goals 1 and 2.

Northern States Bald Eagle Recovery Plan (USFWS 1983)

This plan describes actions necessary in the 24 states it covers to ensure the survival and recovery of bald eagles. Its primary objective is to reestablish self-sustaining populations of bald eagles throughout the Northern States Region. Its initial goal is 1,200 occupied breeding areas with an average annual productivity of at least 1.0 young per occupied nest in at least 16 states. Specific recovery tasks fall into these four general categories.

- 1) Determine current population and habitat status;
- 2) Determine minimum population and habitat needed to achieve recovery;
- 3) Protect, enhance, and increase bald eagle populations and habitats; and

- 4) Establish and implement a coordination system for information and communication.

Due to its success under the Endangered Species Act, the Service delisted the bald eagle. It continues to be protected under the Bald and Golden Eagle Protection Act. In any case, there will remain a significant need to permanently protect bald eagle habitat and ensure the species' future success. We used this recovery plan as we developed our management goals, objectives, and land acquisition proposal.

Partners in Amphibian and Reptile Conservation, National State Agency Herpetological Conservation Report (Draft 2004)

Partners in Amphibian and Reptile Conservation (PARC) was created in response to the increasing, well-documented 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 National State Agency Herpetological Conservation Report (NHCR), a summary report sponsored by PARC, provides a general overview of each state wildlife agency's support for reptile and amphibian conservation and research through September 2004. Each state report was compiled in cooperation with its agency's lead biologist on herpetofaunal conservation. The purpose is to facilitate communication among state agencies and partner organizations throughout the PARC network to identify and address regional and national herpetological priorities.

PARC intends to expand the scope of the NHCR to include other states, provinces, and territories. It will also include other state agencies that are supporting herpetofaunal conservation and research, such as transportation departments, park departments, and forest agencies. The states of New Hampshire and Maine have completed reports included in the NHCR online at <http://www.parcplace.org/documents/PARCNationalStates2004.pdf>. The next NHCR will also integrate the list of species of conservation concern into each state's comprehensive wildlife conservation strategy (see below). We used the latest draft NHCR plan in developing objectives and strategies for goals 1, 2, and 3, and in developing appendix B, "Species and Habitats of Conservation Concern."

Eastern Brook Trout Joint Venture

In 2004, in recognition of the need to address regional and range-wide threats to brook trout, a group of public and private entities formed the Eastern Brook Trout Joint Venture (EBTJV) with a mission to halt the decline of brook trout and restore fishable populations. Its unique partnership has grown and now includes state and federal agencies, regional and local governments, businesses, conservation organizations, academia, scientific societies, and private citizens. It is the nation's first pilot project under the *National Fish and Wildlife Initiative*, and is a geographically focused, locally driven, and scientifically-based effort to protect, restore and enhance aquatic habitat throughout the range of the Eastern brook trout. The EBTJV has been modeled after the joint ventures aligned with the North American Waterfowl Management Plan.

The EBTJV is developing a draft Conservation Strategy that identifies current threats to Eastern brook trout, proposes a general strategy to deal with these threats, and outlines potential corrective measures. One important technical report is "Distribution, Status and Perturbations to Brook Trout within the Eastern United States." It will categorize a variety of threats to brook trout and their habitat and helps to identify restoration and protection priorities. This and other products will then be used to formulate operational plans to begin

Brook trout



Duane Raver/USFWS

implementation of high priority programs. More information is available online at <http://www.fishhabitat.org>.

Native brook trout occur in our project area and we have identified them as a species of conservation concern in appendix B. Sub-watersheds in our project area represent most of the intact brook trout habitat remaining outside of Maine. Maine is considered the last true stronghold for brook trout in the eastern U.S. We will continue to consult with Service and state fisheries biologists involved in the development of the EBTJV Conservation Strategy to assist us in developing objectives and strategies related to brook trout and other associated aquatic resources.

New Hampshire Fish and Game Department, Wildlife Action Plan (WAP 2005), and State of Maine Comprehensive Conservation Strategy

In 2002, Congress created the State Wildlife Grant Program (SWG), and appropriated \$80 million for state grants. The purpose of the program is to help state and tribal fish and wildlife agencies conserve fish and wildlife species of greatest conservation need. The funds appropriated under the program are allocated to states according to a formula that takes into account their size and population.

To be eligible for additional federal grants and satisfy the requirements for participating in the SWG program, each state and U.S. territory must develop a statewide “Comprehensive Wildlife Conservation Strategy” and submit it to the National Advisory Acceptance Team by October 1, 2005. Each plan must address eight required elements, identify and focus on “species of greatest conservation need,” yet address the “full array of wildlife” and wildlife-related issues, and “keep common species common.”

The New Hampshire and Maine plans (NHFG 2005; MDIFW 2005) resulted from that charge. The goal of each plan is to create a vision for conserving that state’s wildlife and stimulate other states, federal agencies, and conservation partners to think strategically about their individual and coordinated roles in prioritizing conservation.

In addressing the eight elements below, those two plans supplement and validate the information on species and habitat and their distribution in our analysis area, and help us identify conservation threats and management strategies for species and habitats of conservation concern in the CCP. The expertise that convened to compile those plans and their partner and public involvement further enhance their benefits for us. We used them in developing objectives and strategies for goals 1, 2, and 3, and in developing appendix B, “Species and Habitats of Conservation Concern.” These are the eight elements.

- 1) Information on the distribution and abundance of species of wildlife, including low and declining populations, as the state fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the state’s wildlife

- 2) Descriptions of locations and relative condition of key habitats and community types essential to the conservation of species identified in element 1
- 3) Descriptions of problems that may adversely affect species identified in element 1 or their habitats, and priority research and survey efforts needed to identify factors that may assist in restoration and improved conservation of these species and habitats
- 4) Descriptions of conservation actions necessary to conserve the identified species and habitats and priorities for implementing such actions
- 5) Plans proposed for monitoring species identified in element 1 and their habitats, for monitoring the effectiveness of the conservation actions proposed in element 4, and for adapting those conservation actions to respond appropriately to new information or changing conditions
- 6) Description of procedures to review the plan at intervals not to exceed 10 years
- 7) Plans for coordinating, to the extent feasible, the development, implementation, review, and revision of the plan strategy with federal, state, and local agencies and Native American tribes that manage significant areas of land and water within the state, or administer programs that significantly affect the conservation of identified species and habitats
- 8) Plans for involving the public in the development and implementation of plan strategies

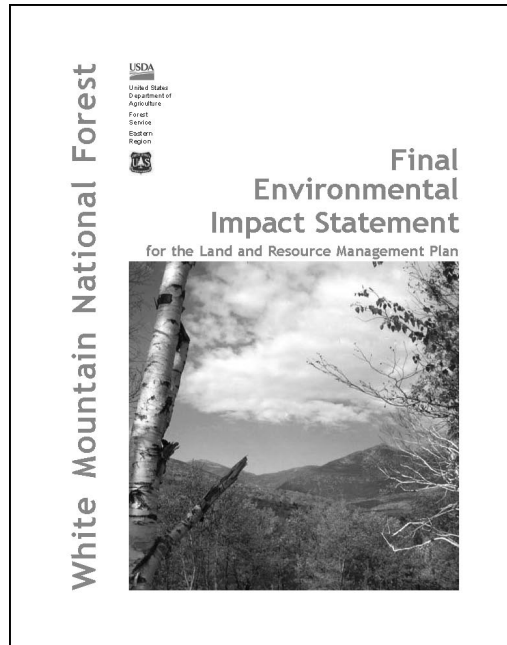
Other Regional Information Sources

We also consulted the plans and resources below as we refined our management objectives and strategies, especially those with a local context.

- Finding Common Ground: Conserving the Northern Forest. 1994. Northern Forest Lands Council, Concord, New Hampshire; copy available at refuge headquarters.
- The Northern Forest Lands Study of New England and New York: A report to the Congress of the United States on the recent changes in landownership and land use in the Northern Forest of Maine, New Hampshire, New York, and Vermont. Governors' Task Force on Northern Forest Lands. 1990. USDA Forest Service, Rutland, Vermont; copy available at refuge headquarters.
- 10th Anniversary Forum, Final Report: Recommendations for the Conservation of the Northern Forest. 2005. Northern Forest Lands Council, Concord, New Hampshire; copy available at refuge headquarters
- Maine State Forest and Conserved Lands plans for Dodge Point, Richardson Lakes, and Days Academy and Sugar Island (Public Reserved Lands) and Kineo and Farm Island (State Park Lands); copy available at refuge headquarters.
- New Hampshire State-wide Comprehensive Outdoor Recreation Plan (SCORP); available online at <http://www.nh.gov/oep/programs/SCORP/documents/scorpsummaryreport.pdf>
- Maine State-wide Comprehensive Outdoor Recreation Plan; available online at <http://www.state.me.us/doc/parks/programs/SCORP/index.html>
- Connecticut Lakes Headwaters Plan; available online at <http://www.nhstateparks.org/ParksPages/CLHWF/CLHWFinterminPlan.html>
- New Hampshire Forest Resources Plan; available online at <http://www.ceinfo.unh.edu/Pubs/ForPubs/NHFRP01.pdf>
- White Mountain National Forest Plan; available online at http://www.fs.fed.us/r9/forests/white_mountain/projects/forest_plan/

- Society for the Protection of NH Forests, New Hampshire's Changing Landscape, 2005; available online at <http://www.spnhf.org/research/research-projects.asp#nhcl>
- New England Forestry Foundation Plan; available online at <http://www.newenglandforestry.org/forestry/rfmp.asp>
- Northern Forest Canoe Trail plan; available online at <http://www.northernforestcanoetrail.org/>
- Appalachian Trail, National Park Service, Strategic Plan and other resources; available online at <http://data2.itc.nps.gov/parks/appa/ppdocuments/05Strategic%20Plan.doc>
- GORP Adventure Travel and Outdoor Recreation with information Appalachian trail; available online at http://gorp.away.com/gorp/resource/us_trail/guid_app.htm
- Rangeley Lakes Heritage Trust; available online at <http://www.rlht.org/index.shtml>

One source used for regional information



Refuge Establishment Purposes and its Land Acquisition History

The Service established the refuge with its first land purchase in 1992 for the following purposes and under the following authorities.

“... the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions” (Emergency Wetlands Resources Act of 1986, 16 U.S.C. 3901(b));

“... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds” (Migratory Bird Conservation Act, 16 U.S.C. 715d);
“... for the development, advancement, management, conservation, and protection of fish and wildlife resources...” (Fish and Wildlife Act of 1956; 16 U.S.C. 742f(a) (4)); and,

“... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude” (Fish and Wildlife Act; 16 U.S.C. 742f(b)(1)) .”

Map 1-3 depicts the current refuge boundary. Table 1.1 summarizes the land acquisition history of the refuge.

Table 1.1. Land acquisition history of the Lake Umbagog refuge (*as of January 1, 2008)

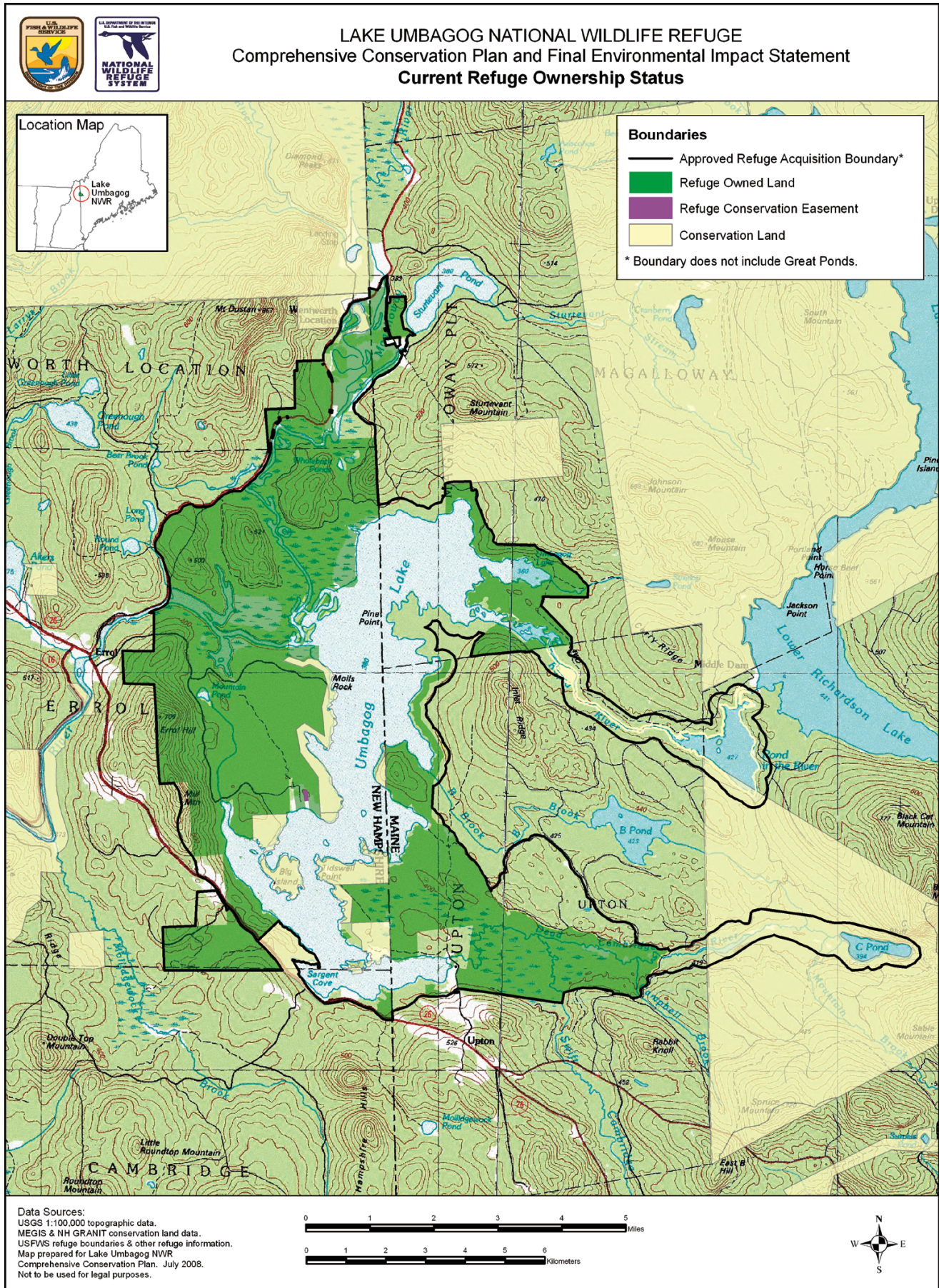
Calendar Year	Acres*	Funding Source#
1992	128	LWCF
1993	41	LWCF
1995	5,986	LWCF, MBCF
1996	203	LWCF
1998	214	MBCF
1999	2,488	LWCF, MBCF
2000	1,309	LWCF, MBCF
2001	8,847	LWCF, MBCF
2002	191	LWCF
2003	1	LWCF
2004	8	LWCF
2005	1,097	LWCF, MBCF
2006	406	MBCF
2007	727	MBCF
Total All	21,650	

Table Notes

* *The Service owns all acreage in full fee simple, except for a conservation easement on 6.01 acres. Acreage is approximate, as numbers are rounded up and it derives from these three sources of varying accuracy: (1) land deeds (2) surveys or (3) GIS digitizing. For ease of presentation, the maps throughout this document do not show Service ownership of the lake bottom, or the road easements outside the approved refuge boundary. However, all summaries of refuge acres, including table 1.1, include that ownership.*

#LWCF—Land and Water Conservation Fund.—funding sources include revenues from the sale of surplus federal real property, motorboat fuel taxes, fees for recreation on federal lands, and receipts from mineral leases on the outer continental shelf.

#MBCF—Migratory Bird Conservation Fund.—the funding source is receipts from the sale of Federal Migratory Bird Hunting and Conservation Stamps.



Refuge Administration

The refuge now has four full-time permanent staff positions: refuge manager, deputy refuge manager, refuge wildlife biologist, and maintenance worker. In addition, the refuge shares a full-time law enforcement officer with the Silvio O. Conte Refuge. Seasonal staff positions will vary between one and ten each year. The Youth Conservation Corps (YCC) program adds an adult crew leader and up to five youths each summer.

Refuge Operational Plans (“Step-down” Plans)

Refuge planning policy lists more than 25 step-down management plans that generally are required on refuges. Those plans contain specific strategies and implementation schedules for achieving refuge goals and objectives. Some plans require annual revisions; others require revision every 5 to 10 years. Some require additional NEPA analysis, public involvement, and compatibility determinations before we can implement them.

The status of step-down plans on the refuge follows. This document incorporates by reference those that are up to date. Chapter 2 provides more information about the additional step-down plans needed and their schedule for completion.

The following plan is up to date with current management.

- Hunt Plan, 2007; including amended EA and FONSI (USFWS, 2007)

We are preparing and incorporating this step-down plan into this CCP.

- Land Protection Plan (LPP)

We will need to complete additional plans after the adoption of the final CCP. The precise list of plans may vary depending on the alternative selected for the final CCP.

Refuge Vision Statement

Very early in the planning process, our team developed this vision statement to provide a guiding philosophy and sense of purpose in the CCP.

“We envision Umbagog National Wildlife Refuge as an essential link in the network of conservation lands in the Northern Forests. We will showcase science-based, adaptive management in a working forest landscape and provide an outstanding center for research. We will achieve this through strong partnerships with State agencies, conservation organizations, land managers, and neighboring communities.

“Our management will perpetuate the diversity and integrity of upland spruce-fir and northern hardwood forests, boreal and riverine wetlands, and lake habitats for the continued health of native fish and wildlife populations. These habitats will provide an important regional breeding area for migratory land birds, waterfowl, and other species of regional significance, such as the common loon and bald eagle.

“Visitors of all ages will feel welcome to enjoy the full complement of priority wildlife-dependent public uses. We will foster their knowledge of and support for conserving northern forest habitats through exceptional outreach and visitor programs. We want all our visitors to return home filled with enthusiasm for promoting and practicing resource stewardship in their own communities.

“We hope residents of neighboring communities in Maine and New Hampshire will value the refuge for enhancing their quality of life. Within the National Wildlife Refuge System, the refuge will be treasured for conserving Federal

trust resources and providing inspirational outdoor experiences for present and future generations of Americans.”

Refuge Goals

We developed these goals after considering that vision, the purposes of the refuge, the missions of the Service and the Refuge System, and the mandates, plans, and conservation initiatives above. These goals are intentionally broad, descriptive statements of purpose. They highlight elements of our vision for the refuge we will emphasize in its future management. The biological goals take precedence; but otherwise, we do not present them in any particular order. Each offers background information on its importance. In Chapter 2, “Alternatives Considered, Including the Service-preferred Alternative,” we evaluate different ways of achieving these goals.

Goal 1. Manage open water and wetland habitats to benefit Federal trust species and other species of conservation concern.

Background

A rich variety of wetland communities on the refuge supports an array of habitats benefiting widely diverse species of animals and plants. The Magalloway River, Whaleback Ponds, Greater Floating Island, Mountain Pond, Tidswell Point, and Dead Cambridge areas all contain extensive wetlands, some with such rare species as heart-leaved twayblade or bog sedge. Rapp (2003) documented an unusual occurrence of a circumneutral fen at Tidswell Point. The refuge peatlands are among the largest and most diverse in the state (Sperduto et al. 2000).

The Service, other federal and state agencies, conservation organizations, sporting groups, and local residents recognize the importance of those unique wetland and wildlife resources. Protecting the lake and its associated rivers and wetlands was a principal reason for establishing the refuge. Those habitats support threatened and endangered species, waterfowl and other migratory species of federal and state concern and populations of mammals, reptiles, amphibians and fish and rare plants. As we mentioned above, New Hampshire lists the refuge as a priority for protection under the NAWMP, as does the Emergency Wetlands Resources Act of 1986 (USFWS 1991).

The refuge is unique in the region for its diversity of breeding waterfowl. Its marshes and backwaters, forested and shrub wetlands and adjacent forested and cut-over uplands provide important nesting and brood-rearing habitat for such waterfowl as black duck, ring-necked duck, and cavity-nesters, including common goldeneye, wood duck, common merganser, and hooded merganser. Blue-winged teal, green-winged teal and mallard also nest in the area.

Lake levels on Umbagog Lake are managed by the operator of a dam at the outlet of the lake in accordance with a license issued by the Federal Energy Regulatory Commission (FERC). The current license issued by FERC is for the Errol Project (FERC no. 3133). It was issued in 1983 for a 40-year term, and both it and this CCP will therefore expire in 2023. The license is currently held by Florida Power and Light Energy Maine (FPLE). The current license requires that the licensee “...conduct a study to determine the reservoir surface elevation and time of year at which stable waters levels should be maintained for the protection of nesting wildlife at Lake Umbagog.” The licensee is further required to “...develop a plan to regulate the level of Lake Umbagog for the benefit of wildlife species and the water users downstream of the Errol Project.” In the past, this has meant limiting water level fluctuations during the loon nesting season in June and July. Wetlands management by the refuge must therefore recognize that water level fluctuations are neither entirely natural nor directly controlled by the refuge. The FERC license and related issues are further discussed in Chapter 3.

Goal 2. Manage floodplain and lakeshore forests to benefit Federal trust species and other species of conservation concern.

Background

The refuge floodplain and lakeshore forests lie next to water bodies and non-forested wetlands, and typically have high species richness with dynamic and complex biophysical processes. These habitats are important for many wildlife species of concern, including nesting and foraging waterfowl, bald eagles, ospreys, and many migratory songbirds. They provide important structural components, including large nest trees for eagles and ospreys and cavity trees for nesting common goldeneye, wood duck, and certain songbirds. These habitats also help control erosion and sediment loading into the lake and its tributaries. Without forested shorelines, stream banks in this area are more susceptible to erosion. The New Hampshire Natural Heritage Bureau (NHNHB) has defined an area along the Magalloway River as a rare type of silver maple floodplain forest community of conservation concern.

Most of the vernal pools on the refuge are embedded in floodplain forested habitats. A vernal pool is a small body of water that lacks a permanent, aboveground outlet. In the Northeast, snowmelt and spring and autumn rains fill vernal pools. They typically dry by mid-to-late summer, or earlier in years of drought. How long water stays in a vernal pool is its hydroperiod, which varies depending on the pool and the year. Maintaining vernal pools with a range of hydroperiods is important in sustaining vernal pool biodiversity. Because of that periodic drying, vernal pools do not support breeding populations of fish. The vernal pools on the refuge contribute to its native biodiversity by providing essential habitat for several obligate amphibian species, including blue-spotted salamander, spotted salamander and wood frog.

The restoration of developed floodplain and lakeshore riparian areas involves removing cabins and other structures, purchased from willing sellers, as funding and staffing allows. In 1996, the refuge acquired cabin leases on the land purchased from the James River, Boise Cascade, and Mead Paper companies. These acquired leases include stipulations to allow their continued use, but requires there be minimal impacts on resources. All leases expire at 50 years.

Goal 3. Manage upland forest habitats, consistent with site capabilities, to benefit Federal trust species and other species of conservation concern.

Background

Forests cover 90 percent of the Upper Androscoggin River watershed. The dominant tree species include red spruce, balsam fir, sugar maple, red maple, yellow birch, and white birch. At the landscape level, the matrix forest is a mixed spruce-fir/northern hardwoods forest; although embedded in that matrix, three broad vegetation types are found in varying amounts: spruce-fir, mixed softwoods-hardwoods, and northern hardwoods. The spruce-fir type is dominated by at least 75 percent red spruce and/or balsam fir at higher elevations, above 2700 ft., on thin, rocky soils at mid-elevations and on nutrient-poor soils in valley bottoms. The mixed hardwood-softwood forest type includes varying amounts of the major tree species in the region, depending on site conditions (Publicover and Weihrauch 2003). Bill Leak, a forester with the U.S Forest Service's Northeast Forest Experiment Station, considers a stand with 25 percent to 65 percent softwood a "mixed wood" stand (Leak, personal communication, 2004). White pine, hemlock, white spruce, northern white cedar, tamarack, black spruce, yellow and white birch, and red maple are also present in varying amounts. The northern hardwoods type is a mixture of at least 75 percent sugar maple, yellow birch, and beech on fine-textured soils at lower and mid-slopes.



© Robert Quinn

Purple-fringed orchid



© Robert Quinn

Black-backed woodpecker

Forest ecologists believe that the forest in the Upper Androscoggin River watershed of 150 years ago was also a mixed forest matrix; however, it supported more softwoods than we see on the landscape today (Kuchler 1964; Charlie Cogbill, personal communication, 2004). Multiple cycles of timber harvesting during the past 150 years affected forest composition. The selective harvesting of softwoods has converted many spruce-fir stands to mixed stands, and mixed stands to hardwood stands. In the absence of further human disturbance, natural succession and disturbance patterns will shift these forests to a higher proportion of softwood (Publicover and Weihrauch 2003). Our analysis for this CCP confirms that this mixed forest type, with a high proportion of softwoods, has the highest natural potential for growth in our area. That analysis included a site capability assessment using The Nature Conservancy (TNC) ecological land units (a combination of elevation, bedrock geology, and topography), Natural Resource Conservation Service (NRCS) soils surveys, and aerial photo interpretation.

Pre-settlement forests are believed to have been multi-aged with a diverse structure including a variety of tree sizes, many large-diameter trees, multiple canopy layers, deep forest duff, and a “pit-and-mound” forest floor. The canopy, shrub, and herbaceous layers of the mixed forests around the refuge today have varying composition and coverage depending on specific site conditions and disturbance history (Rapp 2003).

The breeding bird survey data over the last 30 years shows the importance of this mixed forest habitat for species of concern such as Blackburnian warbler, Canada warbler, and black-throated-green warbler (appendix N). A structurally complex (e.g., vertical diversity, coarse woody debris, large-diameter trees with cavities) mixed forest landscape also supports large, wide-ranging mammals, including marten, fisher, bobcat, and lynx (Ray 2000).

Although no stands of old growth forest are present on the refuge, it contains a few conifer stands with some late-seral characteristics, such as large-diameter trees. Hagen and Whitman (2004) report on the looming loss of late-successional forest in working forest landscapes including northern New England and the negative consequences for forest biodiversity. They note that forests develop along a continuum and, despite a harvest history, a stand can retain and develop such old growth characteristics as large live trees 100–200 years old, large dead trees, and fallen logs. Species associated with those characteristics include mosses, lichens, fungi, and insects.

Natural disturbance regimes affected by long-term climate change and disturbance patterns on the landscape are highly influenced by soil, topography, and forest type (Lorimer 2001; Lorimer and White 2003). Natural disturbance patterns for this region occur at two different scales. Large-scale, stand replacement disturbances from fire and wind occur infrequently, on the magnitude of 1000+ years. Small-scale disturbances, creating single tree-fall gaps, occur frequently (50–200-year return rates) (Lorimer 1977; Seymour et al. 2002). Pure stands of spruce and fir are much more susceptible to windthrow, insect outbreaks, and crown fires than associated hardwood species, because of their shallow root system, prevalence in swamps and on upland sites with thin, stony soils or on upper slopes exposed to high winds. Large areas of mixed spruce-hardwood that typically grow on better soils are rarely destroyed (i.e., stand replacement) by large-scale disturbances (Lorimer and White 2003).

Goal 4. Provide high quality wildlife-dependent activities such as hunting, fishing, wildlife observation and photography, as well as camping and boating in support of those activities.

Background

Hunting, fishing, wildlife observation and photography are four of the six priority public uses designated by the Refuge Improvement Act. The other two priority

uses are environmental education and interpretation (see goal 5 below). The Act stipulates those six uses are to receive enhanced consideration in refuge planning. Opportunities to engage in them should be provided to the extent compatible with refuge goals and objectives. Our objectives aim at providing high-quality opportunities for each of these four activities in ways consistent and compatible with the priorities of our other refuge programs, including opportunities for the other two priority uses. The Refuge Improvement Act does not establish a hierarchy among the six uses, but provides for refuge managers to determine whether any or all are appropriate and compatible. The ability to fund the management of these activities is also a factor for refuge managers to consider in determining their compatibility. Service policy requires that refuge managers set limits on, and establish stipulations for, any of those activities as warranted to ensure their compatibility.

Each of these activities is already facilitated on current refuge lands; however, we propose to improve current opportunities through new infrastructure or improved access.

Goal 5. Develop high-quality interpretative opportunities, and facilitate environmental education, to promote an understanding and appreciation for the conservation of fish and wildlife and their habitats, as well as the role of the refuge in the Northern Forest.

Background

This goal complements goal 4 by recognizing the importance of the remaining two priority public uses: environmental education and interpretation. Its objectives focus on providing informational and educational opportunities about the significance of the refuge and its role in conserving the Northern Forest to audiences of all ages. We strive to foster our visitor's appreciation of wildlife conservation and encourage them to make responsible environmental decisions in the future.

Our proposed future programs will achieve our objectives through increased visitor contacts, on-site programs, and new and improved infrastructure. Our emphasis will be on providing interpretive resources with planned infrastructure (e.g. trails, roadside pullouts, and a visitor contact facility). We will facilitate the use of refuge lands for educational purposes; however, we will look to our state and conservation partners, local and state educators, Friends Group, and/or volunteers to lead the development of educational programs.

One desired outcome of our programs is that participants recognize we manage the refuge to provide a variety of habitats to benefit Northern Forest wildlife, with particular emphasis on migratory birds and wetlands. Through high-quality programs, visitors will gain a better understanding of the unique and important contribution of this refuge to migratory bird conservation and the Refuge System.

Goal 6. Enhance the conservation and management of wildlife resources in the Northern Forest Region through partnerships with public and private conservation groups, private landowners, State and local entities.

Background

The Northern Forest stretches from the St. Croix River in Maine westward through New Hampshire and Vermont across the Adirondack Mountains to the Tug Hill plateau in New York. It includes the largest contiguous forest remaining in the eastern United States. Those 26 million acres encompass the most remote, pristine lakes in the Northeast, the headwaters of the Hudson, Connecticut, St. John and other great eastern rivers, and vast tracts of forest that provide habitats for an impressive array of species, including many that are federal-listed

as threatened or endangered or regional or state species of high conservation concern. Close to a million people live in that landscape, and many of them depend on the forest to sustain their communities and quality of life.

In the last decade, significant changes in land use have threatened the natural landscape, culture, and communities of the region. Huge forest landholdings, many owned by multinational corporations, are being sold at an accelerated rate.

Many of the large, contiguous tracts are being divided into smaller tracts and sold to developers or institutional investment corporations, including insurance companies and bank trusts, whose interests are purely economic. Those sales raise concerns about the rising trend of unsustainable timber cutting, forest subdivision, and other permanent development, particularly around lakefronts and in secluded forest tracts. In addition to fragmenting the forests, those developments destroy wildlife habitat, restrict public access, degrade water quality, spoil the remote and scenic beauty of the forest, and undermine the hope of a sustainable, forest-based economy to support Northern Forest communities. More recently, a shift to renewable energy sources may impact forest management on a regional scale. In May, 2007 New Hampshire enacted the Renewable Energy Act, which codified the renewable portfolio standards for the state. This law requires that all suppliers of electricity in the state demonstrate that they are obtaining 25% of their electricity from renewable energy sources by 2025. Included in the list of renewable energy sources are biomass, wind, hydropower, and solar, among others. Since biomass energy production facilities can utilize wood products not traditionally used by the pulp and paper industry, a large-scale shift to electricity production from biomass facilities has the potential of altering forest stand structure, rotation ages, species composition, soil nutrient levels, and wildlife habitat on a landscape scale..

Those concerns underscore the need for partners who will work together to permanently conserve the ecological integrity of the Northern Forest, preserve public recreational opportunities, and promote the economic sustainability of a forest-based economy. Fortunately, an impressive partnership already exists in the region including over a dozen federal, state, non-governmental, and private entities, who share this common mission. In addition, these partners' landholdings collectively create a conservation lands network, as depicted on map 1-1, which provides a basis for further connecting and conserving resources of conservation concern. The Service is a key partner in this effort, and refuge lands are integral to the land conservation network. Chapter 2 discusses alternative ways of sustaining the partnership and the Service role in it. Appendix A, "Land Protection Plan," presents our preferred vision for expanding our contribution to the partnership and the land conservation network, all in support of sustaining Federal trust resources.

Goal 7. Develop the refuge as an outstanding center for research and development of applied management practices to sustain and enhance the natural resources in the Northern Forest in concert with the Refuge System Land Management and Research Demonstration Area program.

Background

In 1999, the leadership of the Refuge System published their vision for its programs and management priorities in a publication titled "Fulfilling the Promise, the National Wildlife Refuge System" (USFWS 1999). Forty-two different recommendations were identified. One of those was to designate Land Management and Research Demonstration (LMRD) Areas. They envisioned LMRD areas as "places where new habitat management techniques and approaches are developed, implemented, and showcased...places where

professional land managers and others come to learn about cutting edge habitat management techniques and technology, and carry back with them the information and knowledge which allows them to better manage their own lands.” Specifically, the recommendation was to designate areas “to facilitate development, testing, teaching, publishing, and demonstration of state-of-the-art management techniques that support the critical habitat management information needs for fish, wildlife, and plant conservation within the System and other lands” (USFWS 1999).

The implementation of that recommendation has begun. Nationwide, 5 of the 14 LMRD areas approved by the Directorate are now funded and in operation. Those are (1) Hanford Reach National Monument and Saddle Mountain refuge in Washington, (2) the National Elk refuge and National Bison Range in Montana, (3) the Rachel Carson and Parker River refuges in Maine and Massachusetts, (4) the Neal Smith and Northern Tallgrass Prairie refuges in Iowa, and (5) the Bosque del Apache refuge in Arizona. Each of those LMRD areas has a different habitat management focus. Lake Umbagog refuge, in partnership with the Moosehorn refuge and the Nulhegan Division of the Silvio O. Conte refuge, is another approved LMRD area, but lacks funding to implement programs.

Its focus is the management and restoration of habitats in the working forest landscape of the Northern Forest ecosystem. Research will be implemented in cooperation and coordination with other northern forest research entities, such as universities, Manomet Center for Conservation Sciences, and the U.S. Forest Service Northeastern Forest Experiment Station, Forestry Sciences Laboratory.

The Comprehensive Conservation Planning Process

Service policy establishes an eight-step planning process that also facilitates our compliance with NEPA (figure 1.1).¹ Our planning policy and CCP training course materials describe those steps in detail. We followed that process in developing this Final CCP/EIS.

Since 1992, we have focused on conserving land within the approved refuge boundary, facilitating wildlife-dependent public uses, managing habitat for several focus species, such as common loon and bald eagle, and establishing relationships with the community and our partners. In 2001, we began to prepare for developing a CCP by collecting information on refuge resources and mapping its habitats. We convened our core team, which consists of refuge staff, regional office staff, and representatives of the Maine Department of Inland Fisheries and Wildlife (MDIFW) and the New Hampshire Fish and Game (NHFG). We discussed management issues, drafted a vision statement and tentative goals, and compiled a project mailing list of known stakeholders, interested individuals, organizations, and agencies. We also conducted a wilderness review, evaluated wild and scenic rivers potential, and summarized our biological inventory and monitoring information. We initiated all of those steps as part of “Step A: Preplanning.”

In August 2001, we initiated “Step B: Initiate Public Involvement and Scoping” by distributing a newsletter to announce that we were beginning the planning process and ask if people wanted to be on our mailing list. In June 2002, we distributed approximately 1,000 copies of a Planning Newsletter and Issues Workbook to everyone on our mailing list. Those workbooks asked people to share what they valued most about the refuge, their vision for its future and the Service role in their community, and any other issues they wanted to raise. We received 131 completed workbooks.

¹ 602 FW 3, “The Comprehensive Conservation Planning Process”
(<http://policy.fws.gov/602fw3.html>)

On July 16, 2002, we formally announced the start of the planning process in a Federal Register Notice of Intent. During that July and August, we held eight public scoping meetings to identify public issues and concerns, share our draft vision statement and tentative goals, describe the planning process, and explain how people could become involved and stay informed about the process. We announced their locations, dates, and times in local newspapers and special mailings. More than 115 people attended. Those meetings helped us identify the public concerns we would need to address in the planning process. We also solicited public issues and concerns at our booth at the August 2002 Umbagog Wildlife Festival.

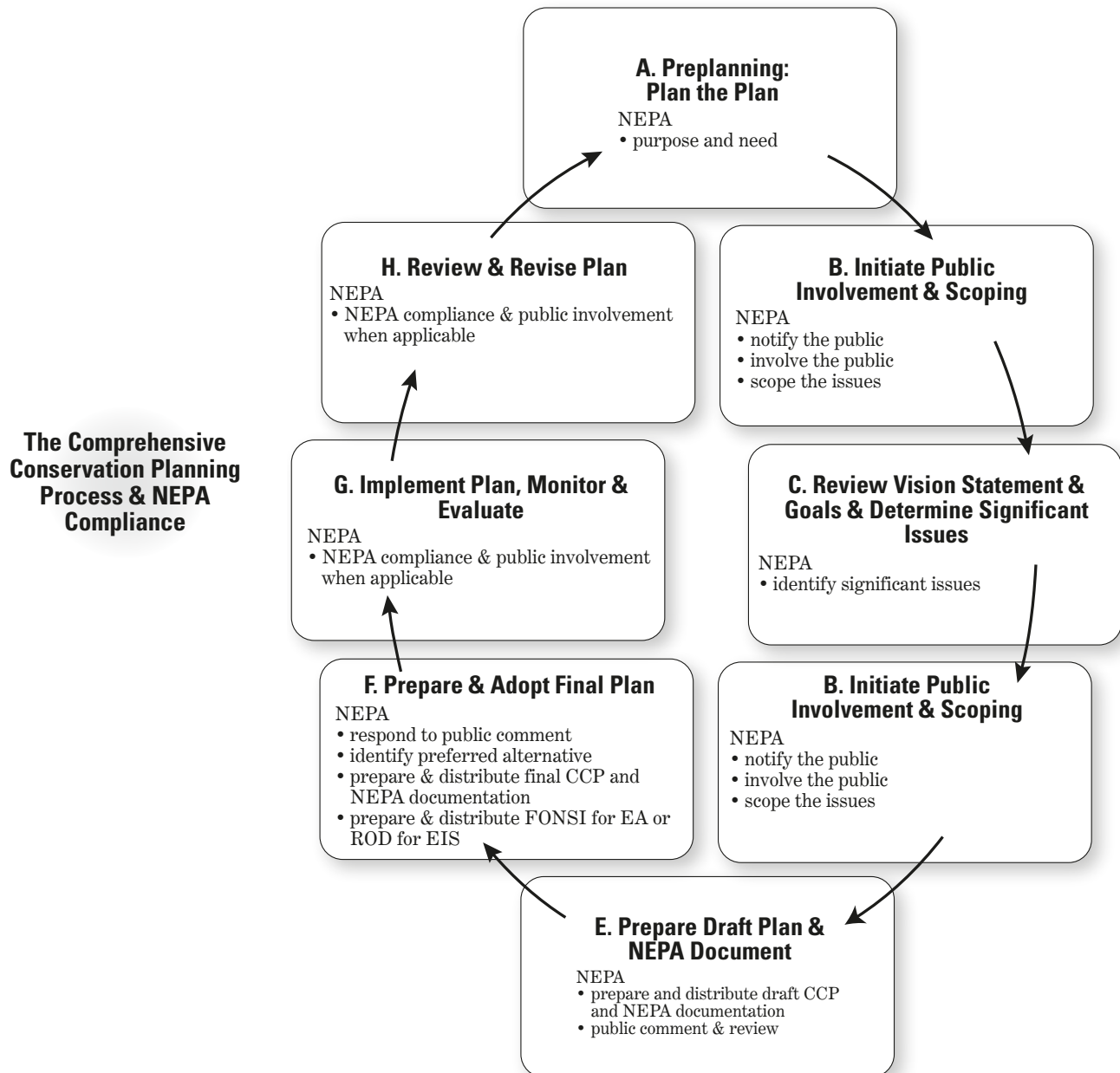


Figure 1.1. The Comprehensive Conservation Planning Process

We worked on “Step C: Review Vision Statement, Goals, and Identify Significant Issues” and “Step D: Develop and Analyze Alternatives” concurrently in 2003 and 2004 in two technical workshops: one on upland forest habitat management

and one on wetlands management. We invited resource professionals and scientific experts to share their opinions on the significance of refuge resources, namely, their assessment of the health, diversity, and integrity of its habitats. We also met with elected officials, our state partners, and other Service divisions to apprise them of the status of the project and exchange technical information. For much of 2004 and into 2005, we compiled and analyzed various management alternatives to serve as the foundation for developing the Draft CCP/EIS. In August 2005, we distributed a newsletter summarizing the alternatives in detail and updating our planning timeframes.

Also in 2004 and into 2005, the USGS Fort Collins Science Center helped us develop and implement a stakeholder survey to provide us with information on public satisfaction, preferences, and expectations regarding our current and proposed refuge management. The final survey report provided valuable information for our management proposals. We distributed an Executive Summary of the results in November 2005. You may request the full report from refuge headquarters in hard copy or CD-ROM, or view it online at <http://www.fort.usgs.gov/products/publications/21507/21507.asp>.

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/EIS and distributing it for public comment. During that 77-day period of public review, we held public hearings to obtain comments. We received comments by regular mail, electronic mail, and as testimony in those public hearings. We reviewed and summarized all of the comments and developed responses to them. A summary of public comments and our responses to them are presented in appendix O this Final CCP/EIS.

We are now releasing our Final CCP/EIS for a 30-day public review period. Its availability has been announced in a NOA in the Federal Register. After the public review period, we will prepare a Record of Decision (ROD) for our Regional Director. If he approves and signs the ROD this will complete the planning process. We will announce the availability of the ROD in another NOA in the Federal Register. That will complete “Step F: Prepare and Adopt a Final Plan.” We can then begin “Step G: Implement Plan, Monitor and Evaluate.”

We will modify the final CCP following the procedures in Service policy (602 FW 1, 3, and 4) and NEPA requirements as part of “Step H: Review and Revise Plan.” Minor revisions that meet the criteria for categorical exclusions (550 FW 3.3C) will require only an Environmental Action Memorandum. We must fully revise CCPs every 15 years.

Issues, Concerns and Opportunities

From our Issues Workbook, public and focus group meetings, and planning team discussions, we developed a list of issues, opportunities, or any other item requiring a management decision. We concentrated further on those issues, as they drive our analysis and comparison of alternatives. We will address three categories of issues in the CCP/EIS.

Significant issues.—Our partners or the public brought these issues to our attention during the scoping process. Our discussions generated a wide range of opinions on how to resolve them, summarized below. We applied those in creating the primary distinctions among the objectives and strategies in each alternative in chapter 2. Ultimately, they will influence our final decision, because their resolution falls within the jurisdiction and authority of the Service.

Other issues and management concerns.—These issues are narrower in scope or interest than the significant issues, but still in that range of opinions. The alternatives resolve them similarly (see “Management Actions Common to all Alternatives” in chapter 2).

Issues and concerns outside the scope of this analysis.—The resolution of these issues falls outside the scope of this EIS or outside the jurisdiction or authority of the Service. Although we discuss them briefly in this chapter, we do not address them further in this Final CCP/EIS.

Significant Issues

Addressing the 11 significant issues below will help us achieve the seven goals above. Chapter 2 describes in detail how the alternatives address these significant issues, and how addressing them will help achieve refuge goals.

1. Which wetland habitats and wetland-dependent species should be management priorities? How will we manage for them on the refuge?

Because one of the purposes for establishing the refuge is to conserve wetlands, addressing this issue is a high priority. It is also a challenge. The water levels in Umbagog Lake directly influence most of the refuge wetlands. The holder of the FERC license controls those water levels, which fluctuate according to releases at Errol Dam. The current licensee, FPLE, meets with the Service annually, as required by its license, to agree on water levels in June and July when birds are breeding and nesting.

To offset our limited direct influence on water levels, some input we received recommends we manage refuge wetlands by planting wild rice, promoting beaver activity, reducing or eliminating external threats of erosion or pollution, controlling access to wetlands, and eliminating invasive species. We believe, as do wetland experts who provided input on this issue, that managing water levels more effectively throughout the year would improve habitat quality for species of conservation concern and other wetland-dependent native species, and sustain such unique wetland types as the Floating Island National Natural Landmark (FINNL).

Those recommendations vary considerably on the timing, extent, and focus of wetlands management. Some suggest we establish more baseline biological information before we manage the refuge wetlands. Others suggest we first work with the current holder of the FERC license, to discuss a year-round regime of water levels that will be more beneficial for wildlife and wetlands. As in any aspect of refuge management, our decisions on managing refuge wetlands could benefit one species of conservation concern, but adversely affect another.

2. Which upland forest habitats and forest-dependent species should be management priorities? How will we manage for them on the refuge?

The decision document establishing the refuge (USFWS 1991) also recognizes that its upland forests play a crucial role in conserving the lake, its rivers and associated wetlands. This document recognized that the refuge was part of a larger conservation partnership to protect and manage timber, wetland, and wildlife resources of the Umbagog area. Conservation easements held by the State of New Hampshire on some of the upland portions of the Refuge specifically granted timber management rights.

Uplands compose at least 58 percent of the refuge. During the last 10 years, we acquired much of that upland forest from timber companies who harvested it intensively before selling it to the Service. The vegetation now growing back on some of those areas lacks the natural species diversity, age-class distribution, and structural components of healthy native forests in the Upper Androscoggin River watershed.

Only in the last 5 years have we acquired enough contiguous forested upland to form efficient management units. Primarily for that reason, we have not managed the vegetation on those lands. During our public scoping, many people

encouraged us to manage those areas to bring them into a more natural, healthy forest condition. Some would like us to manage the upland forests on the refuge exclusively as working forests to promote tree growth and productivity for commercial purposes. Others would like us to initiate some action to get those areas on a natural path sustainable without further human intervention. Some suggested we focus our management on benefiting species that depend on upland forest habitats, particularly, migratory songbirds that regional and state conservation plans have identified as conservation concerns in the last 5 years. Some of those species require mature forest stands, while others prefer a mix of age classes and types. Again, our management decisions could benefit one species of conservation concern but adversely affect another.

Other individuals and organizations encouraged us to expand the refuge as a means of conserving large areas of undeveloped forest lands to benefit species that require contiguous interior forest habitats. Still others expressed an interest in our conducting very little to no active vegetation management in the uplands. Some believe “nature should take its course,” and that the forested areas will recover without our help.

3. What is the appropriate level for each of the six priority public use programs on the refuge? What means of access will we allow for those activities?

The Refuge Improvement Act does not establish a hierarchy among its six priority, wildlife-dependent compatible uses. At times, they may conflict. At other times, the refuge may lack sufficient resources to promote all of them equally. Some people expressed concerns that we may allocate refuge resources disproportionately toward one use to the detriment of another. Service policy authorizes the refuge manager to allocate time and space for those uses to reduce conflict, or terminate or disallow one or more of them. The refuge manager must evaluate, among other things, which use most directly support the long-term attainment of refuge purposes and the Refuge System mission.

During the public scoping process, we heard from many people concerned about a rising number of conflicts between visitors in motorboats and visitors in canoes and kayaks. Both groups typically are involved in priority public uses such as fishing and wildlife viewing. Those promoting motorboats suggest limits on the number of kayakers and canoeists or the size of groups, because the increase in large group trips affects the ability of motorboats to maneuver on the river corridors. Those promoting kayaks and canoes voice their concern over the noise and speed of motorboats disturbing wildlife and affecting viewing opportunities. They also express concern about their own safety, because of the wakes motorboats create. Some motorboat operators suggest that kayakers and canoeists could create more wildlife disturbance by their access to small, quiet coves where some wildlife hide or rest.

Unfortunately, we get reports each year of verbal confrontations between users of motorized and non-motorized boats. Although we cannot prevent all such encounters, our enforcement focuses on people operating boats in a reckless manner, or in a manner that endangers or is likely to endanger any person, property or wildlife.

An additional challenge for the refuge manager and our state partners is determining the capacity of the refuge and the lake to support these priority compatible uses and still provide visitors with a quality experience. We also need to be aware of their impacts on adjacent lands. Several landowners expressed concern that increased boating has increased trespassing onto private land. Boaters have left behind trash and human waste, and have parked or camped where they do not have permission.

4. *How will we manage furbearer populations?*

The term “furbearer” includes all mammals that possess some form of hair (TWS 2001). However, we use the term to identify species hunted or trapped for their fur, including carnivores and rodents. Beaver, bobcat, coyote, fisher, fox, marten, mink, and muskrat are common furbearers on the refuge. Furbearer populations are dynamic; many are capable of doubling their populations in a single year, while others are more subject to limiting habitat factors. For example, muskrat populations can fluctuate dramatically each year. They can decline by 75 percent in the winter and rebound completely by the next fall (TWS 2001). As land managers, we become concerned when furbearer populations meet or exceed the biological carrying capacity of refuge habitats.

The complex subject of furbearer management is also controversial at the national and state levels. Most of the controversy surrounds regulated trapping. We heard from people who object only to certain trapping methods, particularly the foothold trap on land. However, other opponents have moral and ethical objections to killing animals, and do not support any form of trapping.

We also heard from proponents of regulated trapping who believe it provides an important, effective method for managing furbearer populations, is a sustainable use of wildlife resources, and allows for a rural, self-sufficient, subsistence lifestyle of historical significance in the Northern Forest. Supporters acknowledge the Refuge System mission to conserve, protect, and enhance viable populations of native wildlife such as furbearers, but contend that harvesting some furbearers does not threaten the continued survival of their populations (TWS 2001). They often compare it to our hunting and fishing programs in that regard. However, trapping is not one of the six priority public uses in the Refuge Improvement Act.

5. *How will we manage compatible, non-priority recreational uses on the refuge?*

Some of the historical uses on the refuge are not priority uses, nor are they wildlife-dependent, but the refuge manager may determine them compatible after further analysis in this Final CCP/EIS. However, Service policy provides that a use that might be compatible, in the sense that it may not materially interfere with the purpose of the refuge or the Refuge System’s mission, but may nonetheless 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.

*Snowmobiling
on the refuge*



Marvin Moriarty/USFWS

We heard from people both supporting and opposing certain non-priority uses that have historic precedence in the area. Most frequently discussed during public scoping were (1) snowmobiling, a very popular recreational activity, and increasingly important to the local economy; and, (2) furbearer trapping, a recreational activity with cultural and historic roots in the region. We discuss our proposed recommendations for those two activities in chapter 2. We also present in Chapter 2 those activities the refuge manager has previously determined not appropriate and his rationale for not evaluating them further.

For non-priority activities to be compatible and allowed, they would have to be managed so they do not conflict with the goals and objectives for biological and visitor services priorities in the final CCP, are consistent with public safety, and are manageable within the limitations of the refuge budget and available staff. If a priority and non-priority public use conflict, the priority public use will take precedence (603 FW 2). Some people we spoke with argued that these activities detract from our ability to provide priority public uses. They pointed out the limited refuge staff and annual funding of recent years, and did not believe we can manage these activities properly in addition to higher priority programs. Others simply stated they do not believe these activities are appropriate for a national wildlife refuge, and informed us they will review and be critical of any compatibility determination that allows them. That opposition ranged from those opposed to certain activities on ethical and moral grounds, to those concerned with visitor safety and those concerned with direct impacts on wildlife and habitats. We also heard from individuals who support many of these activities.

6. How will we manage camping in remote areas on the refuge?

A developed campground in Umbagog Lake State Park on the south end of the lake is accessible by car from Route 26. The park also includes 30 remote camping sites around the lake, all seasonally open and administered by the State of New Hampshire Department of Resources and Economic Development (NHDRED), Division of Parks and Recreation. Fourteen of those camping sites are on refuge lands; of which 12 are on the lake, and 2 are on rivers. Our ongoing partnership with the state to conserve Umbagog Lake is a very successful, valuable relationship that facilitates wildlife conservation and provides unique recreational opportunities in the Northern Forest. The remote camping sites are extremely popular, and are consistently occupied during the open season. We hear from many people that the highlight of their trip is the opportunity to hear and see loons calling near the campsites at dusk and dawn.

Although we heard from individuals who advocate maintaining camping at its current level, we did not hear from anyone who recommended increasing the number of sites. Some, who expressed support for camping in general, would like to see a reduction in the total number of sites because they are concerned about the total number of visitors to the area, and believe camping encourages group activities. Others felt that continuous use had adversely affected some of the sites, and would like to see them restored.

Some people told us that they do not believe camping is appropriate in a national wildlife refuge, especially if site development or intensive use adversely affect natural habitat. Others expressed concern that the remote sites only encourage inexperienced boaters to get out onto the lake and jeopardize their safety and that of others.

7. How will we manage outfitters and guides on the refuge?

We heard a range of opinions about the desirability of the current level of guided or group tours which occur on adjacent ownerships. Several individuals

expressed concern that guided tours have increased over the last five years, but do not appear to be regulated by any agency. Some of the same people believe that outfitting and guiding is already at its capacity, and opposed group tours because they facilitate getting more visitors to the lake and its surroundings. Others supported guiding as an activity, because it was their livelihood, or because they believe it enhances visitors' experiences by providing safe and successful opportunities for viewing wildlife, photographing nature, hunting, or fishing.

According to Federal regulations and Service compatibility policy (603 FW 2), we may only authorize public or private economic uses of the natural resources on any national wildlife refuge in accordance with 16 U.S.C. 715s and 50 C.F.R. 1(29.1) when we determine that the use contributes to the achievement of the refuge purposes or the Refuge System mission. We may authorize an economic use, such as commercially guided trips, by special use permit only when the refuge manager has determined the use is appropriate and compatible. The permit must contain terms, conditions, and stipulations to ensure compatibility.

Our authority to administer these activities on Umbagog Lake is limited to the lands and waters where the Service has an ownership interest. We have not evaluated these activities because we have had no requests to do so. Once a request is received, we will evaluate the use for appropriateness and compatibility.

8. What should be the refuge role in conserving land in the Upper Androscoggin River watershed? Should we pursue a refuge expansion?

Goal 6 describes significant changes in land use in the Northern Forest and our role in the existing collaborative partnership helping to conserve important habitats, maintain outdoor recreational opportunities, and sustain a viable economic and social quality of life. Our partners and we will continue to use many tools and techniques for accomplishing this mission which range from outreach and education, research and demonstration areas, private lands assistance programs, cooperative management agreements, conservation easements, and land acquisition. Each of those is a tool, although our ability to use these effectively will depend on other factors previously discussed, such as refuge staffing, funding, and the continued strength and collaboration of our partnerships.

In that list of potential methods, land conservation garners the most public attention and interest. We heard a wide range of opinions on whether the refuge should continue to expand. Some people expressed concern that federal ownership will result in a greatly diminished local voice in how those lands are managed and used, and they expect the result will be additional restrictions on non-priority public uses, which they view as "traditional" uses. They believe the Service will not be responsive to local concerns, and that the lands will no longer be subject to local influences. Many people specifically fear a significant loss of commercial timber harvest and its potential impacts on the local economy. Others are concerned about the loss in property taxes, because the Federal Government does not pay property taxes.

However, many expressed support for land conservation for the reasons identified in goal 6 above, including the fact that owners are selling huge landholdings and subdividing them into smaller tracts at an alarming rate. Some people expressed the opinion that state agencies, local governments, or non-governmental entities should take the lead in land protection, and that the Service should play only a supporting role. Others suggested that the Service pursue conservation easements and private lands cooperative management agreements instead of fee

simple purchases as a means of protection. They mentioned that this would also alleviate concerns about the impact on local property taxes.

On the other hand, we heard from many people that Service acquisition of fee title lands was the only way to guarantee the permanent conservation and management of the lands to support native wildlife. Some recognized the importance of the land conservation partnership and lands network that exists and encouraged our continued active involvement, including support for a refuge expansion. They mentioned the benefits of permanently conserving important habitats, the increased opportunities for public access and recreation in areas either not currently open or not guaranteed to be open long-term. Finally, they pointed out that expanding the refuge would maintain the rural character and quality of life so important to many.

9. How can the refuge and its staff be an asset for local communities and support their respective vision and goals for the area?

Our goal is to become an integral part of the economic and social health and vitality of local and regional communities. The challenge for us is to understand the visions of the respective communities and our role in them while staying true to our mission. We need to determine how best to cultivate relationships in the area, reach out to raise our visibility, and identify the resources we have to contribute. During public scoping, the comments we heard and the results of our stakeholder survey indicate some disappointment in the level of communication from refuge staff, and various levels of mistrust of what our agency does communicate.

Others mentioned that this situation is improving, but could be better. Several individuals requested a more transparent planning process with frequent opportunities to participate and share information. Others felt well informed about refuge activities, and valued the contribution of the refuge to their quality of life. Gaining community understanding, trust, and support for refuge programs is very important for our success in managing the refuge and contributing to conservation in the Northern Forest.

10. What staffing, budgets, and facilities are needed to effectively administer the refuge? Where should they be located?

Many people expressed concern about our ability to maintain existing and proposed infrastructure and implement programs on this refuge, given its current levels of staffing and funding. Some told us they recognize the logistical challenges for our four field staff in trying to manage the refuge land base, which straddles two states, is difficult to access in some places, and is significantly affected by Umbagog Lake and Errol Dam, neither of which falls under the direct authority of the Service. Fortunately, our strong partnerships with natural resource agencies in New Hampshire and Maine allow us to resolve most concerns expeditiously.

Some people expressed the opinion that the refuge needs a presence directly on the lakeshore to facilitate administration, outreach, and education of visitors on safety, lake use etiquette, and resource protection.

We also heard interest in insuring that there is adequate law enforcement capability on refuge lands. That is increasingly becoming a concern to many as public use on the refuge and adjacent lands increases. Our hope is that our new half-time refuge law enforcement officer and a full-time law enforcement zone officer shared among the refuges in Maine, northern New Hampshire and Vermont will meet our law enforcement needs and public expectations.

© Robert Quinn



Whaleback Pond

Some people are concerned that any new proposals in this CCP will fall substantially above current budget allocations, thus raising unrealistic expectations. One individual pointed out that budgets can vary widely from year to year because they depend on annual congressional appropriations. Other people supported our pursuit of new management objectives and strategies in the hope that the CCP will establish new partnerships and sources of funding. In fact, several people made specific recommendations on sources of grants or ways to collaborate in certain programs or fund new infrastructure and other projects.

The alternatives recommend varying amounts of funding and staffing, (both permanent and seasonal), to implement programs over the next 15 years. In all of the alternatives, we recommend as essential the minimum staffing levels already approved for the refuge. Appendix H presents staffing recommendations by alternative. Appendix F identifies the funding needs by priority project identified in the 2005 Refuge Operating Needs System (RONS) and Service Asset Maintenance Management System (SAMMS). We regularly update those databases.

11. What actions can Service staff implement on refuge lands to minimize the projected impacts from global and regional climate change?

Climate change is an issue of increasing public concern because of its potential effects on land, water, and biological resources. The issue was pushed to the forefront in 2007 when the Intergovernmental Panel on Climate Change (IPCC), representing the world's leading climate scientists, concluded that it is "unequivocal" that the Earth's climate is warming, and that it is "very likely" (a greater than 90 percent certainty) that the heat-trapping emissions from the burning of fossil fuels and other human activities have caused "most of the observed increase in globally averaged temperatures since the mid-twentieth century" (IPCC 2007). The Northeast is already experiencing rising temperatures, with potentially dramatic warming expected later this century under some model predictions. According to the Northeast Climate Impacts Assessment team, "continued warming, and more extensive climate-related changes to come could dramatically alter the region's economy, landscape, character, and quality of life (NECIA 2007).

Other predicted climate-related changes, beyond warming temperatures, include changing patterns of precipitation, significant acceleration of sea level rise, changes in season lengths, decreasing range of nighttime versus daytime temperatures, declining snowpack, and increasing frequency and intensity of severe weather events (TWS 2004). Since wildlife species are closely adapted to their environments, they must respond to climate variations, and the subsequent changes in habitat conditions, or they will not survive. Unfortunately, the challenge for wildlife is all the more complicated by increases in other environmental stressors such as pollution, land use developments, ozone depletion, exotic species, and disease. Wildlife researchers and professionals, sportsmen, and other wildlife enthusiasts are encouraging positive and preemptive action by land managers. Some recommendations for action include: reducing or eliminating those environmental stressors to the extent possible;

managing lands to reduce risk of catastrophic events; managing for self-sustaining populations; and, looking for opportunities to ensure widespread habitat availability (TWS 2004).

All of the alternatives would manage wildlife and habitats under an adaptive management framework, and all would increase biological monitoring and inventories. These two actions are critically important for land managers to undertake in order to effectively respond to the uncertainty of future climate change effects. The alternatives differ, however, in the extent to which they take other specific actions to reduce environmental stressors, manage for self-sustaining populations, or ensure widespread habitat availability through land protection and conservation.

Other Issues

We explain how we will address the following issues and concerns in “Actions Common to all Alternatives” or “Actions Common to Alternatives B and C” in chapter 2. We organized them under their respective subject headings.

- What should be the Service role in protecting national and local landmarks, and cultural resources in the Umbagog Lake area?
- What is the refuge role with respect to water level management in Umbagog and associated lakes?
- How can the refuge promote responsible use of Umbagog Lake in cooperation with other jurisdictional and management agencies?
- How will existing camp lease agreements, under special use permits (SUPs), be affected by the CCP process?
- How will we protect and manage deer winter yards?
- How will we coordinate resource management with other state and federal agencies in the Upper Androscoggin River watershed?
- How can we work with other agencies to manage invasive plants and animals (e.g. small mouth bass and milfoil) on the lake?
- How will we manage fires (management-prescribed burns and wildland fires) on the refuge?

Issues Outside the Scope of this Analysis or Not Completely Within the Jurisdiction of the Service

1. Changing the timeline for FERC re-licensing of Errol Dam or changing the terms and conditions of the license

Some people expressed concerns with water level management in Umbagaog Lake, namely due to the management of Errol Dam. We heard concerns with water levels being too high, affecting waterbird breeding and nesting habitat. Others mentioned concerns with low water levels during the summer, exposing mudflats and affecting shoreline access to open water. Yet others indicated that if the Service or states had more control over water level management, habitat conditions for species of concern, and wildlife-dependent recreational opportunities, could be enhanced throughout the year.

Water levels are controlled, as noted above, by the holder of the license issued by FERC for the Errol Project (currently FPLE). Once FERC has issued a license, any party wanting FERC to change the terms must petition FERC to reopen the license in order to effectuate any change in its terms. The procedure for doing so requires the petitioner to supply a detailed administrative record justifying a change in the license terms, sufficient to convince FERC that the analysis it did

in issuing the license is no longer accurate, and that a change in the license terms is necessary. The licensee has a right to full administrative process under FERC regulations before its license can be changed by that agency. Such a challenge falls outside the scope of this CCP. Its purpose is to provide the Service with detailed goals and objectives for managing refuge lands, not to provide guidance to the Service concerning matters within the jurisdiction of a different federal agency. However, in chapter 2, alternative B proposes that we continue to meet annually with the licensee to discuss current terms and conditions of the license that relate to wildlife management during the breeding and nesting seasons and to discuss opportunities for habitat enhancement throughout the year.

The timeline for FERC re-licensing is also beyond the control of the Service, and hence beyond the scope of the CCP. The current FERC license for the Errol Project is due to expire in 2023, as will this CCP. Prior to 2023, the Service will be involved in both the drafting of a new CCP and in the licensing process for a renewal of the FERC license (assuming the licensee pursues this). This CCP is not intended to control either the Service's opinions in the next planning cycle or its position before FERC in re-licensing, though actions taken under the CCP may affect environmental baseline conditions for both processes.

2. Giving or transferring refuge lands back to private or town ownership

We heard people express the opinion that the Service should give back, trade, or sell refuge lands to an entity more amenable to the local culture and history. The USGS stakeholder survey (Sexton et al. 2005) indicates that some local respondents do not trust the Federal Government to manage lands on their behalf. Issue 8 above identifies other concerns people expressed about Service ownership.

We established the refuge in 1992 with the first purchase of land after producing a draft and final environmental assessment (Service 1991). Both of these documents extensively evaluated the proposal to create the refuge, and alternatives to that proposal, and included public review and comment. We based our proposal on a strong federal-state partnership to cooperatively protect and manage nationally significant habitats in the area, with strong collaboration among the Service, New Hampshire and Maine state agencies, conservation organizations, and three principal landowners: the James River Company, Boise Cascades Paper Group, and Seven Islands Land Company. We agreed the Service was to take the lead in establishing the refuge on core lands, and New Hampshire and Maine were to take the lead in acquiring conservation easements in adjacent agreed-upon areas.

In addition to the 1991 Final EA establishing the refuge, our 2001 Regional Director's decision to further expand the refuge addressed public and partner comments on land acquisition. Both decisions required the regional director to prepare a Finding of No Significant Impact (FONSI) to disclose that the proposed land acquisition complies with federal laws and does not have a significant impact on the human environment.

The purchase of lands within the approved acquisition boundary represents the Service commitment to honor its responsibilities agreed to in the final decision. Although the Service can exchange refuge land for other land of equal or higher conservation value, a lack of trust in the Federal Government does not constitute a basis for transferring refuge lands to private or town ownership.

Chapter 2



Tom Meredith/USFWS

Harper's Meadow with loon

Alternatives Considered, Including the Service-preferred Alternative

Introduction

This chapter presents:

- Our process for formulating alternatives;
- Actions that are common to all alternatives;
- Actions or alternatives considered but not fully developed; and,
- Descriptions of the three alternatives we analyzed in detail.

At the end of this chapter, table 2.2 compares how each of the alternatives addresses significant issues, supports major programs, and achieves refuge goals.

Formulating Alternatives

Relating Goals, objectives and Strategies

Refuge goals and objectives define each of the management alternatives identified below. As we described in chapter 1, developing refuge goals was one of the first steps in our planning process. Goals are intentionally broad, descriptive statements of the desired future condition for refuge resources. By design, they are less quantitative, and more prescriptive, in defining the targets of our 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. Our goals are common to all the alternatives.

The next step was to consider a range of possible management objectives that would help us meet those goals. Objectives are essentially incremental steps toward achieving a goal; they also further define the management targets in measurable terms. They typically vary among the alternatives and 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 2004a) recommends that objectives possess five properties to be “SMART”: (1) **s**pecific; (2) **m**easurable; (3) **a**chievable; (4) **r**esults-oriented; and (5) **t**ime-fixed.

A rationale accompanies each objective to explain its context and why we think it is important. We will use the objectives in the alternative selected for the final CCP 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 represent the potential suite of actions to be implemented, and by design, most will be further evaluated as to how, when, and where they should be implemented in refuge step-down plans.

Developing Alternatives, including the “No Action” Alternative

After identifying a wide range of possible management objectives and strategies that could achieve the goals, we began the process of crafting management alternatives. Simply put, alternatives are packages of complementary objectives and strategies designed to meet refuge purposes, the Refuge System mission, and goals, while responding to the issues and opportunities identified during the planning process.

To this end, we grouped objectives that seemed to fit together in what we loosely called “alternative themes.” For example, we considered such themes as “current management,” “passive management,” “focal species management,” and “natural processes management.” These were firmed up into four, and then later three, management alternatives after further evaluating how respective objectives

would interact, their compatibility with refuge purposes, and the reality of accomplishing the objectives in a reasonable time frame.

We fully analyze in this final CCP/EIS three alternatives which characterize different ways of managing the refuge over the next 15 years. We believe they represent a reasonable range of alternative proposals for achieving the refuge purpose, vision and goals, and addressing the issues described in chapter 1. Unless otherwise noted, all actions would be implemented by refuge staff.

Alternative A satisfies the NEPA requirement of a “no action” alternative, which we define as “continuing current management.” It describes our existing management priorities and activities, and serves as a baseline for comparing and contrasting alternatives B and C. We suggest you first read Chapter 3, “Description of the Affected Environment,” for detailed descriptions of current refuge resources and programs.

Many of the objectives in alternative A do not strictly follow the guidance in the Service’s goals and objectives handbook because we are describing current management decisions and activities that were established prior to this guidance. Rather, our descriptions of these activities were derived from a variety of formal and informal management decisions and planning documents. As such, alternative A objectives are fewer and more subjective in nature than alternatives B and C.

Alternative B, the Service-preferred alternative, combines the actions we believe would most effectively achieve refuge purposes, vision and goals, and respond to public issues. It emphasizes management of specific refuge habitats to support focal species whose habitat needs benefit other species of conservation concern in the Northern Forest. In particular, we emphasize habitat for priority bird species of conservation concern identified for BCR 14.

Alternative C emphasizes management to restore where practicable, the distribution of natural communities in the Upper Androscoggin River watershed that would have resulted from natural processes without the influence or intervention of human settlement and management. While this alternative does not propose breaching the Errol Dam that expanded Umbagog Lake, it proposes actions to modify the flow and timing of water to mimic the annual natural historic high and low water events, within the requirement of the existing FERC license. In the uplands, it proposes actions to restore the structure and function of native vegetation which resulted from natural historic ice and wind storm events.

We have developed a habitat map for each alternative, presented with each respective alternative’s discussion later in this chapter, to help readers visualize how the refuge vegetation would look over the long-term after managing under each respective scenario. Using Geographical Information Systems (GIS) mapping tools and data sets, our habitat maps are a graphic representation of the potential vegetation that may result under each respective alternative at a coarse scale, and over an approximate 100-year time frame. While we describe in detail possible vegetation management actions within the 15-year CCP planning horizon for alternatives B and C, most of the distinct habitat changes would not be observable at this scale for at least 50 years. The maps are meant to compare the potential distribution of those habitat changes, but are not meant to identify exact locations for implementing a particular strategy on the ground. It will be up to our refuge staff to decide during the implementation phase what specific strategy applies to a particular site, at what level or timing it should apply, and exactly where it applies on a given site. These actions will be detailed in the

annual HMP (see “Refuge Step-Down Plans” below) and annual work plans. Appendix K provides additional, more specific details on our forest management proposals. It also includes a map of our habitat management units on current refuge lands, within which we propose that more active management would occur over the next 15 years (see map K-1).

Actions Common to All of the Alternatives

All of the alternatives share some common actions. Some are required by law or policy, or represent NEPA decisions that recently have gone through public review, and agency review and approval. Or, they may be administrative actions that do not necessarily require public review, but we want to highlight them in this public document. They may also be actions we believe are critical to achieving the refuge’s purpose, vision, and goals.

Service planning policy identifies 25 step-down plans that may be applicable on any given refuge. We have identified the 10 plans below as the most relevant to this planning process, and we have prioritized them. Sections of the refuge HMP which require public review are presented within this document and will be incorporated into the final version of the HMP immediately upon CCP approval. We will also develop an Annual Habitat Work Plan (AHWP) and Inventory and Monitoring Plan (IMP) as the highest priority step-down plans, regardless of alternative selected for implementation. These are described in more detail below. They will be modified and updated as new information is obtained so we can continue to keep them relevant. Completion of these plans supports all seven refuge goals.

All of the alternatives schedule the completion of these step-down management plans as shown.

- A HMP, immediately following CCP approval (see discussion immediately below, and discussion on NEPA requirements on page 2-16)
- An AHWP, within 1 year of CCP approval (see discussion below)
- A IMP, within 2 years of CCP approval (see discussion below)
- A LPP will accompany the final CCP (see appendix A)
- A Hunt Plan (last revised April 2007), within 2 years of CCP approval we will conduct separate NEPA analysis to update our Hunt Plan
- A Fishing Plan, within 2 years of CCP approval
- A Fire Management Plan within 2 years of CCP approval
- A Visitor Services Plan, within 3 years of CCP approval, and assuming a Visitor Services Professional (VSP) is hired; would incorporate hunt and fishing plans noted above
- A Law Enforcement Plan, within 3 years of CCP approval
- Facilities and Sign Plan, within 3 years of CCP approval

Habitat Management Plan

A HMP for the refuge is the requisite first step to achieving the objectives of goals 1–3, regardless of the alternative selected for implementation. For example, the HMP will incorporate the selected alternative’s habitat objectives developed herein, and will also identify “what, which, how, and when” actions and strategies

will be implemented over the 15 year time frame to achieve those objectives. Specifically, the HMP will define management areas, treatment units, identify type or method of treatment, establish the timing for management actions, and define how we will measure success over the next 15 years. In this CCP, the goals, objectives, and list of strategies under each objective identify how we intend to manage habitats on the refuge. Both the CCP and HMP are based on current resource information, published research, and our own field experiences. Our methods, timing, and techniques will be updated as new, credible information becomes available. To facilitate our management, we will regularly maintain our GIS database, documenting any major vegetation changes on at least a 5 year basis. As appropriate, actions listed below in “Actions Common to All Alternatives” will be incorporated into the HMP.

Annual Habitat Work Plan and Inventory and Monitoring Plan

The AHWP and the IMP for the refuge are also priorities for completion upon CCP approval. Regardless of the alternative chosen, these plans are also vital for implementing habitat management actions and measuring our success in meeting the objectives. The AHWP is generated each year from the HMP, and will outline specific management activities to occur in that year. The IMP will outline the methodology to assess whether our original assumptions and proposed management actions are, in fact, supporting our habitat and species objectives. Inventory and monitoring needs will be prioritized in the IMP. The results of inventories and monitoring will provide us with more information on the status of our natural resources and allow us to make more informed management decisions.

Coordinating Umbagog Lake Water Level Management

Under all alternatives, we will continue to work cooperatively with the FERC licensee of the Errol Project, FPLE. Specifically, under Article 27 of the current license, we would continue to develop a yearly water level management plan with the licensee and other regulatory agencies “to benefit nesting wildlife.” While we and others have expressed concerns about the impacts from fluctuating water levels, these concerns have not been evaluated and researched in sufficient detail for us to seek to modify the current water level plan. As such, we will continue to promote stable water levels during the nesting season to the extent possible. We will also work to complete a Memorandum of Understanding (MOU) with FPLE, the holder of the FERC license for the Errol Project, to coordinate activities within the FERC boundary. In addition, although not binding under the current license, we will continue to recommend to FPLE that they voluntarily manage water levels at other critical times of the year (e.g. during fall migration) to benefit wildlife.

Under alternatives B and C, objective 1.5, we have identified several future studies, and inventory and monitoring projects that will assist in evaluating the impacts from water level fluctuations. Implementing this activity supports refuge goal 1 relating to the conservation of open water, submerged aquatic vegetation, and wetlands habitats.

Control of Invasive Species

The Refuge System has identified management to control the establishment and spread of invasive species as a national priority. Fortunately, on this refuge, the threat is currently low. However, our objective is to ensure no new invasive species become established, and we will manage to control the spread of what does exist. To the extent possible, we will physically remove invasive species where they are encountered. Although we have not previously had the need, we propose to use approved glyphosate-based herbicides when determined by the refuge manager to be necessary to control invasive plants, after regional office review and approval. Of particular concern on the refuge are purple loosestrife, *Phragmites*, Eurasian milfoil, and Japanese knotweed.



Ian Drew/USFWS

Aerial view of a portion of the Floating Island National Natural Landmark

In conjunction with the HMP and IMP, we will develop a list of species of greatest concern on the refuge, identify priority areas with which to be vigilant, and establish monitoring and treatment strategies. Refer to the National Wildlife Refuge System Invasive Species Management Strategy released in May 2004 (USFWS 2004b) for additional tools, processes, and strategies. The 2004 report is complimented by a technical report issued in May 2005 by USGS, titled: The Invasive Species Survey: A Report on the Invasion of the National Wildlife Refuge System (USGS 2005). These reports together give both a status review and a management strategy for combating invasive species. In addition, we will stay abreast of Service policy revisions currently being reworked to facilitate implementation. Other strategies include:

- Survey the Floating Island National Natural Landmark (FINNL) and other unique or rare plant communities as a priority to ensure invasive plants do not threaten the integrity of these sites and implement treatments as warranted (see additional discussion on FINNL below);
- Institute proper care of all refuge equipment to avoid introduction or transport of invasive plants; Require researchers on the refuge to take steps to prevent transport of aquatic invasive plants and pathogens;
- Continue to work with state agencies to prevent introduction of invasive species to all water bodies on the refuge; increase enforcement to check boats and equipment to protect against invasive plant transport;
- Implement outreach and education programs, including signage, where appropriate, and actively support state initiatives on this topic; and,
- Develop special regulations on the refuge as warranted to control spread of invasive species.

Implementing this program supports refuge goals 1-3 relating to the conservation of open water and submerged aquatic vegetation, wetlands, floodplain and lakeshore, and upland forest habitats.

Implementing and Prioritizing a Biological Monitoring and Inventory Program

Establishing a foundation of information, or a baseline, from which to make management decisions is critical to achieving our goals. There is much we would like to know about the refuge's resources, including how they function or move across the landscape, and what threatens them. Unfortunately, there is not enough time or funding to accomplish all we would like to know. There are several studies we initiated recently, or plan to initiate, as soon as funding is available, including:

- Visitor use (initiated in 2007);
- Wildlife disturbance study (initiated in 2007);
- Other top priority activities we have identified as funding allows include:
 - ◆ An ecological systems analysis to identify the ecological processes that historically and currently influence the lake, determine lake bathymetry, identify wetlands functions and measures of integrity, and evaluate water quality; and,

- ◆ Baseline contaminants assessment.
- ◆ In conjunction with development of IMP, identify what inventory methods should be implemented to confirm the status and critical components necessary to sustain focal species and habitats identified in objective statements. Prioritize list and begin implementing by re-directing refuge biologist's time to priority inventory and monitoring activities;
- ◆ Continue to coordinate with state agencies and FPLE in the monitoring of bald eagle, osprey, and loon nests, and to evaluate the effectiveness of our protection measures. Objectives 1.6 and 2.3 identify the protection measures we currently implement, or propose to implement, to protect these birds from human disturbance during the nesting season under each alternative; pursue expanding this cooperative monitoring effort to forest dependent raptors suspected to be in decline;
- ◆ Within 3 years of CCP approval, in cooperation with the Lynx Recovery Team, determine whether a monitoring or inventory program on the refuge is warranted for lynx. Implement a program if there is consensus on its value. If survey results are favorable, and recovery experts agree the refuge can make an important contribution to lynx recovery, we will amend the HMP to include measures to sustain and enhance habitat for lynx; and,
- ◆ See discussion below on “deer wintering areas,” “vernal pools” and the “Floating Island National Natural Landmark.”

Implementing this program supports refuge goals 1-3 relating to the conservation of open water and submerged aquatic vegetation, wetlands, floodplain and lakeshore, and upland forest habitats.

Protecting Vernal Pools and other Unique or Rare Communities

Vernal pools and other unique or rare natural communities are important to the health, integrity, and biodiversity of the Upper Androscoggin watershed. Despite the small size, patchiness, and ephemeral nature of some of these habitats, their value is disproportionately significant. All alternatives recognize their importance and propose to promote their conservation.

Our objective is to conserve and maintain all natural vernal pools, including those pools imbedded in wetland or riparian habitats, on existing refuge lands and within the respective refuge expansion areas. Also, we will conserve and protect cliffs, talus slopes, and other unique, significant, or rare upland habitat types identified by Maine Natural Areas Program (MNAP) and NHHI on these same lands.

Strategies:

- Within 5 years of CCP completion, complete inventory for vernal pools and map in GIS. At a minimum, prior to any forest management activities, survey stands for vernal pools and insure best management practices are followed;
- Establish criteria for ranking vernal pools as to their conservation concern and need for management based on size, location, threats, productivity, seasonality, species diversity, and other parameters;
- Within 7 years of CCP completion, develop and implement management standards and guidelines to conserve vernal pool habitat; determine which pools should be protected by a no-disturbance buffer vs. those that should be managed and restored;

- Evaluate effectiveness of management and protection zones;
- Promote vernal pool conservation in refuge outreach programs;
- Within 7 years of CCP approval, cooperate with NHHI and MNAP to inventory and map the other rare and unique types in a GIS database; develop standards and guidelines for the protection and management of these types

Implementing this program supports refuge goals 1-3 relating to the conservation of open water and submerged aquatic vegetation, wetlands, floodplain and lakeshore, and upland forest habitats.

Removing Unnecessary Structures and Site Restoration

All alternatives include restoring to natural conditions, as soon as practicable, developed sites that are no longer needed for refuge administration or programs.

Strategies:

- Within 3 years of acquisition, continue to remove dwellings, such as cabins or other developed sites or structures, if determined they are surplus to refuge needs, and assuming funding is available. Re-grade sites to natural topography and hydrology and re-vegetate to establish desirable conditions.
- Within 3 years of CCP approval, complete demolition of the 12 camps already acquired as planned.
- Within 5 years of CCP approval, inventory and assess all access roads within the refuge, and on any newly acquired lands, and implement procedures to retire and restore unnecessary forest interior and secondary roads to promote watershed and resource protection. All off-road (ORV) and all-terrain vehicles (ATV) trails, and all unauthorized snowmobile trails, will be eliminated.
- Implementing this program supports refuge goals 2-3 relating to the conservation of floodplain, lakeshore and upland forest habitats.

Maintaining Partnerships

All of the alternatives would maintain the existing partnerships identified in chapter 3 and under Goal 6, objective 6.1, while also seeking new ones. These relationships are vital to our success in managing all aspects of the refuge, from conserving land, to managing habitats and protecting species, to outreach and education, and providing wildlife-dependent recreation. The NHTG and the MDIFW have been particularly important and valued partners. We will pursue new partnerships in areas of mutual interest that benefit refuge goals and objectives. We highlight two partnership efforts below. Implementing this program supports all refuge goals, with particular emphasis on goal 6 relating to conserving and managing wildlife resources through partnerships.

Land Conservation

One of our biggest partnership programs is focused on land conservation in the region. The decision document establishing the refuge (USFWS 1991) emphasized that the refuge was part of a larger conservation partnership to protect and manage timber, wetland, and wildlife resources of the Umbagog area. We carry that emphasis forward in the present plan. All alternatives include our continued participation in those partnerships with the goal to permanently protect and sustain Federal trust resources and other unique natural resource values in the Umbagog area and the Northern Forest ecosystem. An important component of this goal is an objective to improve connectivity between existing conservation tracts and preserve working forest and public access. Conservation partnerships in the region have evolved into a dynamic, landscape-level, multi-partner effort.

The list of partners is extensive and includes the Service, other Federal agencies, state agencies, private conservation organizations, local communities, private landowners, and private businesses. Appendix A, the LPP, includes a detailed description of some of the important accomplishments, as well as some current land conservation projects.

While the LPP focuses on land acquisition as a conservation strategy, we are also working with our partners to cooperatively manage important natural resources on other ownerships. One example is in Maine. In 2005, we assessed a U.S. Department of the Navy Training Facility in Redington, Maine, a unit of Brunswick Naval Air Station, which was included on the 2005 Base Realignment and Closure list. This property has since been removed from the Closure list. At the time, we determined the property had high Federal trust resource value and expressed an interest in acquiring it if it is ever officially excessed. In the meantime, we are pursuing a cooperative management agreement with the Navy to assist in managing its natural resources.

Community Relations

We will continue to work within community forums such as the Umbagog Area Chamber of Commerce and town meetings, and other venues. In addition, we will host one informal meeting each quarter in the area to share information or discuss topics of interest.

Permitting Special Uses, Including Research, Economic Uses and Camp Leases

All of the alternatives would require the refuge manager to evaluate activities that require a special use permit for their appropriateness and compatibility on a case-by-case basis. All research, commercial or economic uses, and camp leases require special use permits. Implementing this program supports refuge goals 1-3 relating the conservation of open water and submerged aquatic vegetation, wetland, floodplain, lakeshore and upland forest habitats, and goal 6, relating to conserving and managing wildlife resources through partnerships.

Research

Research on species of concern and their habitats will continue as a priority. Generally, we will approve permits that provide a direct benefit to the refuge, or for research that will strengthen our decisions on managing natural resources on the refuge. The refuge manager also may consider requests that do not relate directly to refuge objectives, but to the protection or enhancement of native species and biological diversity in the region and support the goals of the proposed Umbagog Lake Working Group, or recognized ecoregional conservation team, such as the Atlantic Coast or Eastern Brook Trout joint ventures.

All researchers will be required to submit detailed research proposals following the guidelines established by Service policy and Refuge staff. Special use permits will also identify the schedules for progress reports, the criteria for determining when a project should cease, and the requirements for publication or other interim and final reports. All publications will acknowledge the Service and the role of Service staff as key partners in funding and/or operations. Researchers will be required to take steps to insure that invasives and pathogens (particularly aquatic invasive plants and pathogens) are not inadvertently introduced or transferred to the Umbagog system. We will ask our refuge biologists, other divisions of the Service, USGS, select universities or recognized experts, and states of New Hampshire and Maine agencies to peer review and comment on research proposals and draft publications, and will share research results internally, with these reviewers, and other conservation agencies and organizations. To the extent practicable, and given the publication type, all research deliverables will conform to Service graphic standards.

Some projects, such as depredation and banding studies, require additional Service permits. The refuge manager will not approve those projects until all

*Working in partnership
to develop goals and
objectives*



required permits are received and the consultation requirements under the ESA have been met.

Commercial and Economic Uses

All commercial and economic uses will adhere to 50 CFR, Subpart A, §29.1 and Service policy which allow these activities if they are necessary to achieve the Refuge System mission, or refuge purposes and goals. Allowing these activities also requires the Service to determine appropriateness and prepare a compatibility determination and an annual special use permit outlining terms, conditions, fees, and any other stipulations to ensure compatibility.

Cabin (Camp) Leases

No modifications are proposed for the 29 cabin leases that currently exist under special use permit. These permits are renewed every year, assuming the terms of the permit are met, and until the 50 year lease is up. In addition, there are 4 properties under life-use agreements within the refuge boundary which are observed as private landholdings until the end of their life use.

- The cabin leases include certain conditions, such as (1) the camps must be maintained in a manner compatible with the purposes of the refuge and produce the least amount of environmental disturbance; and, (2) no new permits will be issued for construction of new camps on the properties. Most of these structures were built as summer fishing camps or seasonal cottages, but some have become year-round cottages. All the camp leases expire in 50 years from date of Service acquisition. We are not proposing any changes to lease agreements within the context of this CCP.

Distributing Refuge Revenue Sharing Payments

As we describe in chapter 4, we pay the following localities annual refuge revenue sharing payments based on the acreage and the appraised value of refuge lands in their jurisdiction: Errol, Cambridge and Wentworth Location in New Hampshire; and, Upton and Magalloway Plantation in Maine. These annual payments are calculated by formula determined by, and with funds appropriated by, Congress. All of the alternatives 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. Additional towns may be added with future acquisitions.

Conducting a Wilderness Review

As we described in chapter 1, Refuge System planning policy requires that we conduct a wilderness review during the CCP process. The first step is to inventory all refuge lands and waters in Service fee simple ownership. 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. The results of the wilderness inventory are included in appendix D. The entire refuge will undergo another wilderness review in 15 years as part of the next planning process. Specifically, any lands acquired in fee by the Service in the interim, along with existing refuge lands, will become part of that wilderness review in 15 years.

Conducting a Wild and Scenic Rivers Review

Service planning policy also requires that we conduct a wild and scenic rivers review during the CCP process. We inventoried the river and river segments which occur within the refuge acquisition boundary area and determined that five river segments met the criteria for wild and scenic river eligibility. These river segments and their immediate environments were determined to be free-flowing and possess at least one Outstandingly Remarkable Value. However, we are not pursuing further study to determine their suitability, or making a recommendation on these river segments at this time because we believe the entire river lengths should be studied (not just those on refuge lands) with full participation and involvement of our federal, state, local, and nongovernmental partners. The results of our Wild and Scenic River inventory are included in appendix E. All alternatives would provide protection for free-flowing river values, and other river values, pending the completion of future comprehensive inter-jurisdictional eligibility studies.

Fire Management

None of our alternatives propose to utilize management-prescribed fire as a habitat management tool within the 15-year life of this CCP. While the chance of natural ignition is low, should a wildland fire occur, all alternatives also propose to rapidly and aggressively suppress it in areas where property is likely to be threatened according to the guidance in appendix I, "Fire Management Program Guidance." Our suppression objective is to avoid property damage, minimize human health or safety concerns, and reduce the likelihood of resource damage. Fire is not a prevalent natural ecosystem process in the Northern Forest. It has been suggested by researchers that stand-replacement fire intervals are at 800+ year intervals in most regional forest types (Lorimer 1977). However, given Northeast Regional climate change predictions, the average temperatures may increase, especially in the summer, will be coupled with little change in summer rainfall and result in more frequent, short-term droughts (NECIA 2007). This, in turn, could alter the natural fire regime and result in more frequent fires, or a catastrophic one. We will use an adaptive management approach and monitor changing conditions. If necessary, we could conduct prescribed burns to minimize the threat of a catastrophic fire event.

Protecting Cultural Resources

As a Federal land management agency, we are entrusted with the responsibility to locate and protect all historic resources, specifically archeological sites and historic structures eligible for, or listed in, the National Register of Historic Places. This applies not only to refuge lands, but also on lands affected by refuge activities, and includes any museum properties. As described in Chapter 3, "Description of the Affected Environment," consultation with the Maine and New Hampshire SHPOs indicates there are five recorded archeological sites within the refuge area. Considering the topography of the area and proximity to water courses, it is likely that additional prehistoric or historic sites may be located in the future. Archeological remains in the form of prehistoric camps sites or villages would most likely be located along streams and lakes where early inhabitants would have ample water, shelter, and good fishing and hunting opportunities.

Under all alternatives, we will conduct an evaluation on the potential to impact archeological and historical resources as required, and will consult with respective SHPOs. We will be especially thorough in areas along the lake and streams where there is a higher probability of locating a site. These activities

will ensure we comply with section 106 of the National Historic Preservation Act, regardless of the alternative. That compliance may require any or all of the following: a State Historic Preservation Records survey, literature survey, or field survey.

Refuge Staffing and Administration

Staffing and operations and maintenance funds over the last 5 years are presented in chapter 3. Below we describe activities related to staffing and administration that are shared among the alternatives; some are new, others are on-going. Implementing these activities supports all seven refuge goals.

Permanent Staffing and Operational Budgets

Under all alternatives, our objective is to sustain annual funding and staffing levels that allow us to achieve our refuge purposes, as interpreted by the goals, objectives, and strategies. Many of our most visible projects since refuge establishment, including land acquisition, were achieved through special project or “earmarked” funds that typically have a 1- to 2-year duration. While these funds are very important to us, they are limited in their flexibility since they typically can not be used for any other priority project that may arise.

In response to Refuge System operational funding declines nationwide, our region plans to initiate a new base budget approach in FY 2007. The goal is to have a maximum of 75% of a refuge station’s budget cover salaries and fixed costs, while the remaining 25% or more will be operations dollars. The intent of this strategy is to improve the refuge manager’s capability to do the highest priority project work and not have the vast majority of a refuge’s budget tied up in inflexible, fixed costs. Unfortunately, in a stable or declining budget environment, this may also have implications to the level of permanent staffing.

Appendix F lists our RONS and SAMMS construction and maintenance projects currently listed in those databases, and indicate the regional and refuge ranking. We also included new projects not yet in the databases, but proposed under alternative B. Once approved, if funding is not available, we will continue to seek alternate means of accomplishing our projects; for example, through our volunteer program, challenge cost share grants, or other partnership grants, and internships. The SAMMS projects include a list of backlogged maintenance needs.

Under all alternatives, and within the guidelines of the new base budget approach, we would seek to fill our currently approved, but vacant positions which we believe are needed to accomplish our highest priority projects. Alternatives B and C also propose additional staff to provide depth in our biological and visitor services programs. We identify our recommended priority order for new staffing in the appendix F RONS tables. The alternatives also seek an increase in our maintenance staff since they provide invaluable support to all program areas. Appendix H identifies the staffing requests under each alternative.

Youth Conservation Corps

All alternatives would maintain the annual youth conservation corps (YCC) program which has generally consisted of a crew of four to five persons (15-18 years old), and a crew leader. This has been a very popular program in the local community because youth employment opportunities are limited in this rural area. The crew accomplishes many important tasks in support of our biological and visitor services programs. If enough funding can be secured, we will expand this program to support two crews.

Facility and Fleet Maintenance

All of the alternatives include the periodic maintenance and renovation of existing facilities to ensure the safety and accessibility for staff and visitors. Our

current facilities are described in chapter 3. They include administrative facilities such as refuge quarters, refuge office, and the maintenance shop off Mountain Pond road. Visitor facilities to be maintained under all alternatives include: the 1/3 mile Magalloway River trail and new ¼ mile extension, sign, and viewing platform; and, 2 roofed, wooden information kiosks. A Magalloway River canoe trail and launch site project will be opened in 2008 and will also require periodic maintenance. Any new facilities recommended in the final CCP, once constructed, will be placed on the maintenance schedule. All facilities and fleet maintenance and upgrades would incorporate ecologically beneficial technologies, tools, materials, and practices.

Appropriateness and Compatibility Determinations

Chapter 1 describes the requirements for appropriateness and compatibility determinations. Appendix C includes proposed appropriateness findings and compatibility determinations to support the activities in alternative B, the Service-preferred alternative. Our CCP will include the final approved compatibility determinations for the management alternative selected. We will only allow activities determined compatible to meet or facilitate refuge purposes, goals, and objectives.

The following are stipulations to incorporate into existing or future compatibility determinations:

- Access for non wildlife-dependent activities on the refuge will occur only on certain designated trails.
- Visitor motorized vehicle access on refuge roads is limited to street-registered passenger vehicles up to one-ton hauling capacity in designated areas; no ORV or ATV use will be allowed.
- When the Service acquires land in the proposed expansion area in full, fee-simple ownership, we would allow public access and compatible public recreation, and other refuge uses, consistent with what we currently allow, or propose to allow, on the existing refuge lands. When a conservation easement, or a partial interest, is purchased, the Service's objective is to obtain all rights determined necessary to insure protection of Federal trust resources on that parcel. Typically, at a minimum, the purchase would include development rights. However, we may also seek to obtain the rights to manage habitats, and/or to manage public use and access, if the seller is willing and we have funding available.

The refuge manager has determined that all six priority public uses are compatible, although some have stipulations as detailed in appendix C. Non-priority uses that the refuge manager proposes are compatible on this refuge with stipulations are also detailed in appendix C. These include forest management, research, camping, recreational gathering of blueberries, blackberries, strawberries, raspberries, mushrooms, fiddleheads, and antler sheds, snowmobiling, horseback riding, bicycling, and dog sledding.

Activities Not Allowed

The 1997 Refuge Improvement Act states that "compatible wildlife-dependent recreation is a legitimate and appropriate general public use of the System." Compatible hunting, fishing, wildlife observation and wildlife photography, and environmental education and interpretation are the priority general wildlife-dependent uses of the Refuge System. According to Service Manual 605 FW 1, these uses should receive preferential consideration in refuge planning and management before the refuge manager analyzes other recreational opportunities for appropriateness and compatibility.



Jennifer Casey/USFWS

Sunset on Harper's Meadow

We have received requests for non-priority, non-wildlife dependent activities that have never been allowed on this refuge. Activities evaluated by the refuge manager and determined not to be appropriate on refuge lands include: ATV, ORV or motorbike use, field trials for dogs, and geocaching. Appendix C documents the refuge manager's decision on their appropriateness. Most of these activities are sufficiently provided elsewhere nearby on other ownerships, so the lack of access on the refuge does not eliminate the opportunity in the Umbagog Lake 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.

Refuge Operating Hours

All of the alternatives will open the refuge for public use from ½ hour before sunrise to ½ hour after sunset, seven days a week, to insure visitor safety and protect refuge resources. The only regular exception is for overnight use by visitors with camping permits in designated camping sites. However, the refuge manager does have the authority to issue a special use permit to allow others access outside these timeframes. For example, research personnel or hunters may be permitted access at different times, or organized groups may be permitted to conduct nocturnal activities, such as wildlife observation, and educational and interpretive programs.

Boating Access

Under all alternatives, we would maintain the following boat access sites: the Upper Magalloway River car-top launch; the current office headquarters (Brown Owl) boat launch; and the Steamer Diamond boat launch. Our plans are to open the Upper Magalloway launch site and restroom in 2008. The current office headquarters site will have some minor improvements done to increase visibility for those using trailers and to provide additional signage to warn oncoming traffic.

Changing the Refuge's Name

Under all alternatives, we propose to change the name of the refuge to "Umbagog National Wildlife Refuge" for several reasons. The refuge consists of lake, riverine, and significant uplands habitats. The current name focuses entirely on the lake. In addition, an expansion of riverine and upland habitats is proposed under alternatives B and C, some of which lies as far as 6 miles from the lake. Also, this is a name recommended to us by local residents. We believe the new name is a better representation of the broader geographic context and management emphasis we would pursue under all alternatives.

Adaptive Management

As has been the case in the management of this refuge to date, all of the alternatives will include flexibility in management to allow us to respond to new information, spatial and temporal changes and environmental events, whether foreseen or unforeseen, or other factors that influence management. Our goal is to be able to respond quickly to any new information or events. The need for flexible or 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 will continually evaluate management actions, both formally and informally, through monitoring or research, to consider whether our original assumptions and predictions remain valid. In that way, management becomes a proactive process of learning what really works. On March 9, 2007, Secretary of the Interior Kempthorne issued Secretarial Order No. 3270 to provide guidance on policy and procedures for implementing adaptive management in departmental agencies. In 2007, an intradepartmental working group developed a guidebook to assist managers and practitioners: "Adaptive Management: The U.S. Department of Interior Technical Guide." It defines adaptive management, the conditions under which we should consider it, and the process for implementing it and evaluating its effectiveness. You may view the guidebook at <http://www.doi.gov/initiatives/AdaptiveManagement/documents.html>.

Adaptive management, as it relates to refuge management, promotes flexible decision-making through an iterative learning process that readily responds to uncertainties, new information, monitoring results, and variability in the ecosystems. It is designed to facilitate more effective decisions and enhance benefits. This process will be especially critical as we deal with the uncertainty surrounding the extent and potential impacts of climate change. Given that climate change is expected to exacerbate the current rate of habitat loss, change habitat composition and structure, simplify and fragment habitat, increase the prevalence of weed and pest species, and degrade water quality and alter hydrology, it is incumbent on us as land managers to continually evaluate our management activities and the status of the refuge's resources, and respond to those impacts in a meaningful way as quickly as possible.

Many of the management actions we propose in the alternatives could help minimize the regional impacts of climate change. Our landscape-level partnership with numerous conservation organizations, coupled with our refuge expansion proposals, would result in more stable, resilient habitats across the landscape, and help reduce other anthropogenic (non-climate) stressors. Conserving and connecting protected lands provides wildlife migration corridors, maintains a refugium for species on the edge of their range, removes dispersal barriers and establishes dispersal bridges, protects hydrology, and increases the ecological, genetic, geographical, behavioral and morphological variation in species. Our plans to control invasive plants, maintain the integrity and function of forest floodplains and wetlands, and promote forest health and diversity, could also minimize climate change impacts.

At the refuge level, monitoring and assessing management actions and outcomes, and tracking critical resources and indicators of forest ecosystem health, will be very important. The refuge manager will be responsible for changing management actions and strategies if they do not produce the desired conditions. Significant changes in management from what we present in our final CCP may warrant additional NEPA analysis and public comment. Minor changes will not, but we will document them in our project evaluation reports or annual reports.

Generally, we can increase monitoring and research that supports adaptive management without additional NEPA analysis, 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 elements. Our Inventory and Monitoring Plan (IMP; see discussion on step-down plans below) will determine what we plan in the future. Also, see the discussion on additional NEPA analysis requirements below. Implementing an adaptive management approach supports all seven goals of the refuge.

Actions Common to Alternatives B and C Only

Implementing Forest Management to Achieve Habitat Objectives

Alternatives B and C propose forest management, including tree cutting, as one of several tools to achieve respective habitat objectives for the Federal trust resources, specifically the refuge focal species, identified in goal 3. Under both alternatives, all commercial and non-commercial tree cutting would adhere to accepted silvicultural prescriptions, and the best management practices in each respective state at a minimum. Management activities would be planned to insure that habitat for species requiring large unfragmented habitat blocks is not compromised. Appendix K, “Forest Management Guidelines” describes desired future conditions, silvicultural methods and treatments, and other operational guidelines we would utilize, and identifies proposed locations for management. However, these details may be refined as we acquire site-specific stand exam data.

Regardless of alternative, we expect that forest management to support habitat and focal species objectives in the next 15 years would primarily occur on Service-owned fee lands within the current, approved refuge boundary and in the management units identified in appendix K. In particular, at this time we do not predict that we would conduct any commercial tree cutting in the proposed expansion areas during the 15 year life of this CCP for several reasons.

We cannot accurately predict, but assume it is years away, when we would acquire forest tracts large enough to make a meaningful forest management unit and to create an economically-viable, commercial harvest operation. In addition, once acquired, and assuming funds are available for project work, we would need to conduct a stand exam; map habitat management units and management operational zones; develop management prescriptions; conduct field site-prep and layout work; and, write and implement a contract. However, more importantly, it is our expectation that any forested lands acquired in the proposed expansion areas within the next 15 years, would be harvested to a low stocking density by the current owner before property transfer, and thus, would preclude a commercial harvest in support of our management objectives. This has been our experience with past refuge acquisitions of forested lands. As a result, under either alternative B or C, we predict at this time that our management activities in the proposed expansion areas, within the 15 year life of this CCP, would be more pre-commercial operations in nature, such as thinning, habitat restoration (e.g. restoring log landings, slash piles, etc), and/or vegetation manipulations to create openings and enhance woodcock habitat in woodcock focus areas (map 2-2).

Forest regeneration on refuge land

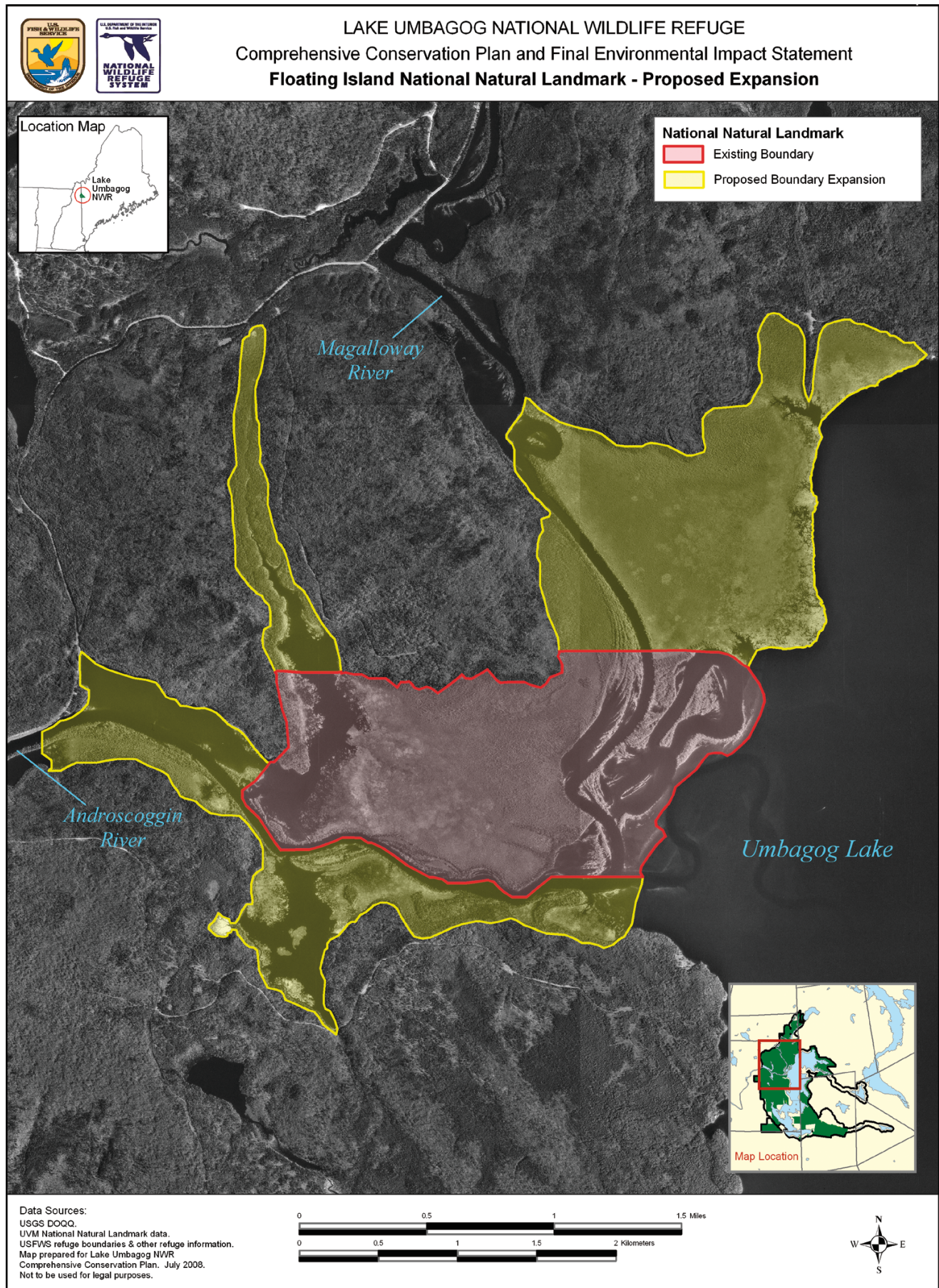


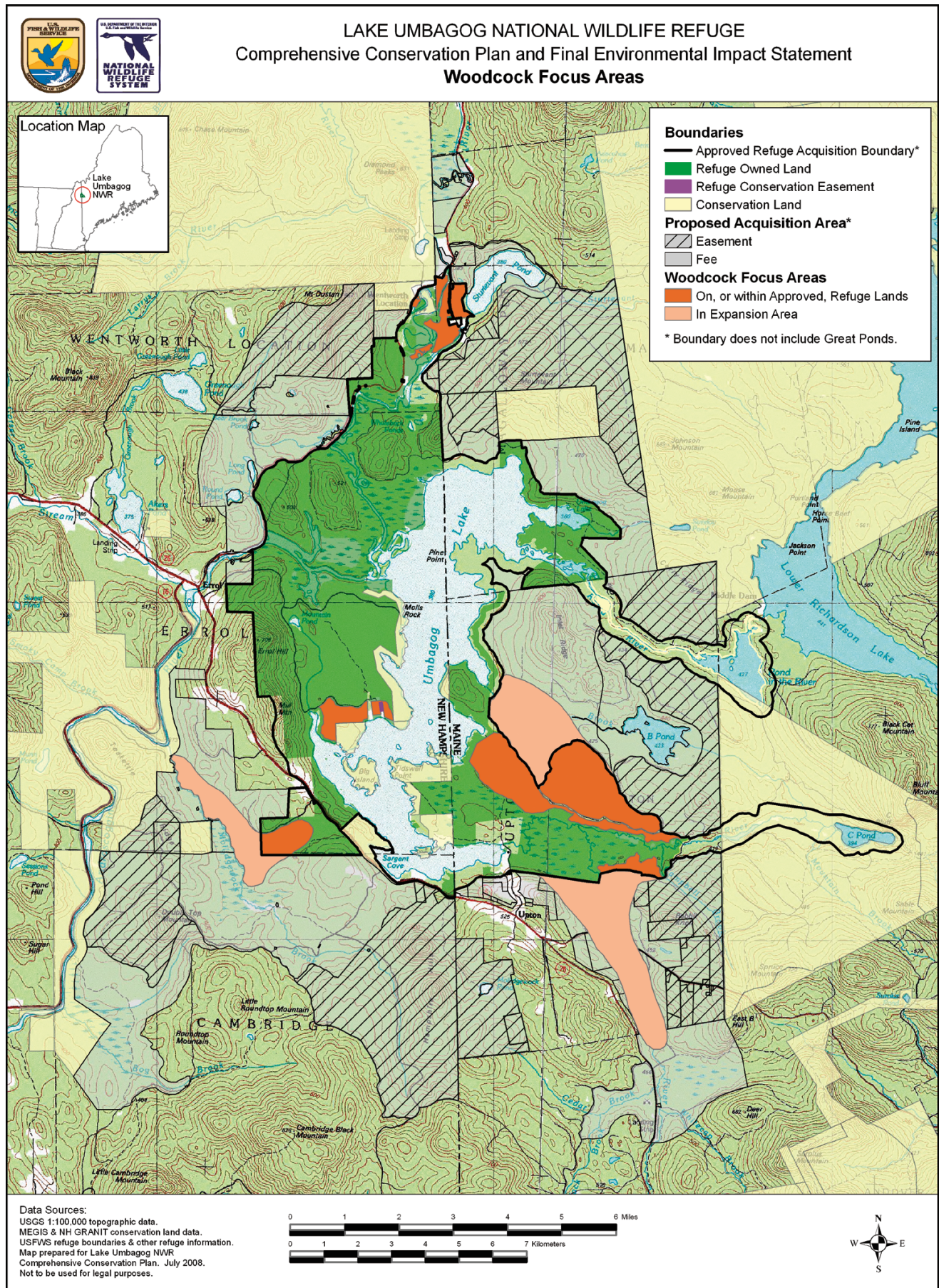
Bill Zinni/USFWS

Prior to implementing any forest management under alternatives B and C, we would plan to collect detailed stand-level information in the proposed forest management areas to insure that management prescriptions and decisions are based on the best available information. We would also evaluate the effects of our management on a refuge-wide scale, to insure that management activities do not adversely impact species requiring unfragmented habitat. Additional strategies are noted below. Implementing this program supports refuge goal 3 relating to the conservation of upland forest habitats.

Strategies:

- Hire a forester and begin a detailed forest inventory and stand map on currently owned refuge lands; within 4 years of CCP approval, complete a forest management plan, amending the HMP as warranted. Consider using a contractor to conduct field work if a forester position is not filled, so that timeframes can be met.





- On lands we acquire in the future with management potential, and if they are acquired in at least 200 acre contiguous, viable management units, we would plan to complete a stand-level evaluation, and map habitat management units and management operational zones within 2 years of acquisition; amend the HMP as warranted.

Expanding and Protecting the Floating Island National Natural Landmark

In chapter 3 we describe the establishment of the FINNL in 1972. It was chosen by the National Park Service (NPS) as an example of an exemplary native bog community. It is currently 860 acres and lies entirely within the refuge boundary.

In cooperation with the NPS, alternatives B and C would expand the boundary of the FINNL to one that is more ecologically-based using the 2002-2003 vegetation survey results (see map 2-1). This new boundary would encompass 2,181 acres. Within 5-10 years of CCP approval, we would conduct all administrative procedures with NPS to expand the boundary and convene a workshop with wetlands ecologists to determine what information should be collected and what monitoring should occur to document any potential loss or degradation of the area. We would also establish a baseline from which to compare subsequent information.

Implementing this program supports refuge goal 1 relating to the conservation of open water and submerged aquatic vegetation and wetland habitats.

Creating an Umbagog Lake "Working Group"

Alternatives B and C propose that within 3 years of CCP completion, an Umbagog Lake Working Group would be created. Members would include representatives from those state and federal agencies with management authority of the lake and its natural resources and recreational opportunities, as well as the holder of the Federal Energy Regulatory Commission (FERC) license, Florida Power and Light Energy (FPLE). The mission of the group would be to voluntarily coordinate, facilitate, and/or streamline management as a partnership to reduce resource threats and resolve user conflicts on the lake and associated rivers. This partnership would not function as a regulatory or enforcement entity, although members may propose changes in existing regulations to their respective regulatory authorities to facilitate a management goal. Some of the priority projects we propose the working group consider are listed below; additional strategies specific to alternatives B and C are included in objective 6.2:

- Work with states to eliminate the use of lead fishing tackle; in conjunction, evaluate the potential for wildlife to ingest lead (bio-availability) from this and other sources in the surrounding lake and rivers;
- Work with State of New Hampshire to evaluate no-wake exemption on Magalloway and Androscoggin rivers which allows high speed boat operation within 150 feet of shoreline
- Cooperatively evaluate area closures to determine if changes to current protection measures are warranted;
- In coordination with states of Maine and New Hampshire agencies, conduct outreach at known user conflict sites such as the Rapid River, and boat launch sites;
- Develop boater ethics programs for the lake and rivers and develop outreach materials for distribution at boat launch sites; and,
- Identify sources of point and non-point sediment and nutrient loading (e.g. septic systems, erosion, forest and other land use practices, etc) impacting refuge wetlands, Umbagog Lake, and associated lakes and rivers, and address these sources where possible.

Implementing a Furbearer Management Program

Our objectives under Alternatives B and C discuss specific habitat conditions and bird breeding densities (e.g. nesting pairs) and productivity goals. There are times when individual furbearing animals, or local concentrations of those animals, impact our ability to achieve priority resource objectives. Protecting human health and safety, maintaining roads, trails, houses and other infrastructure, as well as concerns with impacts on other native wildlife and habitats are a few of the other reasons furbearers might need to be managed. Both non-lethal and/or lethal techniques could be employed in any given situation. We would analyze each situation where these techniques would be employed and choose the most appropriate method to achieve our goals. Trapping is one tool that could be used at the refuge manager’s discretion to achieve an administrative or resource management objective. We intend to consider public trapping to achieve our goals if active management is identified; however, the actual details of how to accomplish this objective would require further analysis of possible alternative methods, and would be laid out in a Furbearer Management Plan, in a separate NEPA process. Implementing this program supports refuge goals 1-3 relating the conservation of open water and submerged aquatic vegetation, wetland, floodplain, lakeshore and upland forest habitats.

Strategies:

- Within 3 years of CCP approval, begin NEPA analysis, including public involvement, associated with developing a Furbearer Management Plan; establish furbearer management units as warranted; identify where habitat management or reintroductions, increases, or reductions of native furbearer species, such as beaver, is desirable.
- Work with States of New Hampshire and Maine to determine population estimates and how refuge fits into the state’s management strategies.

Hunting and Fishing Programs

For the next two years, we would continue to implement our current hunting program, which we describe in chapter 3, except for one minor change. That change is that we would work with the local waterfowl club to evaluate placement of the existing six blinds.

Within two years, however, under alternatives B and C we would begin the administrative process to expand our hunting program, in particular, to accommodate a turkey hunt in both states, and a bobcat hunt in New Hampshire. We would conduct a separate NEPA analysis and include public involvement during that evaluation. If approved, we will update our Hunt Plan and complete all other administrative requirements to create an opening package.

With regards to fishing, we plan to formally open the refuge to fishing, which has not been done to date. Within 2 years of CCP approval, we would complete a Fishing Plan and all other Service administrative process requirements to officially open the refuge to fishing.

New Refuge Headquarters and Visitor Contact Facility

New Refuge Headquarters and Visitor Contact Facility

Alternatives B and C seek a new location for the main administrative and program headquarters office. In conjunction with our state partners, Service Visitor Service’s Specialists, and the core planning team, we identified a list of site selection criteria. Four prospective sites on current refuge lands met most, if not all, of those criteria. We hired Oak Point Associates to evaluate the feasibility and economics of constructing a facility at those four prospective sites, as well as compare them to upgrading our current headquarters office on Route 16 in Errol. Their January 21, 2005 final report can be reviewed at refuge headquarters.

In summary, some of the site-selection criteria include a location: on existing refuge lands, have ready access to the lake for both staff and visitors; on a site already developed or disturbed; on a site immersed in a natural setting with

a diversity of habitats to facilitate an interpretive trail, visitor programs, and outreach on refuge purposes, management, and the refuge's role in wildlife resource conservation in the Northern Forest. The four new sites were all located at the southern end of the lake and referred to as: the Potter Farm site, Thurston Cove site (option A and B), and the State Border site.

Our evaluation of the Oak Point Associates report, together with discussions and a concurrence by our state partners and local Errol officials, resulted in a consensus to propose the new facility be located at the Potter Farm site. While the Potter Farm site is common to alternative B and C, the size of the facility differs depending on the alternative. Alternative B proposes a small office facility, as defined by the new Service facility standards, while alternative C proposes a medium office facility. Under alternatives B and C, the existing headquarters building would be maintained as a research or auxiliary field office. In addition, alternatives B and C would remove the adjacent small cabin at the current headquarters site.

Our Director, via Director's Order 144, and our regional leadership team have identified facility energy and resource conservation as a priority. As such, any new buildings or building upgrades will incorporate ecologically sound and environmentally beneficial technologies, tools, materials, and practices, including building design and construction, water and energy consumption, wastewater management, and solid and hazardous waste management.

Providing Other Visitor Service's Facilities

In conjunction with the proposal to develop a new administrative and visitor contact facility, alternatives B and C propose to construct a series of interpretive trails at the Potter Farm site. A conceptual design and tentative location for a Potter Farm trail were identified by Oak Point Associates in their report. The proposed trail is approximately 2 miles long, and would be designed to allow travel by people with disabilities.

Alternatives B and C also propose additional visitor facilities along major travel routes, including roadside pullouts on Routes 16 and a roadside pullout with overlook platform on Route 26. Each of these sites would have an information kiosk, and provide parking for several vehicles. Both alternatives include a ¼ mile loop extension to the Magalloway River trail accessible to people with disabilities (see maps 2-8 and 2-13). Each of these projects would facilitate wildlife observation, nature photography and interpretation of the refuge's resources. Implementing these activities would support goals 4 and 5 relating to opportunities for high quality hunting, fishing, wildlife observation and photography, and environmental education and interpretation.

Both alternatives B and C deal with public road access similarly. Maps 2-8 and 2-9 depict our proposal on which roads to designate as public routes of travel on both current and proposed expansion refuge lands. The public will be allowed access over these designated roads at their own risk and under the current conditions. It is our intention to maintain the designated roads in a way similar to how they were maintained under previous landowners. Major maintenance of designated roads will occur periodically, especially prior to, during, and post, logging operations. Otherwise, only minor maintenance will occur until the roads are needed again for management purposes. Road maintenance will be done both by refuge staff and private contractors.

Additional NEPA Analysis

NEPA generally requires site-specific analysis and disclosure of impacts in either an environmental assessment (EA) or an EIS for all major federal actions. Other routine activities are categorically excluded from the NEPA requirements to prepare detailed environmental documents. Those generally include administrative actions, and are listed in chapter 4.

Many actions that are proposed in the three alternatives are described and analyzed in enough detail to comply with NEPA, and would not require additional environmental analysis. Although this is not an all-inclusive list, the following project examples fall into this category: the HMP, including its forest and wetlands habitat management programs; the IMP; expanding or reducing priority public use programs, including the fishing program, but excepting the hunting program; new visitor services infrastructure planned; development of a new headquarters and visitor contact facility; and controlling invasive plants

We acknowledge that the proposed additions to the hunt programs under alternatives B and C, and the proposal to implement a furbearer management program (assuming it includes a general public trapping season), are not analyzed in sufficient detail in this document to comply with NEPA and would require further environmental analysis before implementation.

Based on public scoping and internal agency discussions, the following alternatives or actions were considered, but eliminated from further study.

Alternatives or Actions Considered but Eliminated from Further Study

1) Allow a commercial entity to run campsites on refuge lands.

Since the refuge was established, a cooperative management partnership between state and federal agencies has been in place to conserve the unique wildlife habitat and recreational experiences at Umbagog Lake. Having the NH DRED- Division of Parks and Recreation manage the remote lake campsites on the refuge, as well as on those on adjacent state lands, provides maximum flexibility in campsite management on the lake. This arrangement allows us to work directly with the state to adjust campsite locations, level of use, and time of operation, in order to meet our biological objectives. Given this consideration, allowing a commercial entity to run the camp sites was eliminated from further study.

2) Recommend Errol dam removal.

This alternative was considered not practicable, due to the current hydroelectric facility and the significant impact to the local socio-political environment. Additionally, insufficient information is known on the effect such an action would have on existing refuge resources.

3) Recommend the Service purchase and manage the dam, or advocate for another conservation owner to purchase the dam.

This alternative was considered but eliminated from further study, as insufficient information is available to determine if current management is having a significant effect on refuge resources, or if alternative management would assist the refuge in accomplishing our goals and objectives. Nor do we have information indicating that continued operation of the Errol dam for hydroelectric power generation is inconsistent with achieving our goals and objectives. Accordingly it is not clear that it would assist in accomplishing our goals and objectives. Should such information come to light, the Federal Power Act provides the government with the right to pay the licensee the value of the dam and take it over on expiration of the current license. As noted on page 1-36, however, the license and this CCP both expire in 2023, and actions in re-licensing are beyond the scope of this CCP. Accordingly the option of taking over the dam during the remainder of the current license was eliminated from detailed study for this CCP. It may be revisited as an option in the next planning cycle, and when considering the Service's position in re-licensing.

4) Petition FERC to reopen the license and renegotiate the terms.

This alternative was considered but eliminated from further study because, as discussed on page 1-36 reopening the license is outside the Service's jurisdiction. Additionally, as noted above, insufficient information is available to determine

Tyler Cove



Ian Drew/USFWS

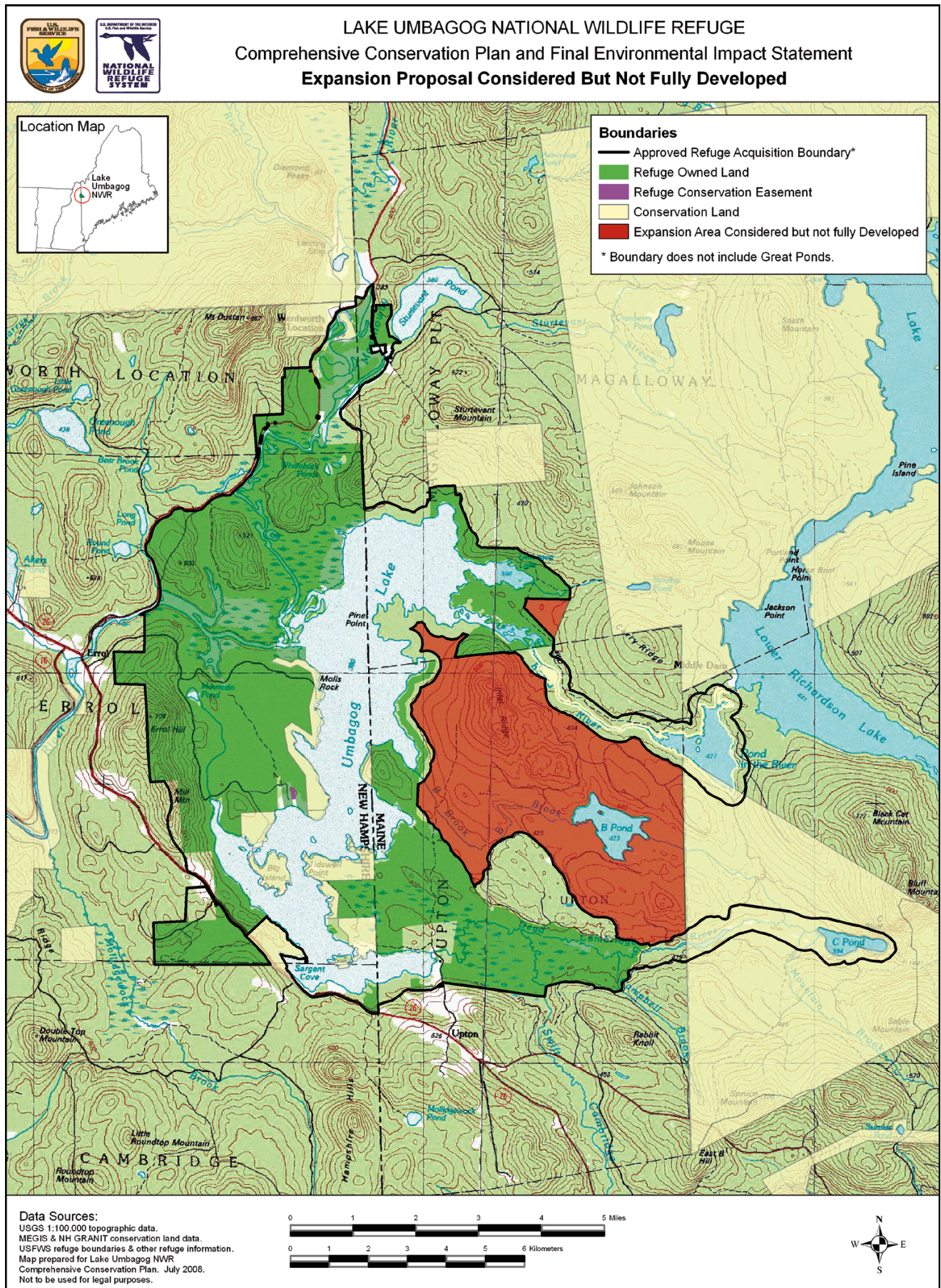
if current management is having a significant effect on refuge resources, or if alternative management would assist the refuge in accomplishing our goals and objectives. Nor do we have information indicating that continued operation of the Errol dam for hydroelectric power generation is inconsistent with achieving our goals and objectives. Accordingly, it is not clear that re-opening the license and re-negotiating its terms would assist in accomplishing our goals and objectives. If sufficient information is obtained over time indicating that different license articles would be more protective of refuge resources, different terms may be pursued in re-licensing. As noted elsewhere, the Service's actions in re-licensing are beyond the scope of this CCP, because this CCP will expire at roughly the same time as the current license.

5) Manage the refuge's forests for present net value and operate similar to a commercial private timber company.

The 1997 Refuge Improvement Act identifies wildlife conservation as the refuge's primary mission. Commercially-driven forest management actions may meet some of the refuge's biological goals and objectives. In those cases, we may manage similar to a private timber company; however, insuring a profit would not be the principal motivating factor for the management prescriptions. Rather, our management objectives would be based on providing the greatest benefit to focal species, their habitats, and other resources of concern. This alternative was not fully developed because, in and of itself, it would not meet the goals and objectives we have established for the refuge.

6) Consider a refuge expansion alternative that includes only the approximately 8,578 upland acres in Upton, Maine that was identified for protection by the Lands for Maine's Future Board in the original 1991 refuge decision document (map 2-3).

In the 1991 decision to establish the refuge, there was a recommendation, based on agreements with state partners during the cooperative planning effort, that certain lands adjacent to the refuge be acquired by respective state agencies to insure the permanent conservation of the lake and its resources. Most of the lands originally identified are in conservation status except for an area in Upton, Maine including B Pond and B Brook. The state of Maine has not conserved



these lands to date and it does not appear they will have the resources to do so. This entire area, approximately 8,578 acres, is encompassed within both our alternative B and C expansion area proposals. As such, it is included as part of a larger conservation proposal. In our opinion, it is an important component of both expansion proposals, but in and of itself, would not achieve our goal to make a significant contribution to watershed protection for current refuge resources, habitat conservation for focal and trust species such as blackburnian warbler, nor would it provide the level of connection to other conserved lands for wide-ranging mammals.

*Fall colors
on the refuge*

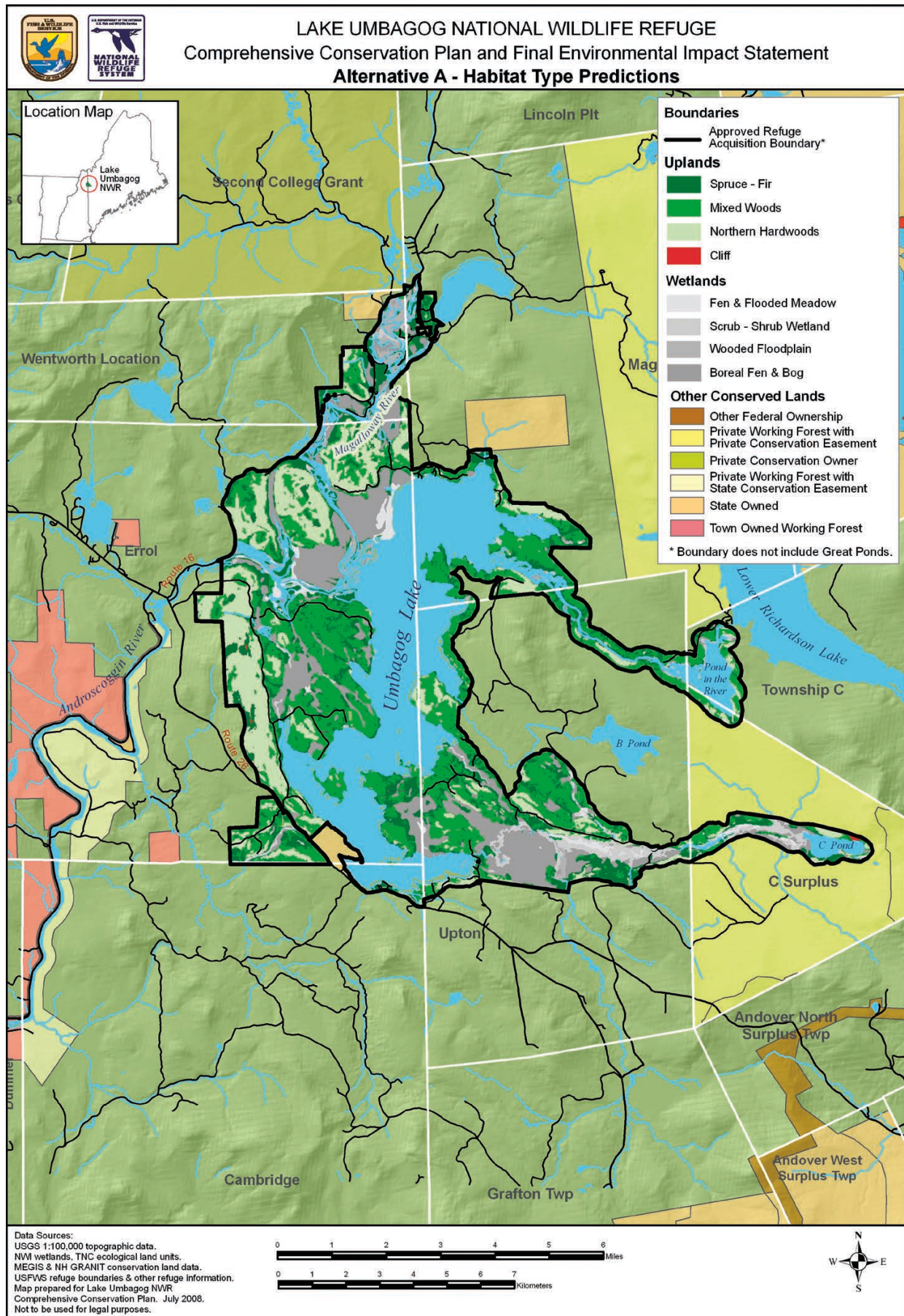


USFWS

Alternative A. Current Management

Introduction

This alternative portrays current management, including activities previously undertaken, or already planned or approved, and is the baseline for comparing the other two alternatives. Our biological program would continue its present priorities such as: cooperating with partners in the monitoring of loon, bald eagle, and osprey populations on the lake; protecting loon, bald eagle, and osprey active nest sites from human disturbance on refuge lands; and, conducting annual bird and amphibian inventories according to regional protocols. We would continue these projects with the help of volunteers, our conservation partners, and using our own staff as funding and staffing allow. Biological research studies would continue to be facilitated if they would benefit the Service and are determined compatible by the refuge manager. Map 2-4 depicts the broad habitat types we predict would result under implementation of alternative A management objectives after approximately 100 years. This map should be compared to maps 2-7 and 2-12, predicting the long-term habitat changes under alternative B and C implementation, respectively. The acreage figures presented are approximations based on GIS mapping from several data sources.



With regards to visitor services, we would continue to offer hunting and fishing opportunities on refuge lands, and respond to requests for interpretive and school programs; however, we would not be able to meet most requests due to limited staff and resources. We would also continue to partner with the State of New Hampshire to provide remote camping sites on Umbagog Lake. Snowmobiling would continue to be allowed with use confined to the designated trails. The Magalloway River Trail would continue to be the only walking trail maintained on the refuge. We would continue to coordinate two annual community events: the Wildlife Festival, and Take Me Fishing. Map 2-5 depicts the public use facilities under current management.

We would continue to seek acquisition from willing sellers of the 7,482 acres that remain within our currently approved acquisition boundary.

Goal 1 Manage open water and submerged aquatic vegetation and wetlands to benefit Federal trust species and other species of conservation concern.

Objective 1.1 (Fen and Flooded Meadow)

Manage 566 acres of fen and flooded meadow within the existing, approved refuge boundary for breeding and migrating American black duck, and other waterfowl species of conservation concern, including ring-necked duck, common goldeneye, and common and hooded merganser.

Rationale

Umbagog Lake is identified as one of three waterfowl focus areas in New Hampshire under the NAWMP (Atlantic Coast Joint Venture 2005). The Refuge supports the highest concentrations of nesting black ducks and ring-necked ducks in New Hampshire (USFWS 1991). The black duck is a species of concern in the NAWMP because of the historic decline in their population, with habitat loss an important contributing factor. The regional importance of Umbagog Lake to black duck was one of the reasons the refuge was established. Though black duck populations are stable or increasing, they are listed as highest priority for conservation in BCR14 (Dettmers 2005).

Other important justifications for establishing the refuge were: conserving the regional ecological significance of the wetlands including and surrounding Umbagog Lake; conserving the diversity of wildlife supported by these wetlands, including several rare and declining species; and, the protection of water quality. Refuge designation was encouraged to ensure the permanent protection of important wetlands since land development and other land use changes seemed imminent and had the potential to adversely impact the biological integrity, diversity, and health of these wetlands habitats. Wetlands protection and

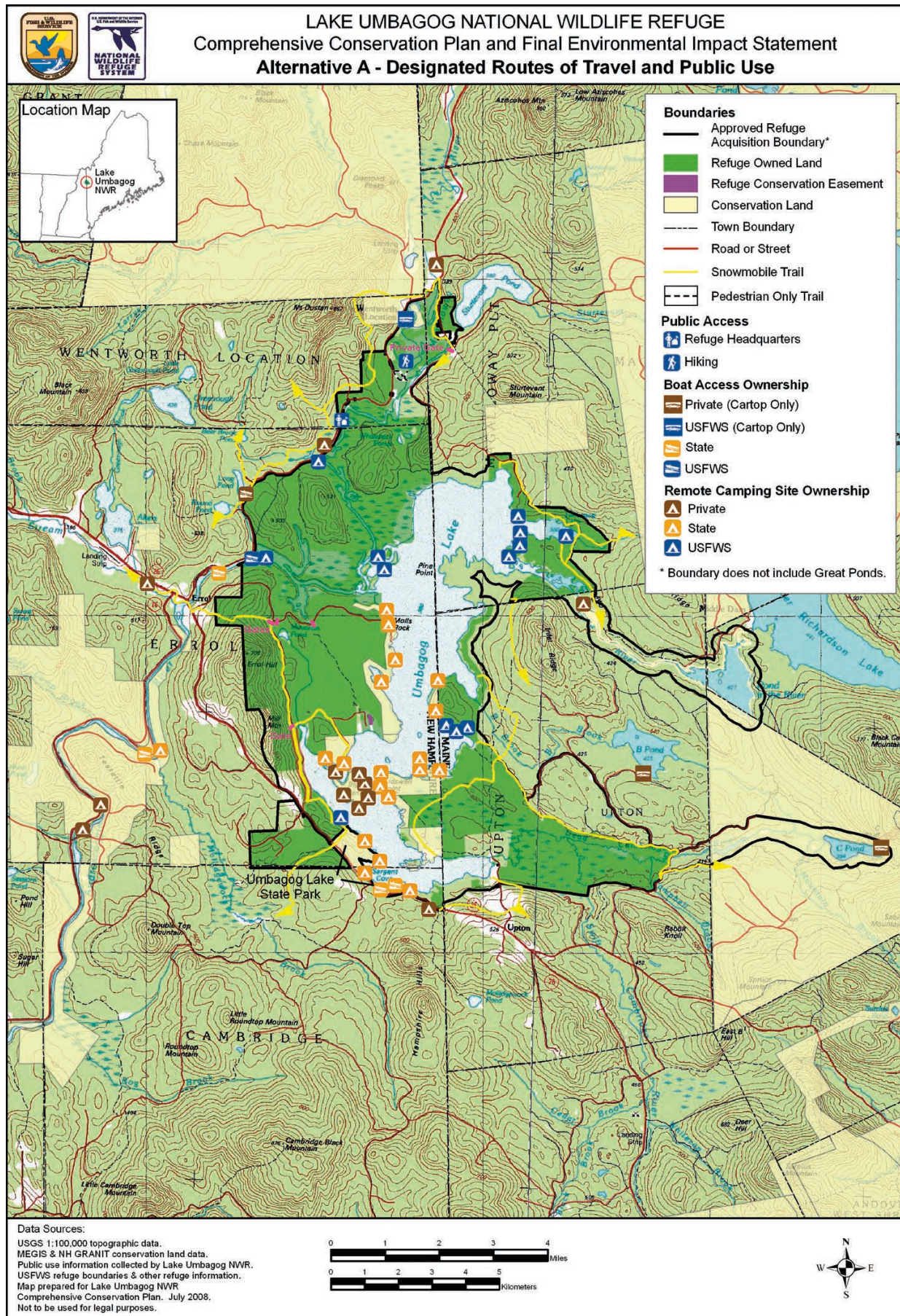
management is the most important goal we have identified in this CCP.

Besides continuing to acquire land from willing sellers within our approved refuge boundary, our current management strategy in this habitat type is “passive.” Our definition of passive management is “to protect, monitor key resources, and conduct baseline inventories to improve our knowledge of the ecosystem.” In other words, we have not actively managed it, but have focused more on collecting baseline information to determine what vegetation is present in this habitat type; how it may be affected by changes in water level; what wildlife are using this habitat type; and what

American black duck



S. Maslowski/USFWS



the potential threats are. The information we collect will help support future management decisions to benefit this habitat type and the species dependent upon it.

Strategies

In addition to those strategies listed under “Actions Common to All of the Alternatives” affecting this habitat type:

- Repeat the aquatic invertebrate survey at wetland edges every 5 years to monitor system health and waterfowl food resources
- Continue to support research to determine the impacts of water level management on fen and flooded meadow habitat
- Continue to establish baseline inventory and permanent markers in this habitat type. Revisit these plots every 5 years.
- Continue spring and fall migratory shorebird and waterfowl surveys.
- Continue to conduct breeding marsh bird surveys according to Regional protocol
- Continue to acquire up to 79 acres of this habitat type still in private ownership within the existing, approved refuge boundary, from willing sellers, and manage similar to current refuge lands under objective 1.1

Objective 1.2 (Boreal Fen and Bog)

Manage 1,402 acres of boreal fen and black spruce bog within the existing, approved refuge boundary, including the Floating Island National Natural Landmark, to conserve the diversity of wetlands and to provide watershed protection consistent with the refuge’s establishment purposes.

Rationale

Same as Objective 1.1

Strategies

In addition to those strategies listed under “Actions Common to All of the Alternatives” affecting this habitat type:

- Continue to establish baseline inventory and permanent markers in this habitat type. Re-survey and photograph plots every 5 years.
- Continue to survey for birds, especially birds of conservation concern known in this cover type, such as palm warblers and rusty blackbirds, to evaluate implications from management on their habitat requirements.
- Continue to acquire up to 167 acres of this cover type still in private ownership within the existing, approved refuge boundary, from willing sellers, and manage similar to current refuge lands under objective 1.2

Objective 1.3 (Northern White Cedar)

Manage the 1,031 acres of northern white cedar forest within the existing, approved refuge boundary to conserve the diversity of wetlands and to provide watershed protection consistent with the refuge’s establishment purposes.

Rationale

Same as Objective 1.1

Strategies

In addition to those strategies listed under “Actions Common to All of the Alternatives” affecting this habitat type:

- Continue to inventory small mammal and amphibians using this cover type
- Continue to acquire up to 202 acres of this cover type still in private ownership within the existing, approved refuge boundary, from willing sellers, and manage similar to current refuge lands under objective 1.3

Objective 1.4 (Scrub-Shrub Wetland)

Manage 940 acres of scrub-shrub wetland within the existing, approved refuge boundary to conserve the diversity of wetlands and to provide watershed protection consistent with the refuge’s establishment purposes.

Rationale

Same as Objective 1.1

Strategies

In addition to those strategies listed under “Actions Common to All of the Alternatives” affecting this habitat type:

- Continue to support research to determine the impacts of water level management on this cover type
- Continue to acquire up to 258 acres of this cover type still in private ownership within the existing, approved refuge boundary, from willing sellers, and manage similar to current refuge lands under objective 1.4

Objective 1.5 (Open Water and Submerged Aquatic Vegetation)

In partnership with the states of Maine and New Hampshire, and the holder of the FERC license for the Errol Project, FPLE, manage the open water, and floating-leaved and submerged aquatic vegetation habitat within the existing, approved refuge boundary to maintain high quality loafing and foraging areas for waterfowl and other water birds, and to maintain high water quality to benefit other aquatic life.

Rationale

Same as objective 1.1

Strategies

In addition to those strategies listed under “Actions Common to All of the Alternatives” affecting this habitat type:

- As previously planned, map distribution of submerged aquatic vegetation – species, density, size of beds.

Objective 1.6 (Common Loon)

Protect and monitor naturally occurring common loon nest sites on Umbagog Lake, in partnership with state of New Hampshire and Maine wildlife agencies, conservation partners and the holder of the FERC license for Errol Project, FPLE, to serve as an “indicator species” for other wetland-dependent nesting wildlife.

Rationale

See rationale for alternative B, objective 1.6, for a description of the importance of common loon management on Umbagog Lake. With regards to water level management on Umbagog Lake, nesting common loon are regarded by the



©Derrick Z. Jackson/Boston Globe

Common loon

Service as the “indicator species” to represent the effectiveness of water level management on nesting wildlife.

Strategies

In addition to those strategies listed under “Actions Common to All of the Alternatives” affecting this species:

- Continue to monitor loon populations in partnership with the states, conservation organizations, and the holder of the FERC license for the Errol Project
- Continue to support research to determine causes and implications for decline in number of loon territories on Umbagog Lake
- Continue annual meetings with FERC licensee or representative to advise on lake water levels to benefit nesting loon, within the conditions of the FERC license and Article 27
- Continue to protect active loon nests in spring and summer from predators and human disturbance using outreach and visitor contact, buoy lines, restricted access, and other tools as warranted
- Continue to develop and maintain an Umbagog Lake loon dataset in partnership with NHFG, MDIFW, and private conservation organizations

Goal 2 Manage floodplain and lakeshore habitats to benefit Federal trust species and other species of conservation concern.

Objective 2.1 (Wooded Floodplain)

Manage 1,293 acres of wooded floodplain within the existing, approved refuge boundary to provide watershed protection consistent with the refuge’s

establishment purposes. Also, continue to manage the 245 acre Magalloway River floodplain to maintain its 'exemplary' site status as identified by the NHHI.

Rationale

Under goal 1, objective 1.1, we described the significance of the wetlands including and surrounding Umbagog Lake in the establishment of this refuge. While it is true that protection of the wetlands, associated wildlife, and water quality were cited as the primary reasons to create the refuge, the decision document and supporting environmental assessment also describe the importance of adjacent lakeshore and upland habitats to the protection of those wetlands and their watersheds (USFWS 1991).

Similar to the rationale for objective 1.1, since refuge establishment, we have focused on acquiring land from willing sellers to ensure adjacent land uses will not impact the resources the refuge was established to protect. Otherwise, our current management strategy in this habitat type is primarily passive. We have not actively managed it, except to restore some former cabin sites and unauthorized camp sites to native vegetation. Instead, we have been collecting baseline information, as funding and staffing allows, in support of future management decisions designed to benefit this habitat type and the species dependent upon it.

Strategies

In addition to those strategies listed under "Actions Common to All of the Alternatives" affecting this habitat type:

- Continue to acquire 153 acres of this cover type still in private ownership within the existing, approved refuge boundary, from willing sellers, and manage similar to current lands under objective 2.1
- Continue to restore natural vegetation on unauthorized campsites
- Continue to remove surplus cabins that we have acquired as funding allows. Restore site (e.g. loam, seed and/or plant) to native vegetation.
- Continue vernal pool, small mammal and amphibian surveys
- Continue to include this habitat type in breeding bird surveys

Objective 2.2 (Lakeshore Pine-Hemlock)

Manage 520 acres of lakeshore pine-hemlock within the existing, approved refuge boundary to provide wetlands and watershed protection consistent with the refuge's establishment purpose.

Rationale

Same as Objective 2.1

Strategies

In addition to those strategies listed under "Actions Common to All of the Alternatives" affecting this habitat type:

- Continue to monitor habitat impacts from public use
- Continue to mitigate significant recreational impacts as needed
- Continue to record wildlife use of this habitat type

- Continue to acquire 288 acres of this cover type still in private ownership within the existing, approved refuge boundary, from willing sellers, and manage similar to current lands under objective 2.2
- Also see objective 2.3.

Objective 2.3 (Bald Eagle and Osprey)

Protect and maintain super-canopy nesting trees for bald eagles, and protect all osprey nests within the existing, approved refuge boundary.

Rationale

See rationale for alternative B, objective 2.3, for a description of the importance of bald eagle and osprey management on Umbagog Lake.

Strategies

In addition to those strategies listed under “Actions Common to All of the Alternatives” affecting these species:

- Continue to protect super-canopy nesting trees on current and future refuge lands.
- Continue to inventory active and historic nesting sites each year
- Continue bald eagle and osprey surveys in conjunction with the States of Maine and New Hampshire, and conservation partners
- Continue to maintain and/or install as warranted, predator guards on active nesting trees
- Continue to implement area closures around bald eagle nest trees; place visible floating buoys and signs to alert all boaters to closure area
- Continue to work cooperatively with State agencies and (Non -Governmental Organization) NGO’s on bald eagle and osprey management
- Continue to support efforts to eliminate practices that contribute lead and other contaminants to the environment

Goal 3 Manage upland forested habitats, consistent with site capabilities, to benefit Federal trust species and other species of conservation concern.

Objective 3.1 (Mixed Spruce-Fir/Northern Hardwood Forest Matrix)

Manage the refuge’s upland forests, including its 3 habitat types: spruce-fir (approximately 3,302 acres); conifer-hardwood mixed woods (approximately 6,313 acres); and, northern hardwood (approximately 6,068 acres) on Service-owned lands within the existing, approved refuge boundary to provide watershed protection consistent with the refuge’s establishment purposes.

Rationale

We define the “forest matrix” as the most extensive, most connected, and most influential landscape type across the Upper Androscoggin River watershed basin. Throughout the watershed, and including the refuge, the forest matrix is a mosaic of forest types and is described as an overall mixed spruce-fir/northern hardwood forest (see chapter 3 for more details). Within this mixed forest matrix; we identify 3 component forest habitat types: spruce-fir; conifer-hardwood mixed woods; and northern hardwood. The Umbagog Lake landscape of today supports a larger percentage of hardwoods than occurred over the last 150 years (Charlie



Ian Drew/USFWS

Upland forest in winter

Cogbill, personal communications, 2004). This reflects a forest composition that was affected by multiple cycles of timber harvesting over those 150 years. Selective harvesting of softwoods has converted many spruce-fir stands to mixed stands, and mixed stands to hardwood stands. In the absence of further human disturbance these forests, through natural succession and disturbance patterns, will shift to a higher proportion of softwood (Publicover and Weihrauch 2003). Unfortunately, this assumption may be complicated by climate change predictions. We will continue to use an adaptive management approach as we learn more about the implications and impacts of climate change. See the section earlier in this chapter, “Actions Common to All Alternatives” for our discussion on adaptive management.

We state in our rationale for objective 2.1 that the refuge was principally established to protect wetlands and associated habitats, and water quality. These resources are all potentially impacted by land uses in the adjacent uplands in the watershed, so protection of these uplands has also been a goal. Our primary management strategy has been to acquire these habitat types from willing sellers within our approved acquisition boundary. Otherwise, our current management strategy has been passive and we would continue to be focused on collecting baseline information and monitoring key resources.

Strategies

Spruce-fir Habitat Type

- Continue to acquire 956 acres of this cover type still in private ownership within the existing, approved refuge boundary, from willing sellers, and manage similar to current refuge lands under objective 3.1.
- Continue to work with state partners to identify and protect critical deer wintering yards (see map 2-10).

Mixed Woods Habitat Type

- Continue to acquire 2,454 acres of this cover type still in private ownership within the existing, approved refuge boundary, from willing sellers, and manage similar to current refuge lands under objective 3.1.

Northern Hardwood Habitat Type

- Continue to acquire 1,428 acres of this cover type still in private ownership within the existing, approved refuge boundary, from willing sellers, and manage similar to current refuge lands under objective 3.1.

Goal 4 Provide high quality wildlife-dependent activities such as hunting, fishing, wildlife observation and photography, as well as camping and boating in support of those activities.

Objective 4.1 (Hunting)

Continue to operate under the 2007 Amended Refuge Hunt Plan (USFWS, 2007).

Rationale

Hunting is one of the six priority public uses to receive enhanced consideration on national wildlife refuges according to the 1997 Refuge Improvement Act. Hunting is also an historic, traditional, and very popular activity in the Umbagog Lake area and in other rural parts of New Hampshire and Maine.

Strategies

In addition to those strategies listed under “Actions Common to All of the Alternatives” affecting this program:

- Continue to offer a hunt program following state of Maine and New Hampshire regulations. The only exceptions are that we do not allow turkey hunting anywhere on the refuge and we do not allow bobcat hunting on refuge lands in Maine (on New Hampshire lands, bobcat hunting is not allowed by state or refuge regulations). Also, no special refuge permits are required for hunting on refuge lands.
- Continue to maintain six waterfowl hunt blinds; maintain a reservation system for the blinds where the maximum stay is one week

Objective 4.2 (Fishing)

In accordance with states of Maine and New Hampshire regulations, continue to allow access for fishing, except in sensitive areas during wildlife nesting seasons.

Rationale

The rationale is similar to objective 4.1.

Strategies

In addition to those strategies listed under “Actions Common to All of the Alternatives” affecting this program:

- Continue annual “Take Me Fishing” event
- Continue to restrict fishing access around loon and bald eagle nesting sites

Objective 4.3 (Wildlife Observation and Photography)

Provide developed, accessible wildlife viewing and photography opportunities on the Magalloway River trail, and upon request, in the six waterfowl blinds.

Rationale

Wildlife observation and nature photography represent two of the six priority public uses to receive enhanced consideration on refuges according to the 1997 Refuge Improvement Act. Opportunities to view and photograph wildlife in a natural setting abound on this refuge due to its rural, undeveloped landscape. Moose and loon are two popular attractions that can be viewed roadside or from boats on the refuge’s lakes and waters. The 1/3 mile Magalloway River trail, with its viewing platform along an oxbow of the Magalloway River, is the only walking trail maintained by the refuge. It is accessible to people with disabilities. A ¼ mile loop extension is planned for 2007-2008.

Strategies

In addition to those strategies listed under “Actions Common to All of the Alternatives” affecting this program:

- Continue to maintain Magalloway River trail and viewing platform
- Continue to evaluate new opportunities upon request

Objective 4.4 (Camping)

Continue to maintain the 14 remote campsites on refuge lands (12 lake sites; 2 on river) in their current locations to provide a unique hunting, fishing, wildlife observation and photography opportunity associated with an overnight stay on refuge lands.

Rationale

Remote camping on Umbagog Lake provides the unique opportunity to view and hear loons during dusk and dawn when they are most actively calling, while totally immersed in a quiet, private natural setting. It is becoming an increasingly rare experience, except in very remote northern areas. Camping is a very popular activity on Umbagog Lake and in other rural parts of New Hampshire and Maine. Over the past few years we have implemented several actions at those camping sites on refuge lands in order to minimize the impacts on natural resources. We are seasonally closing certain sites during the loon nesting season if they are in proximity to active territories. We are phasing in a probation on pets, to be completed in 2009, to minimize disturbance to wildlife and the noise disturbance to adjacent campers, namely from dogs barking. Also, eliminating pets reduces the contribution of feces waste (a potential disease vector for wildlife). We have been recently placing limits on where campers can erect tents at certain sites to minimize soil and vegetation impacts. At certain sites we have initiated restoration projects, or modified site infrastructure, to reverse those impacts.

Strategies

- Continue to close certain campsites which lie adjacent to loon territories during active loon nesting periods
- Continue to work toward prohibiting pets
- Continue to prohibit gathering of firewood on refuge lands
- Continue to limit campsite size
- Continue to maintain and improve campsites on an annual basis

Objective 4.5 (Boating)

Maintain one developed and one unimproved boat launch site, with no established restrictions on use, except limiting access to sensitive areas when they are closed during the wildlife nesting season.

Rationale

Canoes and kayaks are one of the most popular means of accessing Umbagog Lake and experiencing the refuge. We maintain two boat launch sites to facilitate this use. Motorized boat users primarily launch from off-refuge sites. We believe there has been a dramatic increase in boat use over the last eight years, but have not had the resources to measure this observation. Some of the indications have been increased boater conflicts observed by us, or reported to us, and the frequency that parked cars have overflowed onto the highways. We expect this

use to continue to increase, with a commensurate increase in conflicts among users, until or unless a coordinated plan to manage visitor use is developed among the agencies with jurisdiction on the lake.

Strategies

In addition to those strategies listed under “Actions Common to All of the Alternatives” affecting this program:

- Continue to maintain closures around certain bald eagle and loon nesting territories in partnership with the states
- Continue to distribute pamphlet on recommended day-use canoe and kayak trails, which also alerts boaters to closed areas.
- Continue to monitor boat use by counting numbers from a fixed location on peak use days
- Continue to coordinate with states to address increased use

Goal 5 Develop high-quality interpretative opportunities, and facilitate environmental education, to promote an understanding and appreciation for the conservation of fish and wildlife and their habitats, as well as the role of the refuge in the Northern Forest.

Objective 5.1 (Interpretative Programs)

Respond to requests for interpretive programs as time and staffing permits with programs focusing on the Refuge System mission and refuge purposes.

Rationale

Interpretation is one of the six priority public uses required by the 1997 Refuge Improved Act to receive enhanced consideration on refuges. Given our small staff size and available funding, it has been necessary to make hard decisions on where our resources should be allocated. We have chosen to focus on our biological program priorities, and have limited ourselves to responding to only a few requests for specific interpretive programs each year. Currently, we are not able to meet the demand for these programs.

Strategies

In addition to those strategies listed under “Actions Common to All of the Alternatives” affecting this program:

- Continue to hire up to two seasonal interns/year, if resources allow, to help accomplish visitor services program priorities
- Continue to offer programs on a request basis only; usually a minimum of 3, and up to a maximum of 12 annually, focused on presenting the Refuge System mission and refuge purposes. Typical audiences have been students or senior citizen groups
- Continue to develop and distribute standard interpretive brochures (e.g. refuge brochure, species lists, etc)
- Continue to seek funding to finish construction of the Magalloway River trail, with interpretive signage, and make it Americans with Disability Act (ADA) compliant
- Continue to develop/construct self-guided Magalloway River Canoe Trail and boat access



Ian Drew/USFWS
Activities at the Wildlife Festival



Ian Drew/USFWS

Objective 5.2 (Community Outreach)

Provide at least 2 opportunities each year to raise awareness within the local community and among summer visitors about the refuge and its resources.

Rationale

It is particularly important that local year round and seasonal residents and regular summer visitors understand, appreciate, and support the Refuge System mission and this refuge's unique contribution to that mission. It is through these outreach efforts that we hope to garner support for refuge management priorities. In addition, through this outreach, our volunteer program could grow, and our Friends group could see enhanced membership and support.

Strategies

In addition to those strategies listed under "Actions Common to All of the Alternatives" affecting this program:

- Continue to coordinate a minimum of 2 visitor outreach events annually that showcase refuge resources; for example, the Wildlife Festival and Take Me Fishing event
- Continue to distribute brochure and literature on impacts to loons and other wildlife from lead fishing tackle to discourage their use

Goal 6 Enhance the conservation and management of fish and wildlife resources in the Northern Forest Region through partnerships with public and private conservation groups, private landowners, State and local entities.

Objective 6.1 (Partnerships)

Continue to work cooperatively with regional partners engaged in conservation-based regional and community development activities consistent with the Refuge System mission and refuge purposes.

Rationale

The refuge has benefited immensely from our existing partnerships in a variety of ways. These include: the sharing of technical expertise to support wildlife and public use management decisions; research that provides valuable information on refuge resources; collaborative land conservation planning to insure that important wildlife habitat is conserved throughout the Northern Forest, and cooperative outreach and enforcement of refuge regulations. These activities have particularly benefited us as we have not always had the resources to accomplish this work on our own.

Strategies

In addition to those strategies listed under "Actions Common to All of the Alternatives" affecting this program:

- Continue to work with such partners as:

Conservation organizations: Trust for Public Lands, The Nature Conservancy, Audubon Society of New Hampshire (ASNH), Loon Preservation Committee, New England Forestry Foundation, Mahoosuc Land Trust, Society for the Protection of New Hampshire Forests, Androscoggin Watershed Council, Rangeley Lakes Heritage Trust, The Conservation Fund, Trout Unlimited;

Town and county governments: Towns of Upton, Errol, Magalloway Plantation, and Coos County;

Spruce-fir forest



Bill Zimm/USFWS

Private entities: FPLE, Wagner Forest Management;

Universities and other educational institutions: Dartmouth College, University of Vermont, University of Massachusetts, Hurricane Island Outward Bound, The Chewonki Foundation, and the Northwoods Stewardship Center; and,

State agencies: MDIFW, NHFG, NH DRED; and, NH Office of Energy and Planning.

Objective 6.2

Continue to promote responsible use of Umbagog Lake and its tributaries on the refuge.

Rationale

Umbagog Lake is one of the crown jewels in the Northern Forest lake system and has increased in popularity over the last decade as a destination. As we described under objective 4.5 above, we expect visitor use to continue to increase, with a commensurate increase in user conflicts. We recognize that it is imperative that we promote, through as many forums as possible, responsible use of the lake. We have also suggested the need to develop a coordinated management plan among the agencies with jurisdiction on the lake to manage visitor use.

Strategies

In addition to those strategies listed under “Actions Common to All of the Alternatives” affecting this program:

- Continue to include instruction on boater safety and responsible fishing at the annual “Take Me Fishing” event.
- Continue to include instruction on “Leave No Trace” ethics, boater safety, and responsible fishing at the annual “Wildlife Festival.”
- Continue to work with state partners to manage public use in ways that benefit wildlife, such as implementing access closures around sensitive nesting areas.

Alternative B. Management for Particular Habitats and Focal Species (Service-preferred Alternative)

Introduction

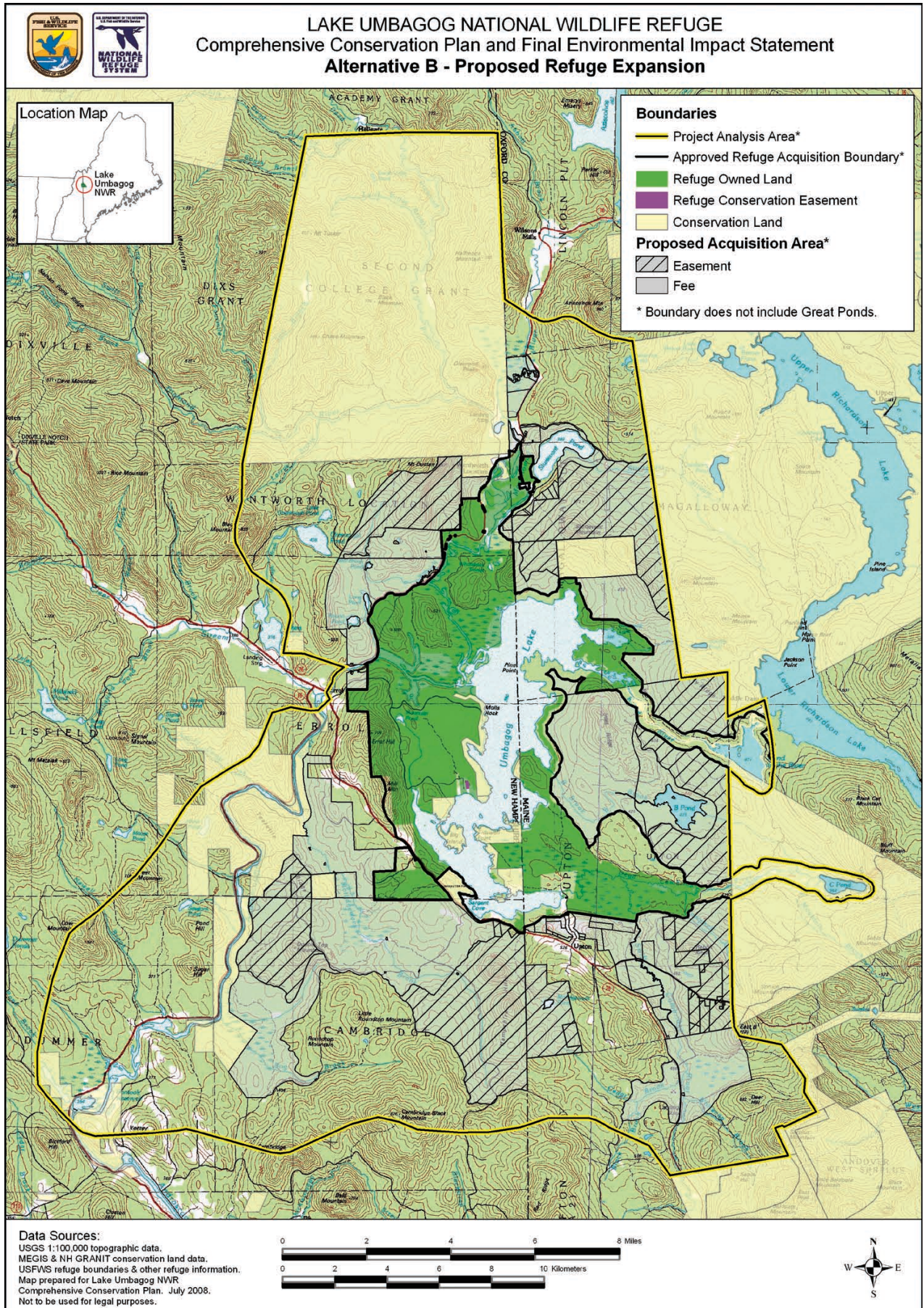
Alternative B is the alternative our planning team recommends to our Regional Director for implementation. It includes an array of management actions that, in our professional judgment, work best towards achieving the refuge's purposes, the vision and goals, and would make an important contribution to conserving Federal trust resources of concern in the Northern Forest. It is the alternative that would most effectively address the significant issues identified in chapter 1. We believe it is reasonable, feasible, and practicable within the 15-year timeframe.

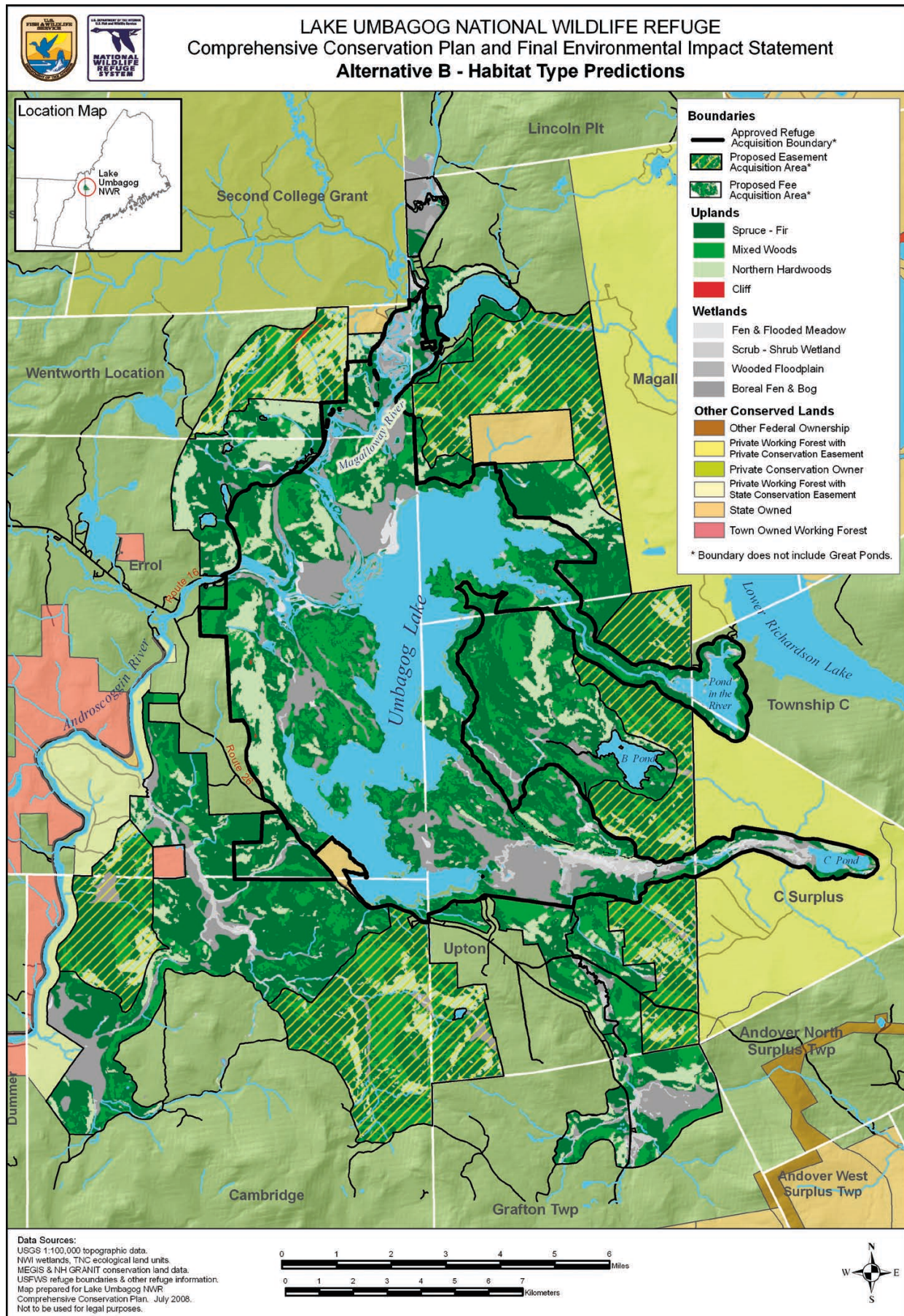
This alternative is designed to emphasize the conservation of a mixed forest matrix landscape and its component habitat types for which we believe the refuge can make the most important ecological contribution within the Upper Androscoggin River watershed, the larger Northern Forest landscape, and the Refuge System. The habitat types we describe support a wide variety of Federal trust resources, in particular, birds of conservation concern identified in the BCR 14 region and wetlands. We identify "focal species" for each habitat type objective, whose life requirements would guide management activities in that respective habitat type. Focal species were selected because they are Federal trust resources whose habitat needs, in our opinion, broadly represent the habitat requirements for a majority of other Federal trust species and native wildlife dependent on that respective habitat type.

Appendix N describes in greater detail our process for selecting habitat types and focal species. Our objective statements for Goals 1-3 below identify the habitat type, acres to be conserved, and the focal species that will be a target of our management. An accompanying rationale statement identifies each focal species' particular habitat needs. The strategies represent potential management actions for accomplishing the objectives and meeting those habitat needs. Map 2-7 depicts the broad habitat types we predict would result after approximately 100 years of implementing alternative B management objectives for upland habitats.

Similar to alternative A, and in keeping with the original purposes for which the refuge was established, the wetlands objectives under goal 1 are our highest priority biological objectives to implement. Protecting the biological integrity, diversity, and environmental health of Umbagog Lake and its associated rivers is paramount. As our second highest habitat management priority under alternative B, we propose implementing the objective under goal 3, which would promote and sustain a mixed forest matrix; that is, a mosaic of spruce-fir, mixed woods, and northern hardwood habitat types, with emphasis on promoting the conifer component. Our analysis indicates that the refuge is in a unique position, based on site capability and natural potential, to make an important contribution to the mixed forest matrix in the watershed, as well as in the larger Northern Forest landscape, and within the Refuge System. As our third habitat management priority, we propose to implement those actions that would improve American woodcock habitat. These actions are identified under objectives 1.4, 2.1, and 3.1.

In support of these priorities, and our other habitat goals and objectives, alternative B proposes to expand the existing, approved refuge boundary by 47,807 acres through a combination of Service fee-simple (56%) and conservation easement (44%) acquisitions (map 2-6). All lands proposed for acquisition are: undeveloped; either are or have the potential to be high quality wildlife habitat; occur in an amount and distribution to provide us management flexibility to achieve our habitat goals and objectives; and, would collectively result in a land base that affords a vital linkage to other conserved lands in the Upper Androscoggin watershed and Northern Forest region. As we acquire lands in fee, we would manage them by the goals, objectives, and strategies under this alternative.







Ian Drew/USFWS

Fishing on Umbagog Lake

Our land conservation objectives are the result of a very active regional partnership and fully complement the management on adjacent conserved lands, both public and private. The proposal also complements the original purpose and intent for which the refuge was established. Our expansion proposal, detailed in appendix A, “Land Protection Plan” (LPP), identifies the significance of the refuge expansion in contributing to the current and planned network of conservation lands and wildlife resources in the regional landscape. Working in partnership with these surrounding landowners is critical to its successful implementation. The detailed strategies in the LPP were developed cooperatively with our state fish and wildlife agency partners, and supported by our other land conservation partners working in the Northern Forest region.

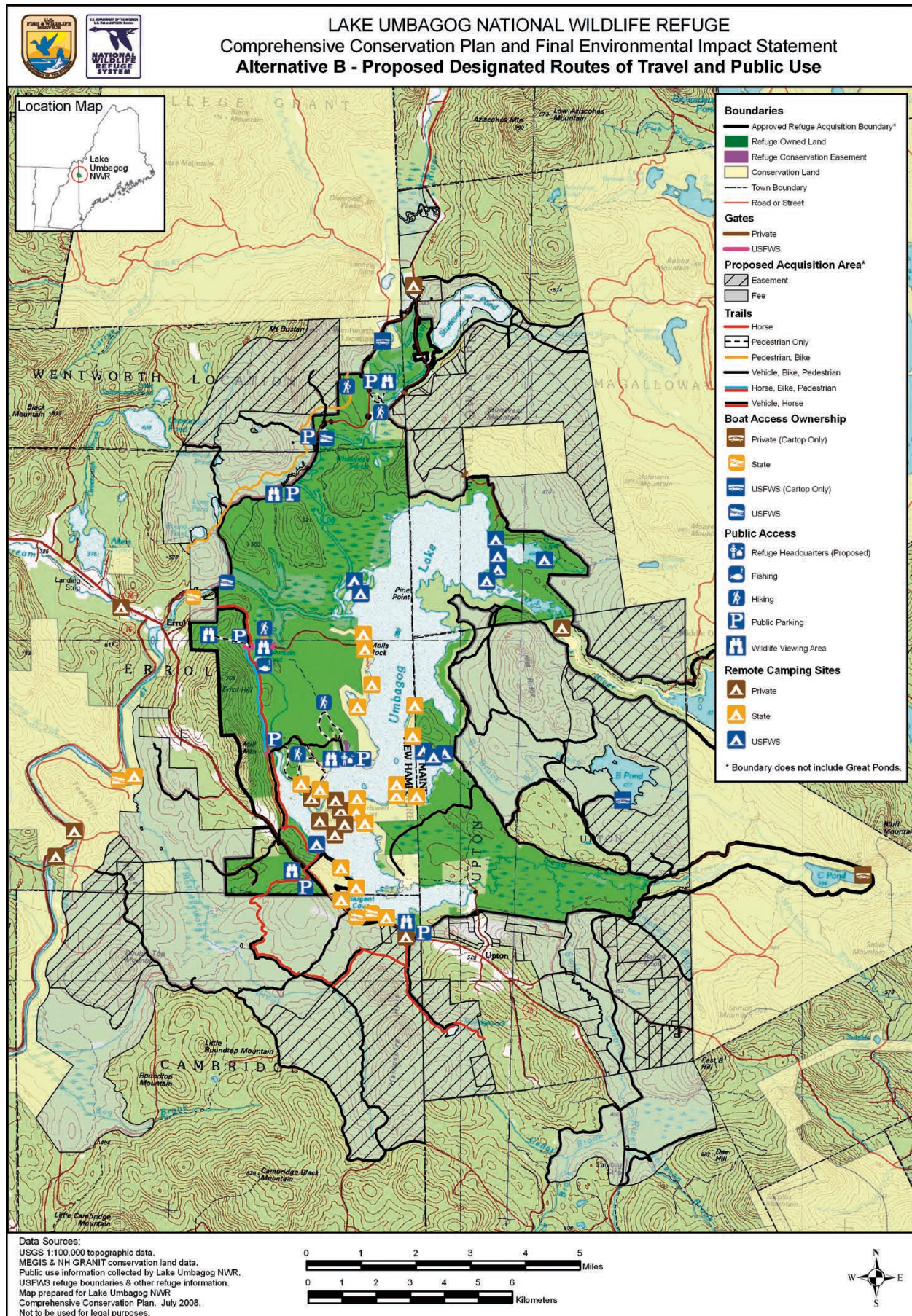
Regarding our visitor services programs, alternative B would enhance the existing priority public use opportunities for hunting and fishing by providing better outreach and information materials, and improving access

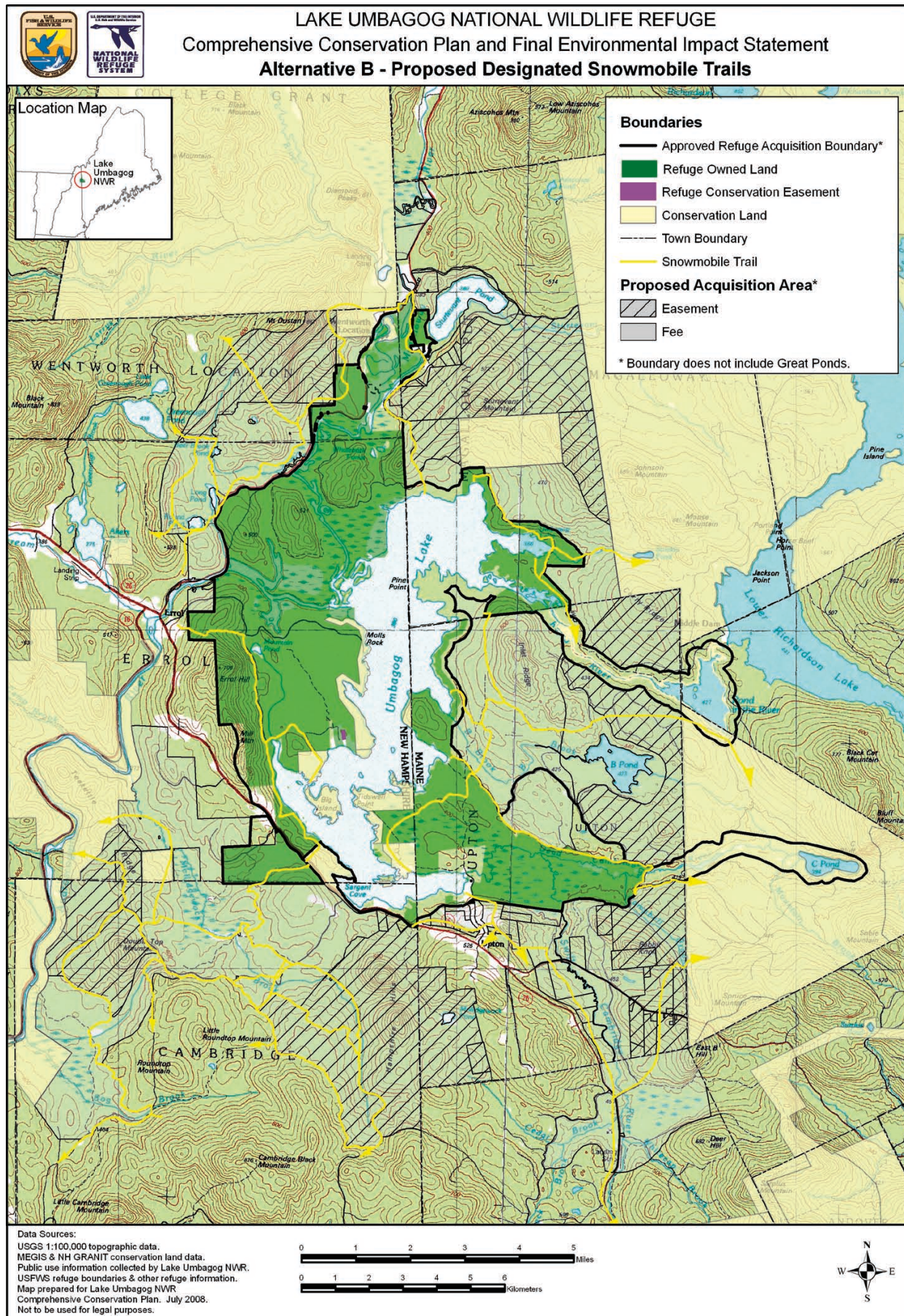
and parking (maps 2-8 and 2-9). Opportunities for wildlife viewing, photography, and interpretation would be expanded primarily by providing new infrastructure such as trails and viewing areas. In addition, new roadside pullouts, informational kiosks, and viewing platforms are proposed along the major travel corridors. Further, new visitor infrastructure, including a series of interpretive trails, would be developed in conjunction with the proposed new location for a refuge administrative headquarters and visitor contact facility at the former Potter Farm site. We would also pursue a partner-managed, regional visitor contact facility in the Town of Errol.

Concerning other refuge uses, we would continue to allow snowmobiling on the existing designated trails. Remote camping on the existing, 12 designated lake sites would also continue to be allowed and managed cooperatively with NH DRED, although we would increase monitoring of individual sites, and rehabilitate or relocate those lake sites in need of restoration. We would eliminate the 2 river sites, and not replace them. We do not plan to increase opportunities for either snowmobiling or camping.

Under alternative B, lands we acquire in the proposed expansion area would be open to long-term public access for compatible, priority public uses such as: hunting, fishing, wildlife observation and photography and environmental education and interpretation. We would maintain open the major road corridors as designated routes of public travel in the expansion lands to facilitate access to these activities (see maps 2-8 and 2-9).

We would also enhance local community outreach and partnerships, continue to support a Friends Group, and provide valuable volunteer experiences as we implement alternative B. As described under goal 7, we would pursue the establishment of a Land Management and Research Demonstration (LMRD) site on the refuge to promote research, and the development of applied management practices, to benefit the species and habitats identified in this alternative.





Goal 1 Manage open water and submerged aquatic vegetation and wetlands to benefit Federal trust species and other species of conservation concern.

Objective 1.1 (Fen and Flooded Meadow)

Manage 669 acres of fen and flooded meadow on Service-owned lands, within the current and expanded Refuge boundaries. Provide nesting and brood rearing habitat for American black and ring-necked ducks, pied-billed grebe and other marsh birds, and brood rearing habitat for wood duck and common goldeneye. Also, manage undisturbed staging areas for migrating waterfowl and stopover areas for migrating shorebirds from late August through mid-October.

Rationale

The fen and flooded meadow habitat type encompasses medium fen, cattail marsh, seasonally flooded mixed graminoid meadow, eastern tussock sedge meadow, spikerush shallow emergent marsh, and few-seeded sedge-leatherleaf fen (appendix M). The wetter edges of these natural communities are functioning as “emergent marsh” habitat for waterfowl and other marsh and water birds.

The refuge currently owns, or has approval to acquire, 566 acres of this habitat type. Under the alternative B expansion proposal, we recommend Service acquisition of an additional 123 acres of this habitat type (103 acres in fee; 20 acres in conservation easement). Our management emphasis over the next 15 years would be to identify the habitat attributes most important for sustaining the focal species identified in the objective statement, and enhancing, and/or restoring, those attributes. We describe some of those attributes in the species’ discussions below.

Umbagog Lake is identified as one of three waterfowl focus areas in New Hampshire under the NAWMP (Atlantic Coast Joint Venture 2005). The Refuge supports the highest concentrations of nesting black ducks and ring-necked ducks in New Hampshire (USFWS 1991). The black duck is a species of concern in the NAWMP because of the historic decline in their population, with habitat loss an important contributing factor. The regional importance of Umbagog Lake to black duck was one of the reasons the refuge was established. Though black duck populations are stable or increasing, they are listed as highest priority for conservation in BCR14 (Dettmers 2005).

Black duck pairs arrive in Maine by April with the peak hatch from June 1-10. They are quite intolerant of human disturbance even during brood stage; therefore, minimizing human disturbance from late May through June may be important. They are generalists in their nest site selection and locate well-concealed nests on the ground in uplands near beaver flowages, floodplains, alder-lined brooks, and other wetlands. On the refuge, black duck and other waterfowl brood rearing habitat is in the “emergent marsh” around the edges of Leonard Marsh, and Harper’s and Sweat Meadows, and the backwaters of the Magalloway and Dead Cambridge rivers. These shallow, permanent fens with abundant emergent vegetation, sedges, floating-leaved plants, pondweeds, and scrub-shrub vegetation rich in invertebrates, are favored brood rearing areas for waterfowl. Ducklings feed mostly on larvae of flies, caddisflies, mayflies, and other insects. Adult ducks eat the seeds of bur reed, sedges, pondweeds, and other aquatic plants as well as insects and other invertebrates (Longcore et al. 2000). In the expansion area, critical waterfowl areas proposed for acquisitions include: the extension of the Magalloway River; Swift-Cambridge River; and, the Mollidgewock Brook.

Ring-necked ducks nest much closer to water than black ducks and are susceptible to water level changes. Therefore, the ring-necked duck may be an

important indicator for the effects of water level fluctuations in Umbagog Lake. They build a nest usually on floating hummocks and islands in dense emergent vegetation, especially *Carex* sedges mixed with other herbaceous or woody plants. These ducks nest May through June, later than black ducks, with peak hatching occurring later in June. This diving duck forages in shallow water usually less than six feet deep. Their primary food sources are seeds and tubers of submerged and emergent plants and some aquatic invertebrates; the young depend entirely on aquatic invertebrates during their first two weeks (Bellrose 1976; Jerry Longcore, U.S. Geological Survey, personal communication, 2004).

The bathymetric study of the lake, proposed under all alternatives, would help determine the effects of water level changes on waterfowl habitat. Water level changes that occur after mid-July would likely not have a significant effect on duck broods. Ducks with broods are not territorial and will keep moving around in the large inter-connected waterways of Umbagog Lake (Jerry Longcore, U.S. Geological Survey, personal communication, 2004).

Umbagog Lake is also an important migratory staging area for the waterfowl mentioned above as well as such species as scaup, scoters, and Canada geese. Many migrating waterfowl feed among the fen and flooded meadows on seeds and tubers of aquatic plants, while other species such as scoters, forage along the rocky shallow water areas of the lake.

Marsh birds using Leonard Marsh, Harper's Meadow, and Chewonki Marsh include Wilson's snipe, Virginia rail, American bittern, pied-billed grebe, and sora. The pied-billed grebe is listed as endangered in New Hampshire. The grebe typically builds a floating platform nest over shallow water attached to the stems of emergent vegetation. There is some indication that water depth (>10 inches to enable predator escape and nest construction) and density of emergent vegetation (≥ 4 in² of stem basal area/yd²) are important criteria and the pied-billed grebe may shift its nesting activity within and between nesting seasons in response to changes in water levels and availability of emergent vegetation cover (Muller and Storer 1999).

Our ability to benefit migratory shorebirds will depend on our ability to work with the holder of the FERC license for the Errol Project, FPLE, to affect water level management outside of June and July. Peak shorebird migration times for the Umbagog Lake area are mid-May to early June during spring, and late-August through mid-October for fall migration (Bob Quinn, private consultant, unpublished data, 2004). Shorebirds forage in exposed mudflats. Exposed mudflats occur irregularly in the fall depending on the lake levels, and occur most commonly where the Androscoggin River leaves Umbagog Lake in the Leonard Pond area. Inland freshwater wetlands and mudflats are thought to be particularly important for migrating spotted and solitary sandpipers. The most common shorebirds using the refuge are Wilson's snipe, spotted sandpiper, greater yellowlegs, and solitary sandpiper. The North Atlantic Regional Shorebird Plan lists greater yellowlegs as a high conservation priority (Clark and Niles 2000).

Strategies

In addition to objective 1.1 strategies under alternative A:

Within 5 years of CCP approval:

- Design and implement an expanded waterfowl, shorebird, marsh, and wading bird breeding survey program to include migration and brood surveys.
- Evaluate, and implement where appropriate, opportunities to expand wild rice and other vegetative food sources for migratory waterfowl.

- Survey aquatic invertebrate availability during spring and fall migration periods for shorebirds and waterfowl.
- Evaluate isolated backwater areas with high potential for waterfowl brood rearing (e.g. quiet backwaters w/ combination of forest cover, submerged aquatic vegetation, and intermixed emergent wetlands in Dead Cambridge and Upper Magalloway rivers) to determine if seasonal boat access closures would reduce habitat disturbance; implement if beneficial.

Within 5-10 years of CCP approval:

- Initiate study to determine the water level regime most beneficial to waterfowl at each important stage: breeding, brood rearing, and spring and fall migration.
- Acquire 123 acres of this habitat type within the expansion area, from willing sellers, and manage the fee lands as described in objective 1.1.

Within 10-15 years of CCP approval:

- Evaluate the impacts of various water levels on shorebirds, waterbirds, and marsh birds.
- If necessary, discuss with the hydropower facility owner/operator the possibility of altering water level management during waterfowl and shorebird migration periods to improve foraging and staging habitat conditions. This would occur voluntarily and within the bounds of, and during the remaining duration of, the current FERC license.

Objective 1.2 (Boreal Fen and Bog)

Manage the 3,679 acres of boreal fen and bog on Service-owned lands, within the current and expanded refuge boundaries, to sustain the health and integrity, and uniqueness of the rare species and natural communities, such as the Floating Island National Natural Landmark, the circumneutral pattern fen, and other peatlands.

Rationale

The boreal fen and bog habitat types encompasses leatherleaf poor fen, medium shrub fen, sub-boreal dwarf-shrub fen, circumneutral pattern fen, black spruce wooded bog, black spruce-larch swamp, and spruce-fir swamp (appendix M). “Peatlands” are another commonly used term to describe some of these plant communities. We recognize these plant communities as important components of the region’s native biological diversity and seek to maintain the health of these areas in keeping with the Service’s Biological Integrity, Diversity, and Environmental Health policy (601 FW 3).

The refuge currently owns, or has approval to acquire, 1,402 acres of this habitat type. Under the alternative B expansion proposal, we recommend Service acquisition of an additional 2,684 acres (2,277 in fee; 407 in conservation easement). Our management emphasis over the next 15 years would be to complete an inventory of the unique and rare community types, and establish what measures of ecological health and integrity should be monitored over time.

On the western side of Umbagog Lake is a large 870-acre peatland complex encompassing four areas: Leonard Marsh, Sweat Meadow, Harper’s Meadow, and Chewonki Marsh. A 750-acre portion of the complex, known as “Floating Island,” was designated as a NNL in 1982 (Nazaire 2003). These areas and associated wetlands form one of the largest peatland complexes in New Hampshire and harbor a high diversity of vascular plants, mosses, and liverworts (Dan Sperduto, NHNHB, pers comm.). The peatland complex is impacted by water level fluctuations in Umbagog Lake, although the impacts on community structure



Pitcher plant

and species diversity and abundance are unknown (Nazaire 2003). In a study of a similar ecosystem in Sweden, Nilsson and Keddy (1988) found a direct correlation between the duration of flooding and species diversity and abundance, with long flood periods reducing plant diversity and abundance.

A rare fen of high regional significance, the circumneutral-patterned fen, is found near the center of Tidswell Point. Most of this fen is on land owned by the State of New Hampshire as part of the Umbagog State Park, with a portion on the refuge. Only a few locations of this natural community type are known to occur in New England. A large, high quality northern white cedar swamp surrounds the fen (Dan Sperduto, NHNHB, pers comm).

Protecting and sustaining the floating bog, patterned fen, and other unique peatlands on the refuge requires increased efforts to identify and understand the factors that determine the occurrence and persistence of these peatland communities. We plan to monitor and manage the factors that affect the peatlands.

Many birds use peatland habitats for breeding, foraging, during migration, or in winter. These include palm warbler, rusty blackbird, black-backed woodpecker, yellow-rumped warbler, northern water thrush, and swamp sparrow, among others. Mink frog, a host of other amphibians, and a diverse suite of small mammals, including many shrew species and bog lemmings utilize this habitat as well. All of these species would benefit from the refuge's objective of conserving the boreal fen and bog habitat.

Strategies

In addition to objective 1.2 strategies under alternative A:

Within 5 years of CCP approval:

- Conduct a comprehensive inventory of the FINNL to better define criteria for monitoring and managing its diversity and integrity over the long-term.
- Work with the NHNHB and MNAP, and NPS to identify and refine monitoring and management criteria for the FINNL and the other unique wetlands.
- Work closely with State Non-game and Natural Heritage programs to identify and monitor rare species occurrences in this habitat type.
- Establish buffer zones around these sensitive natural communities based on best management practices published by both states; evaluate their effectiveness and appropriateness in protecting these habitats over the long-term.

Within 5-10 years of CCP approval:

- Develop a proposal to NPS to modify the current natural landmark boundary to more accurately encompass the natural system.
- Initiate a detailed study to assess rare plants and animals, especially invertebrates, associated with this habitat type.

- Acquire 2,684 acres of this habitat type within the expansion area, from willing sellers, and manage the fee lands as described in objective 1.2

Within 10-15 years of CCP approval:

- Conduct a hydro-geologic study of groundwater and nutrient flow that are maintaining these peatlands. Address issues or threats as necessary.

Objective 1.3 (Northern White Cedar)

Manage 1,031 acres of northern white cedar on Service-owned lands, within the current and expanded refuge boundaries, to sustain the health and diversity of natural and rare ecological communities in the Upper Androscoggin watershed.

Rationale

Northern white cedar habitat encompasses a suite of natural communities, all dominated by northern white cedar (appendix M). Northern white cedar is a boreal species that occurs as far south as Carroll and Grafton Counties in New Hampshire. NHNHB considers northern white cedar swamps a “signature-community” of the north woods and hence an important component of the region’s biodiversity (Sperduto and Engstrom 1998). We recognize these plant communities as important components of the region’s native biological diversity and seek to maintain the health of these areas in keeping with the Service’s Biological Integrity, Diversity, and Environmental Health policy (601 FW 3).

The refuge currently owns, or has approval to acquire, 1,031 acres of this habitat type. Small, scattered stands likely occur within the proposed expansion area, but they are not discernable within the data sets that we used for our vegetation mapping. Should stands be acquired under the alternative B expansion proposal, we would manage them similar to on-refuge stands. Our management emphasis over the next 15 years would be to complete an inventory of this type, and establish what measures of ecological health and integrity should be monitored over time.

The largest (80-100 acres) northern white cedar swamp in New Hampshire surrounds the Whaleback Ponds and extends toward the Magalloway River. This wetland basin is within the refuge acquisition boundary but only a portion is currently under Service ownership (Dan Sperduto, NHNHB, pers comm).

Several northern bird species use this habitat type year-round including boreal chickadee, gray jay, black-backed woodpecker, spruce grouse, and more rarely, American three-toed woodpecker, (a New Hampshire threatened species). White-tailed deer find cover and forage in northern white cedar stands. Ten species of amphibians and 7 species of small mammals are known to occur in this habitat type on the refuge, and will directly benefit from our objective to maintain it.

Strategies

In addition to objective 1.3 strategies under alternative A:

Within 5 years of CCP approval:

- Establish buffer zones to protect these sensitive natural communities using best management practices developed by states; evaluate their effectiveness and appropriateness in protecting this habitat type over the long-term.
- Work closely with State Non-game and Natural Heritage programs to conduct more detailed surveys of rare plant and animal occurrences in, and the overall condition, of these natural communities.

- Ensure that the HMP addresses competition from balsam fir and hardwoods resulting from disturbance or management actions.

Within 5-10 years of CCP approval:

- Evaluate and monitor regeneration of northern white cedar including potential impacts from deer, snowshoe hare, and moose browsing; ensure that the HMP addresses the effects of browsing by these species if relevant.
- Evaluate the habitat requirements of boreal species utilizing this habitat type, such as black backed woodpecker, and if appropriate, manage to enhance habitat components for these species.
- If this habitat type is acquired within the expansion area, from willing sellers, the fee lands would be managed as described in objective 1.3

Within 10-15 years of CCP approval:

- Evaluate land use changes and management actions (e.g., timber harvest) and how they might affect the hydrology of northern white cedar swamps.
- Restore up to 150 acres over 15 years of northern white cedar in areas where past land use practices have converted it to another habitat type; consider winter cutting and other accepted silvicultural practices that would promote cedar stands.

Objective 1.4 (Scrub-Shrub Wetland)

Manage 1,730 acres of scrub-shrub wetland on Service-owned lands, within the current and expanded refuge boundaries, as foraging and brood habitat for American woodcock, and to provide nesting and migratory habitat for birds of conservation concern, such as Canada warbler.

Rationale

Scrub-shrub wetland encompasses speckled alder peatland lagg, speckled and/or green alder shrubland, speckled alder swamp, and sweetgale mixed shrub thicket (appendix M). The refuge currently owns, or has approval to acquire, 940 acres of this habitat type. Under the alternative B expansion proposal, we recommend Service acquisition of an additional 906 acres of this habitat type (790 acres in fee; 77 acres in conservation easement). Our management emphasis over the next 15 years would be to identify the habitat attributes most important for sustaining the focal species identified in the objective statement, and creating and/or enhancing those attributes, especially in woodcock focus areas (map 2-2). We describe some of those attributes in the species' discussion below.

The Service developed the *American Woodcock Management Plan* in 1990 to help stem the decline in American woodcock (USFWS 1990). Long-term trends show a decline of -1.3% per year from 1993-2003 and -2.3% per year from 1968-2003 in the eastern United States. Between 2002 and 2003 Maine reported an increase in the breeding population, yet the overall trend in Maine since 1968 is still negative. New Hampshire showed no significant increase from 2002 to 2003, but it is the only eastern region state showing an increase from 1968 to 2003. Recruitment rates (number of immature birds per adult female) in recent years are 18% below the long-term regional average. The major causes for these declines are thought to be loss and degradation of habitat on the breeding and wintering grounds, resulting from forest succession and land use changes (Kelley 2003). The 2005 Maine CWCS identifies habitat conservation, and additional surveys and monitoring, as the two highest priorities in the state for conserving woodcock populations (MDIFW 2005).

Scrub-shrub wetland on Dead Cambridge River



Bill Zimni/USFWS

Functional foraging habitat for woodcock occurs on moist, rich soil dominated by dense shrub cover (75-90%); alder is ideal, although young aspen and birch are also suitable as feeding areas and daytime (diurnal) cover. Woodcock require several different habitat conditions that must be in close proximity to one another. These include clearings for courtship (singing grounds), large openings for night roosting, young second growth hardwoods (15-30 years) for nesting and brood-rearing, and functional foraging areas (Sepik et al. 1981; Keppie and Whiting 1994).

The Canada warbler is declining across much of its range and is listed as highest priority in BCR 14 (Dettmers 2005). PIF has a goal of increasing the Canada warbler continental population by 50% (Rich et al. 2004). It breeds in a range of habitat types including deciduous forested swamps, cool, moist, mature forest or streams and swamps with dense undergrowth, streamside thickets, and cedar bogs (Conway 1999). Although shrub-scrub is an important habitat component over some of its range, it may be of lesser importance in the northeast. It nests on or near the ground, generally near water. Suitable habitat often has a layer of moss and an uneven forest floor; however, they may be less common in shrub wetlands (Conway 1999). On the White Mountain National Forest in New Hampshire and Maine they occur in northern hardwoods with a softwood understory (DeGraaf and Yamasaki 2001). In central Maine, Collins (1983) found the Canada warbler in forests with a high percent shrub cover (70%), moderate canopy cover (64%), and minor component of conifers in the canopy. Hagan and Grove (1999) suggest the species is likely adapted to natural tree fall gaps, hence their positive response to forest management that creates dense deciduous understory with some overstory remaining. Canada warbler will also benefit from the proposed management in mixed woods and northern hardwoods (see alternative B, objective 3.1). The 2005 Maine CWCS identifies habitat conservation and research as the two highest priorities in the state for conserving Canada warbler populations (MDIFW 2005).

Other birds that nest in scrub-shrub habitat include swamp and song sparrows, common yellowthroat, yellow warbler, and alder flycatcher.

Beaver can be ecologically important to creating and maintaining scrub-shrub and other wetlands environments that also provide important habitat for woodcock and Canada warbler, other focal species such as black duck and wood duck, and culturally important species such as moose. Our proposal to analyze opportunities for furbearer management would consider the impacts of managing local beaver populations to improve habitat and meet refuge goals.. Beaver occupy small to large slowly flowing, wooded streams, rivers, or lakes and rarely occur in fast-moving waters. Howard and Larson (1985) described the best beaver habitat as occurring on relatively wide streams with low gradient on soil with poor drainage. Nearby food sources are also important including the roots and tubers of aquatic vegetation for summer diet and the bark of deciduous trees for fall and winter caching (DeGraaf and Yamasaki 2001). Stream gradients less than 3 percent are optimal, while narrow, steep valleys are less suitable.

Strategies

In addition to objective 1.4 strategies under alternative A:

Within 5 years of CCP approval:

- Develop and implement a plan to improve habitat for nesting and migratory birds of conservation concern, such as Canada warbler.

- If furbearer management plan is appropriate (see “implementing a furbearer management program” earlier in this chapter under “Actions Common to Alternatives B and C only”) implement strategies to manage beaver populations to achieve refuge habitat goals and objective.

Within 5-10 years of CCP approval:

- In woodcock focus areas (map 2-2), develop and implement a plan to manage this habitat in proximity to upland nesting areas. Create and maintain alder in suitable age/size class to maintain quality foraging and brood areas. Alder would be maintained on approximately 20-year rotations
- Manage concurrently for Canada warbler in woodcock focus areas..

Within 10-15 years of CCP approval:

- Acquire 867 acres of this cover type within the expansion area, from willing sellers, and manage the fee lands as described in the objective 1.4.

Objective 1.5 (Open Water and Submerged Aquatic Vegetation)

In partnership with the States of Maine and New Hampshire, and the FERC license for Errol Project (FPLE), as appropriate, manage the estimated 5,880 acres of open water on Service-owned lands, within the current and expanded refuge boundaries, to maintain floating-leaved and submerged aquatic vegetation (SAV) and native fish such as brook trout, provide loafing and foraging areas for water birds, and to maintain high water quality to benefit other native vertebrate and invertebrate aquatic life.

Rationale

The refuge currently owns, or has approval to acquire, an estimated 5,834 acres of this habitat type. Under the alternative B expansion proposal, we recommend Service acquisition of an additional 69 acres of this habitat type (46 acres in fee; 23 acres in easement). The refuge's open waters encompass the rivers and backwaters, small ponds, and the portion of Umbagog Lake that extends from the current shoreline to the original, pre-1851 shoreline, including the zone of floating-leaved and submerged aquatic vegetation. These open waters provide loafing areas for many birds and harbor important plant and other food resources below the surface. Our management emphasis over the next 15 years will be to inventory and map the extent of SAV and mussel beds, and establish parameters, and implement a program, for monitoring water quality and the effects of water-level fluctuations on resources of concern.

Umbagog Lake has some unique features, perhaps related to its extensive shallow areas. The average depth of the lake is 15 feet. Aside from the Magalloway and Androscoggin rivers, most of Umbagog functions as a lake ecosystem. However, little is known about how the riverine and lake aquatic system functions. The lake has vast mussel beds that extend through much of the lake, at least on the New Hampshire side. The enormous collective filtering capacity of this community may contribute much to the high water clarity of the system. More study is needed to understand how the mussels affect the rest of the Umbagog Lake food web and how water level fluctuations affect the mussels (Jim Haney, University of New Hampshire, personal communication, 2005).

SAV, with their flexible stems and leaves, are rooted in the sediment and completely covered by water. These plants produce oxygen, filter and trap sediments, absorb nutrients, and provide food and shelter for fish and wildlife. Plants such as pondweeds, bulrushes, and wild celery produce seeds and tubers critical to foraging waterfowl. SAVs host many aquatic invertebrates that are, in turn, food for waterfowl and their broods. The distribution of these plants in the lake is affected by water depth, water clarity, and sediment type. SAVs typically occur on muddy or soft sediments rather than on sand or gravel sediments (Stevenson et al. 1979, Krischik et al. 2005). Different water levels on Umbagog Lake affect the extent of ice scouring and freezing of the lake bottom and consequently the distribution of SAVs.

The Magalloway River and Umbagog Lake are important wintering habitat for native brook trout from the Diamond River watershed (Diane Timmins, NHFG, personal communication, 2004) and Rapid River (Boucher 2005). MDIFW is concerned about potential recruitment of smallmouth bass into the Rapid River and the Cambridge River systems and the bass dominating critical habitat and food resources to the detriment of “an extraordinary brook trout resource” (Boucher 2005). Smallmouth bass were illegally introduced into Umbagog Lake around 1985. Prior to this release, the major fishery in the lake was a cold water fishery around the mouth of the Rapid River and warm water fishery for pickerel and yellow perch. In addition to potential impacts to brook trout, there are indications that the number and behavior of anglers has changed on Umbagog Lake with the arrival of bass. Bass anglers fish more intensively than other anglers and tend to fish in shallower water, close to shore, and spend more time in one spot. The impacts to this increased fishing pressure on loons and other wildlife is unknown (Forrest Bonney, personal communication, 2002). The 2005 Maine CWCS identifies surveys/monitoring and research as the two highest priorities in the state for conserving brook trout populations (MDIFW 2005). In addition, we will work with our state partners to implement the goals and objectives of the Eastern Brook Trout Joint Venture, an interagency partnership which is currently developing a strategic plan.

Strategies

In addition to strategies under “Actions Common to All of the Alternatives” affecting this habitat type:

Within 5 years of CCP approval:

- Initiate mapping project to determine distribution of submerged aquatic vegetation – species, density, and size of beds.
- Initiate mapping and monitoring program to evaluate native mussel beds; survey lake and associated rivers for rare and invasive species.
- Determine, in cooperation with state partners, the holder of the FERC license for Errol Project, FPLE, and the Umbagog Working Group, how best to implement the Eastern Brook Trout Joint Venture goals and objectives in this area

Within 5-10 years of CCP approval:

- Evaluate littoral zone sediments where submerged aquatic vegetation is sparse or non-existent, and re-establish vegetation where appropriate to enhance or improve food resources for waterfowl.
- Monitor water quality, chemistry, and water levels for potential effects on aquatic vegetation, fish, and waterfowl.
- Inventory macro-invertebrates and fisheries resources.
- Evaluate the potential use of fish barriers to prevent non-native fish species from becoming established in water bodies surrounding Umbagog Lake;.
- Acquire an estimated 69 acres of this habitat within the expansion areas and manage the fee lands as described in objective 1.5

Within 10-15 years of CCP approval:

- Evaluate point and non-point sources of pollution affecting refuge lands and work with State, private and local entities to improve water quality.

Objective 1.6 (Common Loon)

Within 15 years of CCP completion, and cooperating with state partners, and the holder of the FERC license for Errol Project (FPLE), as appropriate, conserve

and manage common loon territories to support a 5-year annual average of 14 nesting pairs on Umbagog Lake and its tributaries, and 4 additional pairs within the expansion area, and achieve a 5-year average annual productivity of 0.5 chicks per nesting pair. Management activities will be focused in fen and flooded meadow, floodplain and lakeshore, and open water and submerged aquatic vegetation habitats.

Rationale

Umbagog Lake and its associated rivers and backwaters are important breeding areas for the common loon in the Northeastern United States. This refuge is one of only 3 in the Refuge System in the lower 48 states that support breeding common loons. The common loon was also one of the key species specifically identified for conservation at the time of refuge establishment. The BCR 14 plan lists the common loon as a species of moderate conservation concern.

Regional threats to common loon include habitat loss due to shoreline development, water level fluctuations, human disturbance (recreational pressures), environmental contaminants, oil spills, lake acidification, mercury poisoning, and lead poisoning among other threats. The proposed Lowest Observed Adverse Effect Level (LOAEL) for mercury in adult loon blood is 3.0 ug/g (Evers et al. 2004). Because blood mercury levels from adult loons sampled from Umbagog Lake during 1994-2004 have never reached this proposed effect level, mercury does not appear to be a risk factor to adult loons in this system. Lead fishing tackle does pose a significant threat to loons. From 2000-2004, six loon carcasses found on Umbagog Lake were submitted to Tufts University School of Veterinary Medicine to determine the cause of death. All six (100%) were attributed to lead poisoning (Mark Pokras, Tufts University, unpublished data).

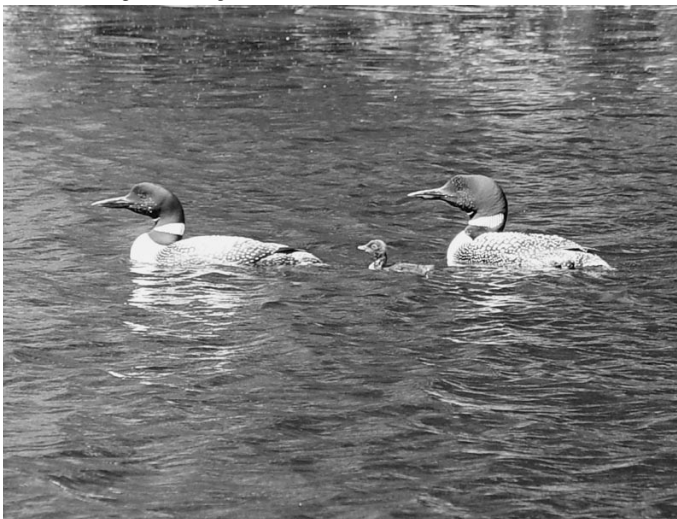
The Service and cooperating partners monitor and manage activities on Umbagog Lake to benefit loons. They work annually with the holder of the FERC license for the Errol Project, FPLE, who manages water levels, and by closing nesting areas, and installing educational signs. In spite of these management activities, the LPC reported that the Umbagog Lake loon population declined from 31 territorial pairs in 2000 to 15 territorial pairs in 2002 (Taylor and Rubin 2002).

The majority of loon nests on Umbagog Lake are established from mid-May to mid-June with hatching dates from mid-June to late July. Nest site selection is often opportunistic with loons using island and mainland marshes, muskrat feeding mounds, floating bogs, and logs. Loons also readily accept floating

platforms (McIntyre and Barr 1997). Common loons are strongly territorial and the territory size they will defend is highly variable depending on lake size, suitable nesting sites and land features that provide privacy from other pairs (Lang and Lynch 1996). Umbagog Lake's large size and prevalence of coves and islands offers many potentially suitable territories for common loons.

Using summary data from LPC reports from 1991 to 2005, the number of nesting pairs were analyzed in 5 year intervals to develop a target number of nesting pairs of common loons. From 1991-1995, the average number of nesting pairs was 17.4 ± 3.44 , from 1996-2000, the number was 18.4 ± 2.30 and from 2001-2005, the number was 14.0 ± 2.92 . The historical average from 1976 to present (14 pairs) is reflected in the most current 5 year average. This number of nesting attempts by common loons also

Common loons and chick on the Magalloway River



Ian Drew/USFWS

reflects current conditions with confounding variables including the presence of 4 nesting pairs of eagles. The refuge and cooperating partners will work to keep the number of nesting pairs at the approximate historical average of 14 pairs. The refuge and cooperating partners will also work toward increasing production of those 14 pairs to an average of 0.5 chicks per pair based on the rate of 0.48 chicks fledged per pair for a self-sustaining population (Evers 2004). This objective is not intended to maximize the number of common loons in the area, but to achieve a level which reduces negative interactions between common loons and between common loons and other waterfowl. The four additional pairs within the expansion area include territories on: 1) Sturtevant Pond, 2) B Pond, 3) C Pond and 4) Pond in the River.

Strategies

In addition to objective 1.5 strategies under alternative A:

Within 5 years of CCP approval:

- As studies are completed on Umbagog Lake, validate the loon nesting and territorial carrying capacities, and further determine whether 14 nesting pairs on the lake, and 4 nesting pairs in the expansion area, remain appropriate targets for these areas.

Within 5-10 years of CCP approval:

- Monitor angler use, and map locations of fishing pressure and other recreational users, in relation to common loon territories and other breeding wildlife
- Develop and implement a study to evaluate interactions of loon with waterfowl during the breeding season; specifically, evaluate how waterfowl interact at high loon densities.
- Develop and implement a study to examine interactions between loons and other piscivores (eagles, osprey, etc.), including competition for food and nest sites.
- Evaluate the need for predator control around common loon sites; consider predator control measures targeted at individual animals
- Evaluate the availability and quality of natural nesting habitat for common loon.

Goal 2 Manage floodplain and lakeshore habitats to benefit Federal trust species and other species of conservation concern.

Objective 2.1 (Wooded Floodplain)

Manage 1,416 acres of wooded floodplain on Service-owned lands, within the current and expanded refuge boundaries, to provide habitat for nesting cavity-dependent waterfowl and other priority bird species of regional conservation concern, including northern parula and rusty blackbird. In addition, manage perching areas for bald eagle, and brood foraging areas for American black duck and other waterfowl. Also, where this habitat type overlays woodcock focus areas, manage for feeding and nesting American woodcock.

Rationale

Wooded floodplain habitat on the refuge includes the following National Vegetation Classification System (NVCS) associations: red maple floodplain forest, red maple-balsam fir floodplain forest, white spruce-balsam fir berm woodland, red maple-tussock sedge floodplain woodland, black ash-mixed hardwoods swamp, and red maple-black ash swamp (appendix M). This habitat type, which constitutes 5% of refuge acres, contributes significantly to the

wildlife diversity known on the refuge. For example, we have detected over 75 bird species from point locations in this habitat type during our breeding bird surveys.

The Magalloway River floodplain, ranked as an S2 (imperiled) community by NHNHB, and approximately 245 acres in size, offers quality habitat for waterfowl, providing the combination of large cavity nesting trees and river bottomland areas with submerged and floating leaf aquatic plants and abundant substrate for invertebrates. Common goldeneye, wood duck, and hooded and common mergansers nest in cavities in live trees with a diameter at breast height (d.b.h.) of 18 inches or more (Tubbs et al. 1986).

The rusty blackbird, a watchlist species for BCR 14 and PIF 28 bird conservation planning areas, nests in riparian areas, boreal wooded wetlands, and beaver flowages (DeGraaf and Yamasaki 2001; Rich et al. 2004). According to the species profile in the 2005 NH WAP, this species has declined dramatically; BBS results from 1996-2001 indicate a 10.7% decline (NHFG 2005).

We have documented rusty blackbird breeding in the Magalloway River floodplain. It builds a nest near streams, ponds, bogs, and fens with a conifer component, usually less than 10 feet above the ground in thick foliage near the trunk of a young spruce or fir or in a shrub thicket. It will also utilize the spruce-fir and mixed woods habitat types between 1000 ft to 4,000 ft in elevation in refuge uplands. During migration rusty blackbirds congregate in flocks in wooded swamps (DeGraaf and Yamasaki 2001) and migrating flocks are documented for Umbagog Lake (Brewster 1937), although they may be less common now (Richards 1994). The rusty blackbird shows some aversion to clearcutting that creates suitable habitat for competitors including red-winged blackbird and common grackle (Dettmers 2005). Some disturbance (e.g., windthrow, beaver activity) creates forest openings allowing regeneration of softwoods and resulting in potential rusty blackbird nesting habitat (Avery 1995). The New Hampshire WAP identifies the use of pesticides on the breeding and wintering grounds, destruction of wintering habitat, acidification of water bodies on the breeding grounds and efforts to control blackbirds on winter roosts may be the contributing to the decline of this bird.

The northern parula is associated with mature moist forests and forested riparian habitats dominated by spruce, hemlock, and fir with an abundance of lichens (especially *Usnea*) in which they build their nests. There are indications that the northern parula population decline is related to the decline of *Usnea*, a lichen sensitive to air pollution (DeGraaf and Yamasaki 2001). PIF considers the northern parula a moderate priority for BCR 14, although the region supports 23% of the population (Dettmers 2005). The northern parula is rarely in deep woods, but also avoids clear cuts and may be sensitive to forest fragmentation (DeGraaf and Yamasaki 2001). It may require at least 250 acres to sustain a breeding population (Robbins et. al. 1989). The 2005 Maine CWCS identifies habitat conservation and research as the two highest priorities in the state for conserving rusty blackbird and northern parula populations (MDIFW 2005).

Through managing this habitat type, and the vernal pools embedded within it, other native species will benefit including a rich diversity of amphibians such as mink frog, spotted and blue-spotted salamanders, and wood frog. In addition, sustaining this habitat would benefit several bats including little brown, hoary, and northern long-eared that roost in tree cavities, under loose bark, or under dense foliage.

The refuge currently owns, or has approval to acquire, 1,293 acres of this habitat type. Under the alternative B expansion proposal, we recommend Service acquisition of an additional 136 acres of this habitat type (123 acres in fee; 13

acres in easement). Our management emphasis over the next 15 years would be to identify the habitat attributes most important for sustaining the focal species identified in the objective statement, and enhancing, and/or restoring, those attributes. We describe some of those attributes in the species' discussions below. We would manage this habitat type on current refuge lands within the habitat management units we have identified in appendix K.

Given our habitat management and land acquisition proposals under alternative B, we estimate refuge fee lands could provide high quality breeding habitat to support 115 pair of northern parula (based on an estimated density of 12.35 ac/pair), and 58 pair of rusty blackbird (based on an estimated density of 24.71 ac/pair), thus contributing directly to the BCR 14 goals for both of these species of conservation concern (Randy Dettmers, personal communication, 2006). These values may be over-estimates, since not all wooded floodplain habitat is equally suitable for these two species.

Strategies

In addition to objective 2.1 strategies under alternative A:

Within 5 years of CCP approval:

Identify suitable habitat, and assess habitat quality and habitat use by migratory birds such as northern parula and rusty blackbird. Document habitat use using regional Service protocol for breeding bird surveys, or other appropriate protocols..

- Develop and implement a plan to improve habitat for nesting and migrating birds of conservation concern, such as northern parula and rusty blackbird.
- Retain the majority of trees with cavities, standing dead trees, downed logs, large trees, and large super-canopy trees in the riparian areas.
- In woodcock focus areas, develop prescriptions to enhance habitat type for this species.

Within 5-10 years of CCP approval:

- Manage lowland hardwood and alder to provide adequate food resources for beaver to promote a natural cyclical succession of this habitat type driven by beaver.
- If furbearer management plan is appropriate (see “implementing a furbearer management program” earlier in this chapter under “Actions Common to Alternatives B and C only”) implement strategies to manage beaver populations to achieve refuge habitat goals and objective.
- Map and monitor the rare floodplain forest type that occurs along the Magalloway River.
- Acquire 136 acres of this cover type within the expansion area, from willing sellers, and manage the fee lands as described in the objective 2.1.
- Evaluate isolated backwater areas with high potential for waterfowl brood rearing (e.g. quiet backwaters with the combination of forest cover, submerged aquatic vegetation, and intermixed emergent wetlands in Dead Cambridge and Upper Magalloway Rivers) to determine if seasonal boat access closures to reduce disturbance; implement closures if beneficial.

Within 10-15 years of CCP approval:

- Maintain, enhance and/or create cavity trees within a range of diameter classes in close proximity to water to provide roosting and nesting areas. Maintain suitable habitat between snags (standing dead trees) and feeding areas.

- Restore the hydrology of the Day Flats area by plugging ditches and re-contouring the disturbed areas.
- Evaluate the dynamics and succession of the red maple/black ash type and relate its importance to focal species. If warranted, restore and maintain it to sites where site capability is high for this type and it is part of the predicted potential natural vegetation.

Objective 2.2 (Lakeshore Pine-Hemlock)

Maintain 520 acres of lakeshore pine-hemlock on Service-owned lands, within the current and expanded refuge boundaries, to provide nesting and migrating habitat for birds of conservation concern; to sustain the vegetation diversity within this type, such as the jack pine component; to maintain nesting habitat for bald eagle, osprey, and other raptors; to protect water quality; and, to maintain the scenic and aesthetic values of the Umbagog Lake and other lake shorelines.

Rationale

The lakeshore pine-hemlock habitat type is comprised of the following NVCS associations: hemlock mesic forest, hemlock-hardwoods forest, hemlock-white pine-red spruce forest, red pine-white pine forest, and jack pine/blueberry/feathermoss forest (appendix M).

The refuge currently owns, or has approval to acquire, 520 acres of this habitat type. Small stands likely occur in the proposed expansion area, but they were not discernable in the data set we used to map vegetation. Should stands be acquired in fee under the alternative B expansion proposal, they would be managed similarly. Our management emphasis over the next 15 years would be to protect and sustain existing and potential nest stands and perch trees for bald eagle and osprey, and to inventory and monitor the jack pine stands to serve as a basis for future management.

On the refuge, bald eagle and osprey often nest in large supercanopy trees (large white pines that stick up above the other canopy trees), or in tall snags (standing dead trees) in this habitat type. Additional information on bald eagles and osprey is discussed under objective 2.3. Jack pine communities are rare in New Hampshire and Maine and the stands around Umbagog Lake are the only low-elevation occurrences in New Hampshire (Publicover et al. 1997). The jack pine stands at Umbagog Lake are scattered along the rocky eastern shore and islands of the lake.

Through managing this habitat type, other native species will benefit, including nesting merlin and sharp-shinned hawk, olive-sided flycatcher, veery, and yellow-bellied sapsucker, among many other common species.

Strategies

In addition to objective 2.2 strategies under alternative A:

Within 5 years of CCP approval:

- Develop and implement a HMP to perpetuate this habitat type, giving priority to water quality protection and aesthetic values
- Maintain large diameter trees for raptor perch trees and future nest trees (also see objective 2.3 immediately below)
- Ensure the HMP addresses recruitment of super-canopy pines.

Within 5-10 years of CCP approval:

- Work with NGO's and States to increase monitoring and protection of raptors, and if feasible, implement cooperative procedures to protect merlin and other forest dependent raptors of conservation concern.

Within 10-15 years of CCP approval:

- Where jack pine occurs, map and monitor this type, and consult with state heritage program and other regional ecologists to determine if special management is warranted to sustain this rare ecological community in the Upper Androscoggin watershed; amend HMP to include management prescriptions.

Objective 2.3 (Bald Eagle and Osprey)

Maintain habitat within one mile of high quality bald eagle foraging habitat to support 3-4 nesting pairs of bald eagle with a minimum annual 1.0 chick/pair productivity level over a 5 year average. Given this bald eagle density, and recognizing inter-specific competition, maintain habitat to support 15 nesting pair of osprey on existing and proposed refuge expansion lands, with a minimum annual 1.0 chick/pair productivity level over a 5 year average.

Rationale

The protection of these two species was a primary reason the refuge was established, and they have been a management priority since then. As such, we believe their management warrants special consideration in a separate objective statement.

Bald eagle

The bald eagle is listed as endangered in New Hampshire and threatened in Maine and continues to be protected by the Bald and Golden Eagle Protection Act. In New Hampshire and Maine, bald eagles are found along major rivers and lakes or near the coast in relatively undisturbed forest patches. Bald eagles perch on, nest in, and hunt from tall, coniferous and deciduous trees or snags (standing dead trees) near water. In the Northeast, white pine is the most common nest tree. Nests are usually within 250 feet of open water near quality foraging areas.

Fish are the preferred food source, although eagles also take waterfowl, aquatic mammals, and scavenge for food. Eagles fish mostly in shallow, low-velocity waters. Chain pickerel, brown bullhead, suckers, white perch, and yellow perch are typical prey in interior Maine (Charles Todd, MDIFW, unpublished report).

Bald eagle



USFWS

In winter, some individuals may leave the breeding areas and congregate in areas with large expanses of unfrozen, open water. A forest stand that offers thermal protection from inclement winter weather is needed for communal night roosting. Night roosts are most often found near foraging areas, but may be further away if the roost is more protected. Umbagog Lake does not support a winter roost site, although some eagles remain in the area (along the Androscoggin River) and scavenge on the lake.

The main goal of the *Northern States Bald Eagle Recovery Plan* (USFWS 1983) is to reestablish self-sustaining populations of bald eagles throughout the northern states region. The initial recovery plan objective is to have 1,200 occupied breeding areas distributed over a minimum of 16 states with an average annual productivity of at least 1.0 young per occupied nest. From 1994-2002 the Leonard Pond nest on Umbagog Lake produced an average of 0.89 chicks/year. A second nest, near Tidswell Point, has produced 1.5 chicks/year from 2000-2005. Umbagog Lake is at the headwaters of the Androscoggin River, and as such, the eagles on the lake are an extension of the Maine eagle population.

Charlie Todd (MDIFW, personal communication, 2005) determined that Umbagog Lake has the potential to support two to three successful nesting pairs of bald eagles given the separation distance that eagles typically establish from one another. Todd (2005) evaluated several large live white pines near the dead nest tree in Leonard Pond to determine the potential for alternative nest sites in the area. Alternative nesting trees appear to be available to the eagles should they decide to use an alternative site.

Osprey

The Upper Androscoggin River watershed is an important breeding area for osprey. At the core of this area, Umbagog Lake and its associated rivers and backwaters, was the only part of New Hampshire that maintained a breeding population of osprey through the region-wide decline from the 1950s through the 1970s (NHFG 2005). Osprey are listed by the State of New Hampshire as a threatened species. Regional threats to osprey include predation, shoreline development, human disturbance, electrocution, mercury, lead shot and sinkers, non-point source pollution (contaminants), and wetland loss (NHFG 2005). Osprey populations have experienced strong recoveries on the statewide scale since the early 1980s (Martin et. al. 2006).

Osprey nesting in the U.S. will winter in the Caribbean, Central America, and South America (Henry and VanVelzen 1972; Environment Canada 2001). Osprey breeding on the east coast of the U.S. will winter primarily in northern South America and sometimes in Cuba and Florida (Martel et. al. 2001). Female osprey generally winter farther south than males and individuals of both sexes show strong fidelity to wintering and breeding sites (NHFG 2005).

In northern New England, osprey will typically establish breeding territories near large lakes, major rivers, and coastal estuaries. A habitat model developed for the Gulf of Maine watershed (USFWS 2000) found that 90% of 200 osprey nests were located within 0.6 miles of major rivers or lakes greater than 100 acres in size. Osprey generally require areas with dependable fishing sources within 2 to 3 miles, standing trees or other suitable structures located in wetlands, and an ice-free period of no less than 20 weeks (NHFG 2005). Ospreys nest atop a variety of structures including natural snags (standing dead trees) and artificial poles in or near water with good visibility (DeGraaf and Yamasaki 2001).

Over the past 25 years, the ASNH, through a contract with NHFG, has monitored nesting attempts, and also began augmenting nesting sites with artificial nesting structures around the lake in 1977 (NHFG 2005). In 2005, through a contract with the refuge, ASNH and the Biodiversity Research Institute (BRI) conducted aerial surveys for osprey in addition to the ground surveys used from 1996 to 2004. A similar method of aerial surveys had been used by ASNH from the mid-1980's to 1996 when they were discontinued due to a lack of aircraft and qualified pilots. Seven new nests were discovered (5 in New Hampshire, 2 in Maine) and field observations were conducted on 26 osprey nests in the study area. The 2005 survey data estimated 17 territorial pairs of osprey, with 14 of those pairs actively engaged in nesting and 12 of the 14 nesting pairs successfully fledged a total of 18 young (Martin, et. al. 2006). ASNH has found osprey numbers to be variable over time. The 14 nests discovered in 2005 more than doubles the number of active nests found in 2004 (Martin et. al. 2006).

Charlie Todd (MDIFW, personal communication, 2005) suggested a link between an increasing bald eagle population and declining osprey numbers as a result of increased competition and territoriality. He has observed that bald eagles will appear in an area with many ospreys; with time the osprey may decline and

eventually there are osprey areas and eagle areas with no overlap. Bald eagle population recovery has been reported to displace osprey pairs to less optimal nesting areas that are further from preferred foraging areas (Ewins 1997).

Strategies

In addition to objective 2.3 strategies under alternative A, and objective 2.2 strategies immediately above:

Within 5 years of CCP approval:

- Protect super-canopy trees within 1 mile of high quality foraging habitat to support nesting and perching by bald eagles and osprey.
- Protect individual nest trees with at least a 600-foot buffer area.
- Continue to protect active bald eagle and osprey nests from predators and human disturbance using outreach and visitor contact, buoy lines, restricted access, predator guards and other tools as warranted.
- Protect historic nest sites, nest trees, and partially constructed nest trees.

Within 5-10 years of CCP approval:

- Manipulate pines in high quality raptor habitat areas to promote new nesting sites.
- Develop and implement outreach methods designed to minimize discarded fishing tackle and lines.

Within 10-15 years of CCP approval:

- Ensure recruitment of new nest trees; identify stands with potential.

Goal 3 Manage upland forest habitats, consistent with site capability, to benefit Federal trust species and other species of conservation concern

Objective 3.1 (Mixed Spruce-Fir/Northern Hardwood Forest)

Conserve the mixed spruce-fir/northern hardwood forest on Service-owned lands within the current and expanded refuge boundaries, to sustain well-distributed, high quality breeding and foraging habitat for species of conservation concern, including Blackburnian, black-throated green, and Canada warblers, and American woodcock. Also, where consistent with management for those refuge focal species, protect critical deer wintering areas and provide connectivity of habitat types for wide-ranging mammals.

Rationale

As we mentioned under goal 3, alternative A, we define the “mixed spruce-fir/northern hardwood forest matrix” as the most extensive, most connected, and most influential landscape type across the Upper Androscoggin River Watershed basin. Knowing the mixed forest matrix is important because it can influence ecological processes that may affect biodiversity, including the amount and distribution of wildlife species. Others have also defined the mixed spruce-fir/northern hardwood forest as the past, current, and potential future dominant landscape type in the Upper Androscoggin River Watershed basin (Kuchler 1964; Charlie Cogbill, pers comm, 2004). Embedded in the mixed forest matrix landscape, we also define three dominant habitat types: spruce-fir; conifer-hardwood mixed woods; and, northern hardwood (see figure 2.1A and 2.1B). Each of these individual habitat types is found in varying amounts on the refuge and in



Chan Robbins/USGS

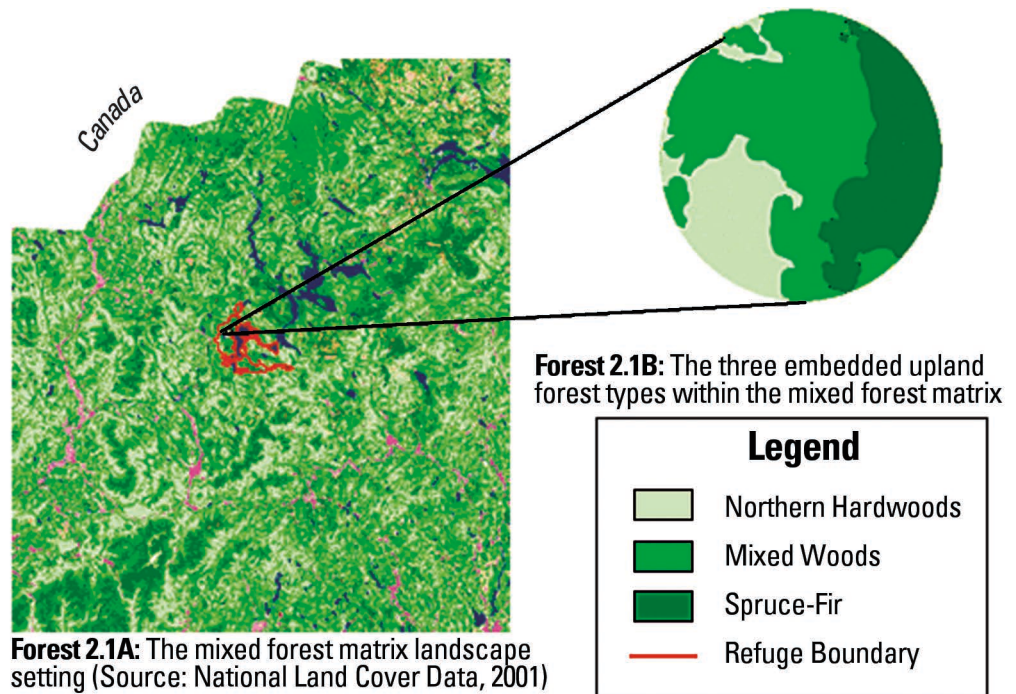
Black-throated green warbler

the surrounding landscape. We have developed separate sub-objectives for each type as outlined below.

According to Cogbill, during the last 150 years, the mixed forest included more conifer than occurs today, particularly in the lowlands, and contained little aspen or white pine (Cogbill pers comm. 2004). This is also consistent with Kuchler’s potential natural vegetation types, and our analysis of the site capabilities on refuge lands (Kuchler 1964). Site capabilities were interpreted from ecological land units (ELUs), a combination of elevation, bedrock geology, and topography, which are three physical characteristics that strongly influence what types of plant communities may be found there (Anderson 1999).

In the Partners in Flight (PIF) Eastern Spruce-Hardwood Physiographic Area 28 Plan, the mixed forest is identified as a high priority habitat that is critical for “long-term planning to conserve regionally important bird populations” (Rosenberg and Hodgman 2000). Our breeding bird survey data shows the elevated importance of the refuge’s mixed forest matrix for blackburnian, Canada, and black-throated green warblers in the area. We have selected these, and the American woodcock, as our refuge focal species for management. These species habitat requirements are described below.

The selection of our focal species resulted from a landscape analysis described in appendix N. It was after this analysis our planning team determined that sustaining a mature mixed forest, with a high conifer component and high structural diversity, was the most important ecological contribution the refuge could make through management to the Upper Androscoggin River watershed,



the Northern Forest, and the Refuge System. As such, after goal 1, this goal would be the next highest habitat management priority under alternative B. To accomplish this, we would manage our forest to achieve a mix of regeneration, mid-, and mature age classes, and retain snags (dead or dying trees that are

still standing), and other wildlife trees, downed wood and super-canopy trees. Some areas in all forest habitat types, may be retained as unmanaged 'control' or comparison areas, as part of forest management research projects. Additionally, forestry industry inoperable and high resource sensitivity zones will receive little or no active management. In low and moderate resource sensitivity areas, we will primarily use uneven-aged management techniques to convert the existing, predominantly even-aged forest stands to a multi-aged, multi-structured condition. Even-aged management techniques may also be used in certain stands, such as those with healthy, advanced regeneration of spruce and fir, woodcock focus areas, or in deer wintering areas. Appendix K provides important details on how we plan to manage our forests. It includes additional information, supplementing what is provided below.

The 15 year scope of our CCP falls far short of the decades used to measure tree growth and stand development in the mixed forest. This objective requires consideration of a much longer timeframe within which to measure and achieve results. As such, our expectation is that it would take at least 100 years to accomplish this objective. This timeframe is based on our prediction of how long it would take to achieve the forest and stand composition and structural characteristics targeted for our refuge focal species identified in the objective statement.

Our habitat type classifications are based on grouped National Vegetation Classification System (NVCS) "associations." A cross-walk between refuge forest habitat types, NVCS associations, Society of American Forester types, and other vegetation classification systems is included in appendix M.

General Strategies (also see strategies for the three specific habitat types in sub-objectives below)

In addition to alternative A:

Within 5 years of CCP approval:

- Conduct breeding bird surveys according to regional Service protocols to track breeding bird trends on the refuge.
- Conduct a detailed inventory in each of the three habitat types to identify or refine specific silvicultural prescriptions.
- Conduct resource surveys prior to forest management to ensure that resources of concern are identified and impacts minimized or eliminated
- Perpetuate, through accepted silvicultural practices, the three habitat types through time, distributed within the refuge based on site capability and our ability to access and manage them. Insure that habitat patch size and connectivity are sufficient for species requiring large blocks of unfragmented habitat

Within 5 -10 years of CCP approval:

- Acquire up to 23,501 acres of upland forest within the expansion area in fee simple, and 20,427 acres in conservation easements, from willing sellers, and manage as described in objective 3.1.

Sub-Objective 3.1a (Spruce-Fir Habitat Type)

Manage the refuge's 17,778 acres (approximately) of spruce-fir to:

- Sustain singing, nesting and feeding habitat for blackburnian and black-throated green warblers (refuge focal species) by perpetuating a high (>70%) crown closure, favoring spruce during stand improvement, and maintaining super canopy trees

- Maintain at least 50% of deer wintering areas (map 2-10) as quality shelter at any given time, consistent with management of our focal species
- Provide connectivity of forested habitat types for wide-ranging mammals, consistent with management for our focal species
- Provide other structural characteristics to improve stand diversity for other native wildlife species dependent on this habitat type. This will include retention of approximately 6 live cavity trees or snags (standing dead trees/acre, with at least 1 of these exceeding 18 inches/dbh, and 3 others exceeding 12 inches dbh, and retaining coarse woody debris and super dominant or super canopy trees.
- The spruce-fir habitat type includes both high and low elevation spruce-fir. It is comprised of the following NVCS associations: lowland spruce-fir community, red spruce rocky summit, and a black spruce-red spruce community. It is an important ecological component of the diversity of the Upper Androscoggin River Watershed and supports many species of conservation concern.

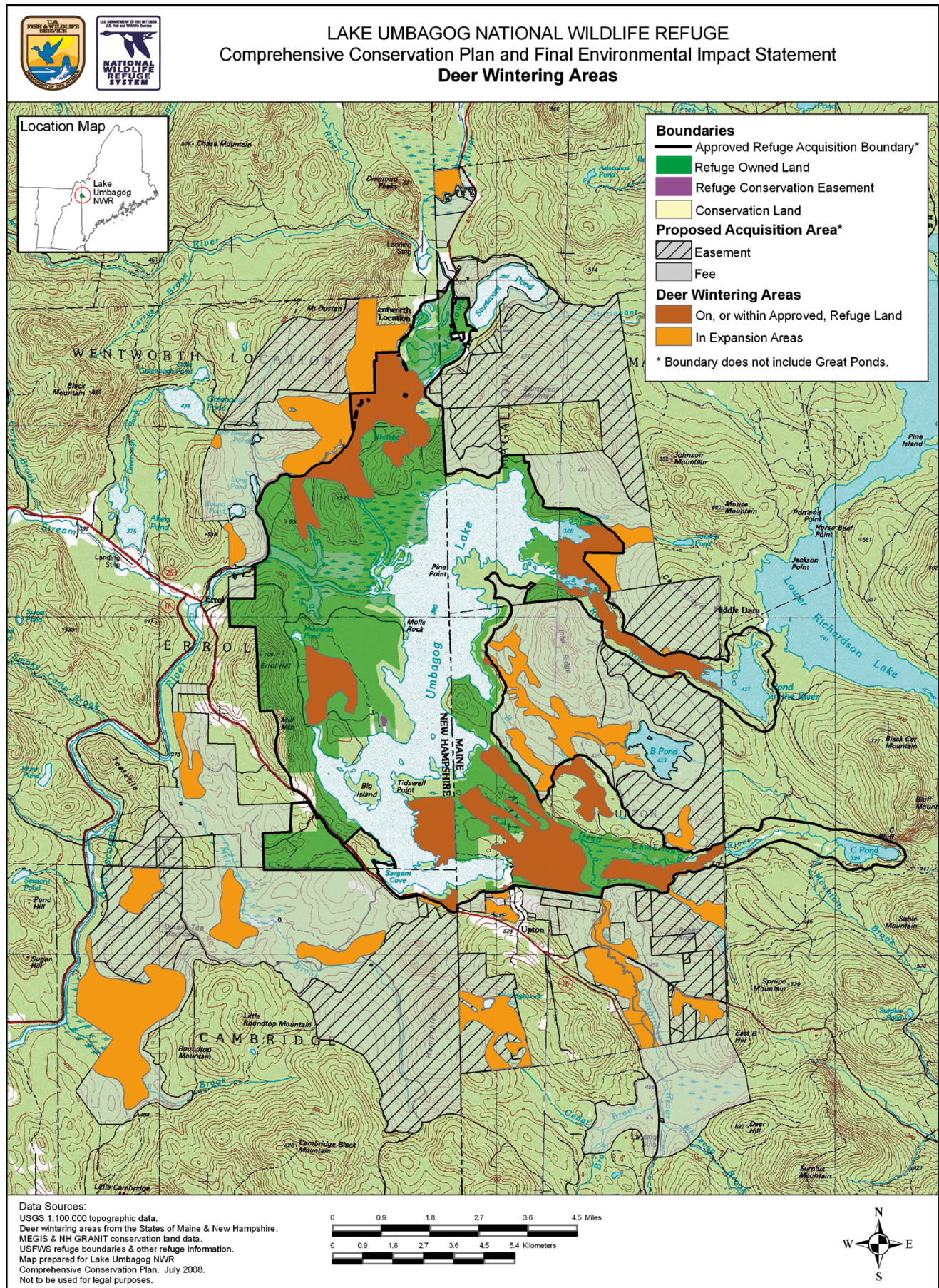
The 1995 New Hampshire Forest Resources Plan describes the spruce-fir habitat type as supporting more rare animal species than other major habitat types and considers mature spruce-fir a rare habitat type (New Hampshire Division of Forests and Lands 1995).

While we believe this habitat type was much more dominant historically in the mixed forest matrix than we see on the landscape today, its extent and age class distribution in New Hampshire and Maine has been affected by natural disturbances such as spruce budworm and bark beetle outbreaks, and from human disturbances, primarily logging. The 2005 New Hampshire Wildlife Action Plan (WAP) identifies development, timber harvest, non-point pollution, and altered natural disturbance regimes as the most challenging issues currently facing the conservation of this habitat type (NHFG 2005).

Given the apparent decline in spruce-fir habitat, its significance to our mixed forest focal species (blackburnian and black-throated green warblers), and its importance in State conservation plans, the spruce-fir habitat type will be our highest priority for upland forest management. Since our management will tend to create larger blocks of mature spruce-fir on the landscape, we anticipate that a by-product of our management will be the improvement of habitat quality for species more closely tied to this habitat, such as bay-breasted warbler, boreal chickadee, and gray jay, among others

Specific Strategies for the Spruce-fir Habitat Type (see appendix K for additional details)

- Improve habitat structural diversity for refuge focal species through pre-commercial and commercial thinning and/or other stand improvement operations, as appropriate. We will favor spruce during all stand improvements.
- Regenerate this habitat type through accepted silvicultural practices. Methods include, but are not limited to:
- Utilize primarily single tree or group selection uneven-aged management techniques, and to a lesser extent, clearcutting, or shelterwood even-aged techniques, 2) treatments should be timed to optimize the ability of the site to regenerate spruce and other conifer, 3) target age class goals under management will range from 100-130 years; and, 4) the size of each treatment action and cutting interval will be determined by management unit size, silvicultural prescription, and rotation age.



- In critical deer wintering areas (map 2-10), maintain updated maps of critical areas and manage these stands, to the extent compatible with management of Federal trust resources, to ensure long-term continuation of this habitat. The overall target would be to maintain a minimum of 50% of a deer wintering area as quality shelter at any point in time. Quality shelter includes softwood cover over 35 feet tall and 70% or higher crown closure (Reay et al. 1990). Refuge staff will assist state agencies with ground surveys of wintering deer areas on refuge lands.

Sub-Objective 3.1b (Conifer-Hardwood “Mixed Woods” Habitat Type)

Manage the 11,354 acres (approximately) of conifer-hardwood mixed woods with a high conifer component to:

- Sustain singing, nesting and feeding habitat for blackburnian and black-throated green warblers (refuge focal species) by perpetuating a high (>70%) crown closure, favoring spruce during stand improvement, and maintaining super canopy trees. Enhance foraging habitat for the black-throated green warbler and other native species dependent on this habitat type by developing small gaps to promote a diverse, layered understory. We will favor conifers wherever possible based on site capability.
- Provide connectivity of forested habitat types for wide-ranging mammals, consistent with management for our refuge focal species.
- Provide other structural characteristics to improve stand diversity for other native wildlife species dependent on this habitat type. This will include retention of approximately 6 live cavity trees or snags (standing dead trees)/acre, with at least 1 of these exceeding 18 inches/dbh, and 3 others exceeding 12 inches dbh, and retaining coarse woody debris and super dominant trees.

The conifer-hardwood mixed woods habitat type is comprised of the following NVCS associations: aspen-fir woodland, successional spruce-fir forest, and red spruce-hardwood forest. We believe the conifer component within this habitat type was much greater over the last 150 years than it is today, due to the past 20 years of logging practices. The New Hampshire WAP identifies development and acid-deposition as the most challenging issues facing this habitat type (NHFG 2005). The 2005 Maine CWCS identifies large-scale forestry operations that result in habitat fragmentation, change in over- and under-story species composition (stand conversion), reduction in rotation length, and loss through development as major threats to this habitat type (MDIFW 2005a).

Specific Strategies for the Mixed Woods Habitat Type (see appendix K for additional details)

- Improve habitat structure for refuge focal species through pre-commercial and commercial thinning and/or other stand improvement operations. We will favor spruce during all stand improvements.
- Regenerate this habitat type through accepted silvicultural practices. Favor conifer on appropriate sites. Methods include, but are not limited to:

On conifer dominated sites -

Utilize primarily single tree or group selection uneven-aged management techniques, and to a lesser extent, clearcutting, or shelterwood even-aged techniques, 2) treatments should be timed to optimize the ability of the site to regenerate spruce and other conifer, 3) target age class goals under management will range from 100-130 years; 4) the size of each treatment action and cutting interval will be determined by management unit size, silvicultural prescription,

*Mixed woods
on the refuge*



Ian Drew/USFWS

and rotation age. 5) in areas of advanced, healthy conifer regeneration, we will implement silvicultural techniques to protect it.

On hardwood dominated sites -

1) utilize small group selection with up to 1/5 to 1/2 acre group sizes, 2) target age class goals under management are 100-200 years, and 3) cutting cycles will be 15 to 20 years in order to maintain understory development.

Sub-Objective 3.1c (Northern Hardwood Habitat Type)

Manage the 9,872 acres (approximately) of northern hardwood habitat type on those sites optimally suited for hardwood growth to:

- Provide foraging habitat for Blackburnian and black-throated green warblers (refuge focal species) by developing multi-aged stands and a mid- to high canopy closure
- Sustain breeding, nesting and foraging habitat for Canada warblers, a refuge focal species, by developing openings, a diverse, layered understory, and promoting the aspen and birch community. This management would also benefit American woodcock (see discussion below)
- Provide other structural characteristics to improve stand diversity for other native wildlife species dependent on this habitat type. This will include retention of approximately 6 live cavity trees or snags (standing dead trees)/acre, with at least 1 of these exceeding 18 inches/dbh, and 3 others exceeding 12 inches dbh, and retaining coarse woody debris, and super dominant trees. Where possible, we will maintain and encourage the development of mast producing trees (e.g. black cherry, mountain ash, beech).

The northern hardwood habitat type is comprised of the following NVCS associations: red maple-yellow birch early successional woodland, northern hardwood forest, semi-rich northern hardwood forest, and paper birch talus woodland. This habitat type is more extensive on the landscape today than probably occurred over the last 150 years (Charlie Cogbill, personal communication, 2004). Similar to the spruce-fir type, its distribution is largely due to site capability and land-use changes over time. It is also an important ecological component of the diversity of the Upper Androskoggin River watershed.

The northern hardwood habitat type is a deciduous forest dominated by sugar maple, yellow birch and American beech on well-drained soils on mid-elevation slopes. American beech becomes more common in older stands. Most of the area covered by this community was logged at some time in the past (Rapp 2003). Aspen-birch is another forest component of this habitat type, although it can also be a temporary, early successional feature of any of the three broad upland habitat types on the refuge. White birch, quaking and bigtooth aspen, and pin cherry can dominate an area following a large disturbance such as fire or clearcut; however, these shade intolerant species are eventually replaced with more shade tolerant species characteristic of the particular site conditions.

Specific Strategies for the Northern Hardwood Habitat Type (see appendix K for additional details)

- Improve habitat structure for refuge focal species through pre-commercial and commercial thinning and/or other stand improvement operations.
- Regenerate these habitat types through accepted silvicultural practices. Methods include, but are not limited to:
 - 1) Utilize single tree or small group selection of up to 1/2 acre group sizes, 2) target age class under management are 100-200 years; and, 3) cutting cycles of 15 to 20 years in order to maintain understory development.

Sub-Objective 3.1d (Woodcock Focus Areas)

Manage the 2,664 acres in woodcock focus areas to provide and sustain all life stage habitat requirements for woodcock.

- Use accepted silvicultural practices in woodcock focus areas (map 2-2) to create openings, promote understory development, and sustain early successional habitat for American woodcock and Canada warbler. Generally, use group selection, clearcuts or patch cuts of up to 5 acres in size. Some larger roosting fields may also be maintained. Cutting cycles will be approximately 8-10 years on a 40 year rotation. Some 3-5 acre openings may be permanently maintained primarily by mowing and brush clearing using mechanized equipment.
- Perpetuate aspen-birch communities where they exist, and strive to achieve an appropriate distribution of regenerating, young, mid and mature age classes
- Conduct woodcock singing male surveys to document wildlife response to habitat management.

Focal Species Habitat Requirements

The Blackburnian warbler is associated with mature conifer habitats (> 80% canopy cover) of spruce, fir, hemlock, and pines, and in spruce-fir/hardwood mixed habitats including deciduous stands with patches of conifers. It nests and gleans insects in the upper canopy of conifers, especially spruce and hemlock, if present, and rarely pines (DeGraaf and Yamasaki 2001). Males sing from the tops of the tallest conifers, preferably over 60 feet. The Blackburnian warbler is

a moderate priority with a high regional responsibility within Bird Conservation Region (BCR) 14 (Dettmers 2005). Approximately 25% of the global population occurs in this region. This warbler is of conservation concern because of its relatively small total range, its preference for mature conifers, and its restricted winter range in the subtropical forests of northern South America. Declines are recorded for New England although the overall population appears to be stable. It is considered a forest interior species, susceptible to forest fragmentation and short rotation timber harvesting (50 years or less) (Hagen et al. 1996; Morse 2004). The effects of forest fragmentation, loss of hemlock to woolly adelgid, and deforestation on the wintering grounds are issues of concern to the conservation of this species (Morse 2004). The 2005 Maine CWCS lists the loss of hemlock as the chief threat to this species' conservation in Maine and identifies habitat conservation and research as the two highest priorities in the state for conserving their population state-wide (MDIFW 2005a).

The Canada warbler is declining across much of its range and is listed as highest priority in BCR 14 (Dettmers 2005). This bird is found throughout the watershed, and is not tied specifically to any of the three refuge upland habitat types, but may be tied more directly to a well-developed understory or shrub layer. PIF also has a goal of increasing the Canada warbler continental population by 50% (Rich et al. 2004). The Maine CWCS identifies habitat conservation and research as the two highest priorities in the state for conserving Canada warblers (MDIFW 2005a).

The black-throated green warbler is one of the forest-interior species most closely associated with a mixed forest. Black-throated green warblers are a moderate priority in BCR 14, with a high regional responsibility (18.4% of the global population), and a moderate regional threat level. This species is generally abundant and stable in the region. Although it occupies a wide range of forested habitat types, in the Northeast, it occurs at highest densities in closed canopy mid-to-mature forest with a significant conifer component. This foliage-gleaning warbler generally forages high in the canopy, but at a lower height than blackburnian warblers (Morse 1967). Spruce (particularly red spruce) and paper birch are favored foraging substrates. Although it will nest in deciduous trees, preferred nest sites are in dense conifer foliage on a limb or tree fork, at a height of about 20 ft. (DeGraaf 2001; Foss 1994). Large spruce trees are favored male singing perches (Morse 1993). Black-throated green warblers appear to require fairly large forest patches and a generally forested landscape (Norton 1999). Askins and Philbrick (1987) found that they disappeared from a 250 acre forest tract that became isolated from other forested habitat. Black-throated green warbler densities also decline in heavily thinned forest (Morse 1993). However, structurally heterogeneous forests that include small gaps provide improved foraging opportunities for this warbler (Smith and Dallman 1996).

The American woodcock is a highest priority species in BCR 14 (Dettmers 2005). Woodcock require several different habitat conditions that should be in close proximity to one another, and can consist of both uplands and wetlands habitat types. These include clearings for courtship (singing grounds), large openings for night roosting, young, second-growth hardwoods (15-30 years) for nesting and brood-rearing, and foraging areas (Sepik et al. 1981; Keppie and Whiting 1994). These habitat conditions occur naturally on the refuge and can be expanded through habitat manipulation. Lorimer and White (2003) estimate that natural disturbances in the pre-settlement forests created about 1-3% early successional habitat in mixed woods and northern hardwood forests and up to 7% in spruce flats that are more susceptible to blowdown.

Other Species Benefiting From Our Focal Species Management

As we described in the introduction to this alternative, we selected focal species, in part, because we believe their habitat requirements also represent the habitat

needs for many other Federal trust and native wildlife species dependent on that respective habitat type. For example, other birds of high conservation concern in BCR 14 that breed or forage in the mixed forest which we expect will benefit over the long-term from our management include: bay-breasted warbler (BCR highest priority), and boreal chickadee, Cape May and black-throated blue warblers (BCR high priority). Cape May and bay-breasted, in particular, prefer stands dominated by conifer, or pure conifer, which our management under this alternative would emphasize. While these species do not presently occur at high densities in our area, we predict their presence and breeding pair numbers would increase as our forest management tends toward favoring spruce, and as we allow for some stands to tend toward older age classes. Specifically, we may begin to see direct benefits to Cape May and bay-breasted warblers after 25-50 years of our proposed forest management under this alternative.

Our management for focal species on both currently-owned and proposed refuge lands, would also serve to ensure long-term conservation of critical deer wintering areas, and provide habitat connectivity for wide-ranging mammals including American marten, fisher, bobcat, black bear (Ray 2000), and potentially for the Federal-listed lynx, although it has not been documented in the immediate area (re: chapter 3, mammals discussion). Both state agencies have identified certain deer wintering areas as critical to maintaining the region's deer population and both have regulations and policies in place for their protection. In these areas, deer annually congregate in large numbers for protection and survival against wind, deep snow, and extreme cold. Typically, the deer wintering areas lie in lowland conifer or conifer-dominated mixed stands, 35 feet or taller, where there is a high crown closure, approximately 70% (Reay 1990). In addition, there are patches of hardwoods or softwoods within or near the core of the area at a height accessible to deer as browse. We predict that management strategies for our focal species would provide these stand attributes, and thus, management of deer wintering areas complements our habitat management priorities. Map 2-10 identifies critical deer wintering areas on or adjacent to the refuge provided by NHFG and MDIFW.

The 2005 New Hampshire WAP includes a list of "important wildlife" that may benefit from conserving mixed forest habitat types (NHFG 2005). Besides the species mentioned previously, species known on the refuge include: Cooper's hawk, hoary bat, northern goshawk, American three-toed woodpecker, blue-spotted salamander, northern myotis, ruffed grouse, wild turkey, veery, wood thrush, yellow-bellied sapsucker, American redstart, ovenbird, blue-headed vireo, and rose-breasted grosbeak. Appendix N, table N.1, lists additional species of conservation concern that will benefit from our management by habitat type.

Summary of Upland Forest Management Proposal

Our management emphasis over the next 15 years would be to maintain, enhance, create and/or restore the habitat attributes important for sustaining the focal species identified in the objective statement. Appendix K provides additional guidance we are proposing to follow. During the next 15 years, we would primarily manage the mixed spruce-fir/northern hardwood forest on current refuge lands within the habitat units we identify in appendix K.

The refuge currently owns, or has approval to acquire, 15,683 acres of upland forest. Under the alternative B expansion proposal, we recommend Service fee simple acquisition of an additional 23,501 acres of upland forest, and purchase of conservation easements on another 20,427 acres. Fee acquisition would allow for full management capability on those lands. On these easement lands, our objective would be to purchase the minimum rights necessary to insure quality wildlife

habitat would be permanently sustained. Typically, we would purchase at least development rights; however, we could purchase additional rights as needed. The Service works on a willing seller-only basis, and it would be up to the landowner to determine what additional management rights, if any, would be sold.

Given our long-term habitat management and land acquisition proposals under alternative B, we estimate refuge fee lands could provide high quality breeding habitat in the mid- and mature-aged spruce-fir and mixed woods habitat types to support up to approximately 3,975 pairs of blackburnian warblers (based on an estimated density of 4.94 acres/pair), and 2,892 pairs of black-throated green warblers in (based on an estimated density of 6.79 acres/pair) (Randy Dettmers, personal communication, 2006). In addition, refuge fee lands could provide high quality breeding habitat in the mixed woods and northern hardwoods habitat types to support up to approximately 1,036 pairs of Canada warblers (based on an estimated density of 13.84 acres/pair). In the refuge’s woodcock focus areas (map 2-2), there would be high quality habitat to support up to approximately 280 American woodcock singing males (based on an estimated density of 23.8 acres/singing male) (Andrew Weik, personal communications, 2006). We recognize, however, that these estimates are based on habitat acres alone, and may not fully take into account intra-specific competition among other breeding bird species in the same area.

In summary, and presented in table 2.1 below, our management would have the potential to directly contribute towards the BCR 14 goals for each of these species of conservation concern (Randy Dettmers, personal communication, 2006).

Table 2.1. Potential number of refuge focal species breeding pairs/singing males supported in refuge’s upland forest habitat types under alternative B management

Refuge Focal Species	Refuge Habitat Type	Number of Potential Breeding Pairs/ Singing Males Supported
Blackburnian warbler	Mid-and mature aged spruce-fir and mixed woods	3,975 pair
Black-throated green warbler	Mid-and mature aged spruce-fir and mixed woods	2,892 pair
Canada warbler	Mixed woods and northern hardwoods	1,036 pair
American woodcock	Woodcock Focus Areas	280 singing males

In addition, results from a Canadian study evaluating mean total density of all birds in various habitats indicate that under full implementation of this objective, over the long term, refuge fee lands could contribute a potential mean total density, inclusive of all breeding birds, of over 8,538 bird pairs in the spruce-fir and mixed woods habitat types combined (based on an estimated mean total density of 2.3 acres/pair), and 3,981 bird pairs in the northern hardwoods habitat types (based on an estimated mean total density of 2.48 acres/pair) (Kennedy et al. 1999).

Goal 4 Provide high quality wildlife-dependent activities such as hunting, fishing, wildlife observation and photography, as well as camping and boating in support of those activities.

Objective 4.1 (Hunting)

Within 3 years of CCP approval, at least 80% of hunters on the refuge will report that they had a high-quality experience.

Rationale

Hunting is identified in the 1997 Refuge Improvement Act as a priority public use. Priority public uses are to receive enhanced consideration when developing goals and objectives for refuges. Further, hunting is an established traditional use in the local area. We have implemented a hunt program on the refuge during the past 6 years.

In April 2007 we issued an amended Refuge Hunt Plan and environmental assessment after a 30 day public review and comment period. With our stated hunt program objectives, we intend to: 1) maintain a diversity of habitats within the refuge that are capable of supporting a diversity and abundance of wildlife species, and 2) provide wildlife-dependent recreational opportunities. We recognize hunting as a healthy, traditional, outdoor pastime that is deeply rooted in American heritage and, when managed appropriately, can instill a unique understanding and appreciation of wildlife, their behavior, and their habitat needs. It is also a priority public use on national wildlife refuges.

The refuge hunt program was first implemented during 2000, consistent with state regulations, and additional refuge regulations stipulated in 50CFR. Refuge lands were opened to migratory game bird and waterfowl and small and big game hunting. In April 2007, we amended the 2000 Refuge Hunt Plan and associated environmental assessment, and our Regional Director issued a new Finding of No Significant Impact. The amendment was completed to provide a more detailed analysis of the potential cumulative effects of the current hunt program.

Under alternative B, as we described earlier in this chapter under “Actions Common to Alternatives B and C Only”, within two years we propose to evaluate new hunting seasons, such as a turkey hunt on refuge lands in both states, and a bobcat hunt on refuge lands in Maine, consistent with both states’ regulations. However, as we stipulate in that earlier section, additional NEPA analysis and public involvement would need to occur before an expanded program could be implemented.

Providing a high-quality hunt on the refuge promotes visitor appreciation and support for refuge programs. A quality hunting experience is one that: 1) maximizes safety for hunters and other visitors; 2) encourages the highest standards of ethical behavior in taking or attempting to take wildlife; 3) is available to a broad spectrum of the hunting public; 4) contributes positively to or has no adverse effect on population management of resident or migratory species; 5) reflects positively on the individual refuge, the System, and the Service; 6) provides hunters uncrowded conditions by minimizing conflicts and competition among hunters; 7) provides reasonable challenges and opportunities for taking targeted species under the described harvest objective established by the hunting program; 8) minimizes the reliance on motorized vehicles and technology designed to increase the advantage of the hunter over wildlife; 9) minimizes habitat impacts; 10) creates minimal conflict with other priority wildlife-dependent recreational uses or refuge operations; and 11) incorporates a message of stewardship and conservation in hunting opportunities. These are all criteria we will use to evaluate our hunt program.

Strategies

In addition to objective 4.1 strategies under alternative A:

Within 2 years of CCP approval:

- Evaluate the potential for a turkey hunt on refuge lands in both states, and a bobcat hunt on refuge lands in Maine. If appropriate, develop a new Hunt Plan opening package, including new NEPA document, Federal Register notice, and public involvement opportunities. Both new hunt additions will be consistent with respective states’ regulations and refuge regulations.

Within 5 years of CCP approval:

- Establish an inter-state (New Hampshire and Maine) and Service Umbagog Lake Working Group to annually review hunting seasons in an effort to make seasons as consistent as possible
- Develop annual hunt plan after annual state meetings
- Evaluate numbers and distribution of waterfowl blinds each year, including placement of blinds on Maine side of refuge. Work with local waterfowl clubs to improve construction and placement of blinds, and evaluate and manage wood duck boxes.
- Waterfowl hunters would have priority for using blinds during the hunt season
- Establish additional parking areas off of the current road network to facilitate hunting in the expansion area as lands are acquired

Within 5-10 years of CCP approval:

- Provide literature, training, and other outreach tools targeting accurate identification of species of concern on the refuge (e.g. at check stations, kiosks, signage)
- Conduct surveys, or develop reporting system such as check station or permit system, to collect data for evaluating numbers and quality of program

Within 10-15 years of CCP approval:

- Evaluate pull-outs and parking areas for safety, and improve or relocate where necessary; also evaluate opportunities to provide access for people with disabilities
- Try to distribute the hunting pressure through use of maps and outreach

Objective 4.2 (Fishing)

Within 4 years of CCP approval in cooperation with the states, provide opportunities such that at least 80% of anglers on the refuge, or accessing the lake through the refuge, report they had a high-quality experience.

Rationale

Fishing is identified in the Refuge Improvement Act as a priority public use. Priority public uses are to receive enhanced consideration when developing goals and objectives for refuges. Providing high quality fishing opportunities for the public to engage in this activity on the refuge promotes visitor appreciation and support for refuge programs.

We would continue to allow access for fishing, in accordance with states of Maine and New Hampshire regulations, except in sensitive areas during nesting season. We propose to develop a new fishing access site on existing refuge lands at Mountain Pond, in conjunction with new trail and parking area plans. We define a high quality fishing program as one which 1) maximizes safety for anglers and other visitors; 2) causes no adverse impact on populations of resident or migratory species, native species, threatened and endangered species, or habitat; 3) encourages the highest standards of ethical behavior in regard to catching, attempting to catch, and releasing fish; 4) is available to a broad spectrum of the public that visits, or potentially would visit, the refuge; 5) provides reasonable accommodations for individuals with disabilities to participate in refuge fishing activities; 6) reflects positively on the Refuge System; 7) provides uncrowded conditions; 8) creates minimal conflict with other priority wildlife-dependent



USFWS

Preparing to fish on the lake

recreational uses or refuge operations; 9) provides reasonable challenges and harvest opportunities; and 10) increases visitor understanding and appreciation for the fishery resource

Strategies

In addition to objective 4.2 strategies under alternative A:

Within 5 years of CCP approval:

- Assist partners in conducting creel and angler surveys
- Work with partners to maintain or restore a quality brook trout fishery wherever appropriate in the Umbagog watershed, including the Rapid, Dead Diamond and Dead Cambridge rivers and tributaries, and C and B Ponds; cooperate with partners in maintaining and improving existing fish barriers to protect trout; work with Umbagog Working Group to implement recommendations from the Eastern Brook Trout Joint Venture once their strategic plan is completed
- Officially open the refuge to fishing through 50CFR regulations and develop a fishing plan
- Continue to restrict anglers from sensitive nesting areas or other areas determined to be high wildlife impact areas; establish thresholds of acceptable change when restrictions may be imposed to minimize impacts; Distribute angling pressure through maps and outreach
- Continue annual “Take Me Fishing” event
- Work with states through interstate commission, or other forum (e.g. proposed Umbagog Lake Working Group), to develop consistent fishing regulations on lead tackle
- Increase educational outreach to public on dangers of lead tackle and other debris to wildlife and the environment.
- Within 5-10 years of CCP approval:
 - Provide improved shoreline access (e.g. trails, docks, etc)
 - Improve opportunities for handicapped access to high quality fishing areas
 - Construct safe pullouts
 - Establish additional parking areas off of the current road network to facilitate fishing in the expansion area as lands are acquired
 - Provide walk-in fishing access to Mountain Pond in conjunction with new trails and parking area plans

Within 10-15 years of CCP approval:

- Work with states to eliminate fishing tournaments on Umbagog Lake to maintain reasonable solitude and a natural experience for anglers and other users.

Objective 4.3 (Wildlife Observation and Photography)

Within 2 years of CCP approval, at least 80% of refuge visitors engaged in wildlife viewing and nature photography will report a high quality experience

Rationale

Wildlife observation and photography are identified in the Refuge Improvement Act as priority public uses. Priority public uses are to receive enhanced consideration when developing goals and objectives for refuges. Providing high quality opportunities for the public to engage in these activities on the refuge promotes visitor appreciation and support for refuge programs.

This alternative expands upon alternative A by enhancing infrastructure to increase wildlife observation and photography opportunities. Additional trails would be created on refuge lands in the Potter Farm and Thurston Cove areas, and Mountain Pond (see map 2-8). These trails would be supplemented with observation platforms and photography blinds. Location of the trail, platforms, and blinds are planned to provide visitors with quality viewing opportunities without disturbing the wildlife. Refuge trails and roads would remain open year-round from ½ hour before sunrise to ½ hour after sunset, except as otherwise permitted under a special use permit. Access to trails is by foot travel, including snowshoeing and cross country skiing, or by snowmobile on refuge-designated snowmobile trails.

We have also identified one trail in the expansion area we would like to develop for year round use once those lands are acquired. It parallels Route 16, connecting Wentworth Location to Errol, and we preliminarily refer to it as the potential “Long Pond Trail.” It is currently a snowmobile trail, but could also be developed to provide a year round viewing and photography opportunity. Also in the expansion area, generally, we would plan to keep designated major gravel roads open to vehicle travel to afford additional opportunities for wildlife observation and photography.

We define high quality wildlife observation and photography programs as those in which: 1) observation occurs in a primitive setting or use safe facilities and provide an opportunity to view wildlife and its habitats in a natural setting; 2) observation facilities or programs maximize opportunities to view the spectrum species and habitats of the refuge; 3) observation opportunities, in conjunction with interpretive and educational opportunities, promote public understanding of and increase public appreciation for America’s natural resources and the role of the Refuge System in managing and protecting these resources; 4) viewing opportunities are tied to interpretive and educational messages related to stewardship and key resource issues; 5) facilities, when provided, blend with the natural setting, station architectural style, and provide viewing opportunities for all visitors, including persons with disabilities; 6) observers understand and follow procedures that encourage the highest standards of ethical behavior; 7) viewing opportunities exits for a broad spectrum of the public; and 8) observers have minimal conflict with other priority wildlife-dependent recreational uses or refuge operations.

Strategies

In addition to objective 4.3 strategies under alternative A,

Within 5 years of CCP approval:

- Provide literature on wildlife viewing opportunities at kiosks and visitor contact facilities
- Designate self-guided canoe trail, with information on wildlife viewing, on Magalloway River
- Close wildlife viewing sites as warranted during nesting season or other sensitive times of the year
- Develop web-based or other wildlife viewing reporting system

Within 5-10 years of CCP approval:

- With partners, promote an Upper Androscoggin watershed regional wildlife viewing trail system (e.g. auto, boat, snowmobile, etc) across ownerships
- Construct wildlife viewing pull-outs at safe, strategic locations (e.g. moose wallows) on Route 16 and 26
- Provide sensitively placed access to view unique fens and bogs
- Create webcam near loon, eagle, and osprey nests
- Work with partners to identify and promote wildlife viewing opportunities on and off the refuge
- Provide ADA compliant photo blinds
- Consider use of temporary blinds for photography in certain sensitive locations where permanent blinds are not appropriate
- Construct new trails: the Potter Farm and Thurston Cove group of loop trails, Mountain Pond area trails, and along Route 16 in the expansion area; make at least one of these ADA compliant to the extent feasible (see Map 2-8)

Objective 4.4 (Camping)

Maintain overnight lake experiences on refuge lands, on no more than 12 remote lake sites, to facilitate compatible, safe and unique hunting, fishing, wildlife observation, and photography opportunities.

Rationale

We currently allow camping on refuge lands on 12 remote sites on Umbagog Lake. Two additional river sites are planned for elimination and rehabilitation. Our lake camping program is administered by NH DRED- Division of Parks and Recreation in conjunction with their management of other camping sites, on state and other ownerships, and the management of the Umbagog State campground. Remote camping on Umbagog Lake provides the unique opportunity for visitors to view moose, and hear loons during dusk and dawn when they are most actively calling, while allowing the visitor to be totally immersed in a quiet, private, primitive, and natural setting. Remote lake camping is becoming an increasingly rare experience in the Northeast, except in very remote northern areas. Similar to hunting and fishing, camping is an historic, traditional, and very popular activity on Umbagog Lake and in other rural parts of New Hampshire and Maine.

Under alternative B we would plan to enhance our current camping program and increase site monitoring to ensure: site conditions are not deteriorating; wildlife is protected; and, campers adhere to regulations. We would complete a formal cooperative agreement with NH DRED- Division of Parks and Recreation. Our agreement would include the provision that we would not increase the current capacity for camping on refuge lands. In cooperation with NH DRED- Division of Parks and Recreation and other partners, we would establish thresholds on what is acceptable change to resources and determine when restrictions or mitigation measures should be imposed to reverse impacts before any damage is permanent. We would also require campers to adhere to "Leave No Trace" principles. The Leave No Trace program is a nationally recognized curriculum of outdoor values that promotes visitors' ethical use of recreational lands. Our outreach program would include distribution of literature and demonstration of Leave No Trace principles.

Strategies

In addition to objective 4.4 strategies under alternative A:

Within 5 years of CCP approval:

- Complete cooperative agreement with NH DRED. It will include: 1) setting fees; 2) limits on number of campers at individual sites; 3) sanitation requirements, 4) resource, and long-term site protection and restoration needs; 5) required orientation to campers; and, 6) boat access only, no personal water craft;
- Manage camping through site locations, and scheduling of day and season lengths, to provide a quality experience while providing maximum protection for wildlife resources
- Establish a program of increased outreach on-site, and increased enforcement of rules and regulations to minimize illegal camping
- Consider designating some sites as “two nights only” for paddlers moving through the area
- Provide campers with an orientation and overview of rules and regulations and Leave No Trace program
- Restore sites or seasonally close sites as needed to protect resources
- Remove river camping sites at North 1 and North 2, administered through Mollidgecock State Campground, along Route 16
- No pets; no loud music (external speakers)

Within 5-10 years of CCP approval:

- Establish inter-governmental and inter-jurisdictional Umbagog Lake Working Group to develop formal cooperative management agreement encompassing cooperative management of the entire lake area.
- Improve campsites to address safety, long term sustainability without degradation, provide a diversity of site locations and opportunities, and resolve social, environmental, and resource issues,

Objective 4.5 (Boating)

Within 4 years of CCP approval, at least 80% of boaters passing through the refuge on the Magalloway and Androscoggin rivers, and associated designated waterways, will report they had a high quality experience based on the following criteria: a) suitable access; b) minimal conflict with other users; c) safe experience; and d) a reasonable chance to view wildlife in a natural setting with minimal disturbance.

Strategies

In addition to objective 4.5 strategies under alternative A:

Within 5 years of CCP approval:

- Develop an interpretive self-guided canoe/kayak trail for the Magalloway River; interpret management activities and habitats visible from trail; promote a “Leave No Trace” boater ethic
- Improve maps and interpretive literature for boaters



Boating on the refuge

- Place registration boxes at boat launches to obtain better information on group size, seasons of use, destination, etc.
- Work with recreation specialists to determine the best way to document use and identify conflicts
- Continue outreach program to alert boaters to closed areas and its purpose to protect nesting wildlife

Within 5-10 years of CCP approval:

- Work with partners, including proposed Umbagog Lake Working Group, to manage boater access (types, numbers, and distribution) along lakes and rivers; establish thresholds of acceptable change identifying when restrictions may need to be imposed to maintain visitor experiences and protect natural resources

- Seek opportunities with partners to evaluate visitor opportunities within an Upper Androscoggin River watershed regional context (e.g. regional auto, walking, and boat trails, visitor centers, tours, etc)
- Develop water ethics/etiquette brochure and interpretive literature at strategic locations (e.g. boat launches, kiosks, offices)
- Provide restroom facilities for boaters at Steamer Diamond, Wentworth Location, current refuge office (Brown Owl), and proposed new refuge office at Potter Farm

Goal 5 Develop high quality interpretive opportunities, and facilitate environmental education, to promote an understanding and appreciation for the conservation of fish and wildlife and their habitats, as well as the role of the refuge in the Northern Forest.

Objective 5.1 (Interpretative Programs: on-refuge emphasis)

Every year, at least 80% of visitors contacted after attending refuge interpretive programs will be able to identify one of the following: 1) be able to identify the refuge's purpose; 2) name at least one refuge focus species and a management action to benefit the species; 3) describe the refuge's role in conserving the Northern Forest, 4) understand the refuge's contribution to the Refuge System and to regional migratory bird conservation.

Rationale

The National Association of Interpreters defines "interpretation" as a communication process that forges emotional and intellectual connections between the interests of the audience and the inherent meanings in the resource. Interpretation is a priority public use identified in the 1997 Refuge Improvement Act and it is one of the most important ways we can raise our visibility, convey our mission, and identify the significant contribution the refuge makes to wildlife conservation. Public understanding of the Service and its activities in the states of New Hampshire and Maine is currently very low. Many are unaware of the Refuge System and its scope, and most do not understand the importance of the refuge in the conservation of migratory birds.

Providing high quality opportunities for the public to engage in environmental interpretative activities promotes stewardship of natural resources, and an understanding of the refuge's purpose. They also garner support for refuge programs and help raise public awareness of the role of the refuge in Northern Forest and its contribution to migratory bird conservation.

We define high quality interpretive programs as those which: 1) increase public understanding and support for the Refuge System; 2) develop a sense of stewardship leading to actions and attitudes that reflect concern and respect for wildlife resources, cultural resources, and the environment; 3) provide and understanding of the management of our natural and cultural resources; and 4) provide safe, enjoyable, accessible, meaningful, and high quality experiences for visitors increasing their awareness, understanding, and appreciation of fish, wildlife, plants, and their habitats.

We have identified several new trail opportunities on current refuge lands and one in the expansion area. These were described under our wildlife observation and photography discussion above. As additional lands are acquired in the expansion area we would also evaluate their potential to provide high quality interpretive opportunities.

Strategies

In addition to objective 5.1 strategies under alternative A:

Within 5 years of CCP approval:

- Hire a VSP to implement programs and develop a Visitor Service's step-down plan incorporating objectives, finalizing strategies, and coordinate the evaluation of visitor numbers, visitor satisfaction, visitor impacts, carrying capacity, and thresholds of acceptable change.
- Improve on existing brochures and develop new ones interpreting management practices and focus species needs; also, develop self-guided walking trail guides as new trails are constructed
- Establish a self-guided interpretive canoe/kayak trail along the Magalloway River
- Establish self-guided interpretive signs along approved snowmobile trails in partnership with local snowmobile clubs and businesses
- Assess interpretive opportunities in expansion areas as lands become available
- Provide interpretation signs at the Magalloway River trail; including information at trailhead
- Construct information and interpretive kiosks at boat launches, overlooks, roadside pullouts, and any new trailheads

Within 5-10 years of CCP approval:

- Provide a limited number of interpretative programs at two State campgrounds each year, in cooperation with State Parks Staff; utilize volunteers or Friends Group to the extent possible
- Sponsor a limited number of guided interpretive programs on refuge via walks, canoes, kayaks, and/or pontoon boat; utilize volunteers or Friends Group to the extent possible

- Incorporate into Visitor Services plan a procedure for evaluating effectiveness of programs by doing a pre-test, then a post test, or design an evaluation into each program
- Continue to seek funding to finish construction of self-guided Magalloway River trail and new loop extension, and make it ADA compliant
- Construct new interpretative trails: the Potter Farm and Thurston Cove group of loop trails, Mountain Pond area trails, and one along Route 16 in the expansion area trail; make at least one of these ADA compliant to the extent feasible

Within 10-15 years of CCP approval:

- Develop at least 2 pull-outs off Highways 16 and 26 on the refuge where wildlife viewing opportunities exist
- Develop an overlook at Route 26-New Hampshire state line

Objective 5.2 (Community Outreach)

Each year, provide at least 10 outreach efforts for elected officials, local community leaders, neighbors, and other stakeholders to become more informed about the refuge and its resources and our management priorities.

Rationale

Greater outreach efforts will increase recognition of the refuge, the Refuge System, and the Service among neighbors, local leaders, conservation organizations, and elected officials. We will strive to annually increase outreach efforts toward the local citizenry. This publicity will also help generate support for similar conservation efforts in the region.

It is particularly important that local residents understand, appreciate, and support the Refuge System mission and this refuge's unique contribution to that mission. In addition, our volunteer program could grow and our Friends group could see enhanced membership and support. The proposed Refuge Headquarters and visitor contact facility will serve as an important resource for refuge visitors and local community, providing educational and recreational opportunities, as well as meeting and exhibit space for local conservation organizations.

Gaining support from local community, private landowners, private conservation groups, Congressional, State, and local elected officials, for refuge programs is essential to meeting our goals. This can only happen when these elected officials understand and appreciate the nationally significant contribution of the refuge and its programs to the permanent protection of Federal trust resources. We need to impress upon these individuals the importance of refuge lands to current and future generations of Americans.

Strategies

In addition to objective 5.2 strategies under alternative A, expand activities to:

Within 5 years of CCP approval:

- Update refuge fact sheets
- Create press kit continue to promote events scheduled on refuge

- Respond to requests for presentations at local service organizational meetings, chamber events, etc
- Participate in those community service, professional associations, and chamber events throughout Upper Androscoggin watershed that would provide the greatest benefit to achieving goals and objectives and furthering the mission of the Refuge System
- Maintain web page
- Establish/maintain a regional media list including newspapers, radio, television
- Foster relationship with selected individuals; personally invite them to refuge activities
- Contact landowners each year to inform them of refuge activities.
- Consider having annual meetings with interested adjacent landowners to facilitate communications, raise awareness and understanding of, and seek support for, refuge management programs

Within 5-10 years of CCP approval:

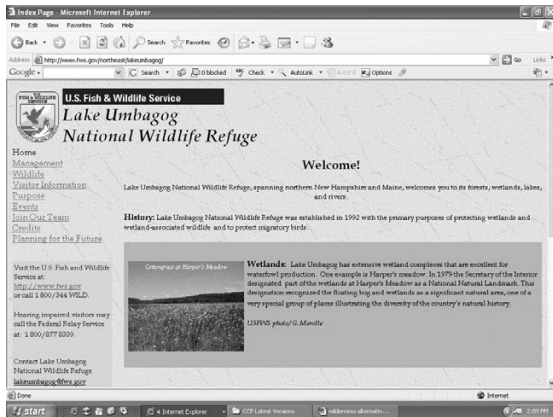
- Consider a webcam at eagle and loon nesting sites

Within 10-15 years of CCP approval:

- Develop web-based outreach and interpretive materials, e.g. virtual tour

Objective 5.3 (Visitor Awareness)

Within 2 years of CCP approval, at least 80% of refuge and Umbagog Lake visitors will be aware of public use opportunities and restrictions put in place to protect trust resources and provide quality public use opportunities.



Refuge webpage

Rationale

Same as rationale for objective 5.2 strategies under alternative B

Strategies

Within 5 years of CCP approval:

- Place informational signs at critical spots (visitor concentration areas)
- Develop and distribute map and other outreach materials for visitors to understand where permitted activities can occur and how they can access; map will portray closed areas, gates, etc; other outreach materials will why area closures and other restrictions are necessary to protect resources

- Utilize refuge web site to distribute information; update and maintain current its information
- Also, see other objectives under goal 4 for specific program recommendations

Within 5-10 years of CCP approval:

- Develop a public access management plan, working with States and other partners providing public access to Umbagog Lake; establish thresholds of acceptable change which, when exceeded, may warrant that access restrictions be put in place
- Utilize public forums to raise awareness and explain access restrictions

Objective 5.4 (Environmental Education Opportunities)

Facilitate environmental education opportunities on the refuge, in partnership with other educators, to explain the importance of conserving and managing the natural resources in the Northern Forest to students, teachers, and other visitors. All who participate in environmental education programs on the refuge will be able to 1) understand the need for migratory bird conservation; 2) identify the refuge's role in the Refuge System and in conserving Northern Forest Federal trust resources, and 3) name at least one refuge focus species and a management action to benefit the species.

Rationale

Environmental education is a process designed to develop a citizenry that has the awareness, concern, knowledge, attitudes, skills, motivations, and commitment to work toward solutions of current environmental problems and the prevention of new ones. Environmental education is identified in the 1997 Refuge Improvement Act as priority public use. Providing high quality environmental education opportunities for the public on a refuge can: promote stewardship of natural resources; develop an understanding of the refuge's purposes and the mission of the National Wildlife Refuge System; and, help raise awareness, understanding, and an appreciation of the role of the refuge in the Northern Forest and its contribution to migratory bird conservation. It also can garner support for other refuge programs.

As we evaluated the future of this program, in comparison to our other priority public use programs, we determined our emphasis would be to facilitate the use of the refuge for educational programs, but look to our partners, Friends Group, and/or volunteers to develop any curriculum and to lead those programs. This recommendation is based on consideration of this plan's 15-year timeframe and what we can reasonably expect for staffing and operational funds, and because we believe our other priority public use programs would be more effective in reaching more visitors. We do not want to imply that we do not value environmental education, but only wish to convey that, on this refuge, the majority of our limited visitor services resources would be best spent in other priority public use programs.

Strategies

Within 5 years of CCP approval:

- Provide educational materials on the refuge web site
- Provide materials to local schools, upon request, as they develop curriculum related to refuge resources
- Facilitate opportunities for state and local partners, colleges or universities, or other educational program coordinators to lead nature-based educational programs on refuge lands

Within 5-10 years of CCP approval:

- Evaluate potential for state and other partners to provide opportunities for adult education programs, such as Elder Hostel
- Work with NHFG, MDIFW, and university extension and conservation education partners to facilitate complementary programs and to seek assistance in implementing program requests

Goal 6 Enhance the conservation and management of fish and wildlife resources in the Northern Forest Region through partnerships with public and private conservation groups, private landowners, State and local entities.

Objective 6.1 (Regional and Community Partnerships)

Actively engage in regional and community economic development and conservation partnerships and initiatives, consistent with the Refuge System mission and refuge purposes.

Rationale:

These objectives would encourage broader cooperation between the Service and local communities. Partnerships are essential for this refuge to accomplish projects and programs. Further, the Service can provide valuable technical assistance to local conservation organizations, particularly on management of habitat for migratory birds. In addition, the potential for the creation of a regional Umbagog Area Friends Group would be explored.

This objective also builds on alternative A by fostering relationships with elected officials and business leaders, thereby strengthening political support for the refuge and its programs. This objective would also raise the awareness of opportunities for compatible outdoor recreational uses. These uses will attract visitors to the area and contribute to the local economy.

Law enforcement staff plays an important role on the refuge. Officers not only enforce regulations, but just as importantly, they conduct outreach and serve to raise the visibility of the Service in local communities while out on patrol. It will be even more important in the future, should we implement this alternative with new programs and new regulations, that we have the capability to alert people to these changes and can enforce them, as necessary. We believe that a law enforcement partnership could substantially increase our ability to effectively manage and conserve refuge resources.

Strategies

In addition to objective 6.1 strategies under alternative A,

Within 5 years of CCP approval:

- Share resources, equipment, and expertise with State and private landowners.
- Become a member of established associations, such as the Upper Androscoggin Advisory Committee

Within 5-10 years of CCP approval:

- Work with conservation partners to achieve common goals; establish MOU, Memorandum of Agreement (MOA) and cooperative agreements as appropriate

Objective 6.2 (Cooperative Management of Umbagog Lake)

Promote responsible use and management of Umbagog Lake, associated rivers, and adjoining uplands in partnership with other jurisdictional and management agencies (see also Goal 4, Objective 4.4).

Rationale: See rationale for objective 6.1 under alternative B.

Strategies

In addition to strategies under “Actions Common to Alternatives B & C Only” affecting this program:

Within 5-10 years of CCP approval:

- Exchange with partners, techniques and ideas on managing public use on Umbagog lake, its tributaries, and associated uplands

- Work with States of New Hampshire and Maine to establish an Umbagog Lake Working Group with responsibility to develop consistent regulations and best management practices for activities on the lake and rivers, including:
 - a) wake zones; b) fishing regulations, including fishing tackle; c) boating regulations; d) allowed events/tournaments; e) invasive species management, such as plants and bass; f) outfitter and guide licensing; g) boater ethics program, including waste disposal protocol; h) camp site management; i) other motorized activities, including PWC, float planes; j) promote/develop appropriate locations for access; k) launch sites
- Also, specifically work with Umbagog Lake Working Group to resolve the Rapid River user conflicts among anglers and boaters; develop management strategy (e.g. control access, require permits, schedule launches, limit numbers, etc)

Objective 6.3 (Partner-managed Visitor Facilities)

Within 10 years of CCP approval, develop a visitor contact facility in Errol with partners, where all the visitors to this facility have access to information on outdoor opportunities in the Umbagog area. The Services' role in the facility is to interpret the refuge's contribution to the conservation and management of the Northern Forest and its wildlife resources.

Rationale: See rationale for objective 6.1 under alternative B.

Strategies

Within 5 years of CCP approval:

- Explore other opportunities to display refuge visitor contact information at strategic portal areas (e.g., Evans Notch Visitor Center, Colebrook center, Northern Forest Heritage Park)
- Provide map with what's open; e.g. roads snowmobile trails, pull outs, parking, boat launches, river trail

■ Within 5-10 years of CCP approval:

- Work with chamber of commerce, NHFG, MDIFW, and New Hampshire Division of Parks and Recreation, Town of Errol, local businesses, conservation organizations to evaluate regional opportunities for visitors services that include the refuge
- With partners, develop an MOU to create a staffed visitor contact facility in town; refuge would only provide supplemental support for staffing. Purpose of facility is to allow visitors to: 1) receive information on what nature-based opportunities are available in the local area; 2) know where to go; and 3) make whatever arrangements and contacts needed for their visit.
- Pursue alternative funding sources (e.g., State highways grants, main street grants, scenic byways, SAFETEA) to maintain partner run facilities that promote refuge vision and goals
- Provide services such as selling hunting permits, providing maps, making reservations. Also, offer limited interpretative program, develop exhibits, provide basic orientation: short video; interactive kiosk, some natural history museum pieces (native wildlife displays)
- Provide visitors with information on programs available on the refuge

Goal 7 Develop Umbagog National Wildlife Refuge as an outstanding center for research and development of applied management practices to sustain and enhance the natural resources in the Northern Forest in concert with the Refuge System Land Management Research Demonstration (LMRD) program.

Objective 7.1 (Research and Applied Management)

Within 5 years of CCP approval, establish a forest research and management program on refuge lands that enhances the best available science for making management decisions which benefit wildlife resources.

Surveying vegetation on the refuge



Rationale

Fortunately for us, researchers from many universities, state and Federal agencies and non-governmental organizations have conducted research and provided us with valuable information on refuge resources. Without these partnerships, we would not have had the staff or funding to accomplish this important work on our own. We will continue to support cooperative research that benefits the Refuge System, refuge purposes, goals, and objectives. Some of the projects that are on-going, or a priority for us to implement after approval of this CCP, are discussed under “Actions Common to All of the Alternatives” above. Other desirable research projects are identified as strategies under objectives statements.

We describe the Service’s support for an LMRD area to represent the Northern Forest ecosystem in chapter 1 under the Goals discussion. In summary, LMRD areas were envisioned “...to facilitate development, testing, teaching, publishing, and demonstration of state-of-the-art management techniques that support the critical habitat management information needs for fish, wildlife, and plant conservation within the System and other lands”(USFWS 1999).

Lake Umbagog Refuge, in partnership with the Nulhegan Division of the Silvio O. Conte Fish and Wildlife Refuge, and the Moosehorn Refuge, developed a proposal to be included in the LMRD program. It was one of 13 LMRD proposals approved at the national level. Through this LMRD program and our partners, as explained in Goal 6, we would be able to expand the contribution we are making to the focal species in this alternative by exporting our forest management techniques to proposed easement lands as well as private and public lands beyond our conservation proposal. Currently, we do not have funding for this program. Our objectives below outline a course of action to establish an LMRD program on this refuge.

Strategies

In addition to the strategies under “Actions Common to all of the Alternatives” affecting this program:

Within 5 years of CCP approval:

- Hire an LMRD coordinator with sufficient project funding and integrate with existing refuge staff, who will work with partners to: a) establish and prioritize forest research needs; ; b) identify and coordinate with on-going northern forest research projects at universities and other agencies (i.e. Forest Service) in order to complement on-going research and avoid duplication of effort) c) facilitate forest management research on Northern Forest public and private lands; d) coordinate the exchange of research results among Northern Forest landowners; e) publish research findings in peer-reviewed publications

- Conduct a research needs assessment for the refuge; emphasize research projects that evaluate our assumptions, objectives, strategies, and techniques on focal species management

Within 5-10 years of CCP approval:

- Develop a mission and framework for a research program, including research criteria, protocol, and approval for activities on refuge lands
- Facilitate priority research and publish findings in peer-reviewed publications; all research products, including presentations, posters, and/or journal articles done by others will acknowledge the role of the Service, refuge staff and/or Refuge System lands, as appropriate, as key partners in the research effort.

Objective 7.2 (Outreach for Research and Applied Management Program)

Demonstrate habitat management techniques to partners, the scientific community, and the public to promote conservation of wildlife in the Northern Forest. Distribute findings regularly through various media.

Rationale

Same as objective 7.1 under alternative B

Strategies

Within 5-10 years of CCP approval:

- Facilitate demonstration areas on both refuge, and other ownerships, that showcase habitat management techniques for species of concern in the Northern Forest.
- Cooperate with the Partners for Wildlife Program to accomplish outreach and applied management activities; coordinate with their staff, and funding sources
- Provide forums to present and discuss research findings
- Conduct a series of workshops and courses
- Develop a website for others to access research findings; publish findings

Alternative C. Management to Create Natural Landscape Composition, Patterns and Processes

Introduction

This alternative strives to establish and maintain the ecological integrity of natural communities within the refuge and surrounding landscape in the Upper Androscoggin watershed. Ecological integrity is defined by having all native species present, ecological processes and natural disturbance events, occurring, within their respective distribution, abundance or frequency, and natural range of variability, characteristic of that community type under natural conditions. A natural community with high integrity is also defined as being resilient and able to recover from severe disturbance events (Roe and Ruesink 2004). Management under alternative C would range from passive, or “letting nature take its course,” to actively manipulating vegetation to create, or hasten the development of, mature forest structural conditions shaped by natural disturbances. No particular wildlife species are a focus of management.

As a priority, we would implement studies, consult experts, and conduct literature reviews, to further refine our knowledge of disturbance patterns and structural conditions in both wetlands and uplands natural communities. Under alternative C, we would continue to recognize the current FERC license; however, we would also discuss with the licensee opportunities to manage at water levels that mimic a more natural hydrologic flow throughout the year. Our wetland management

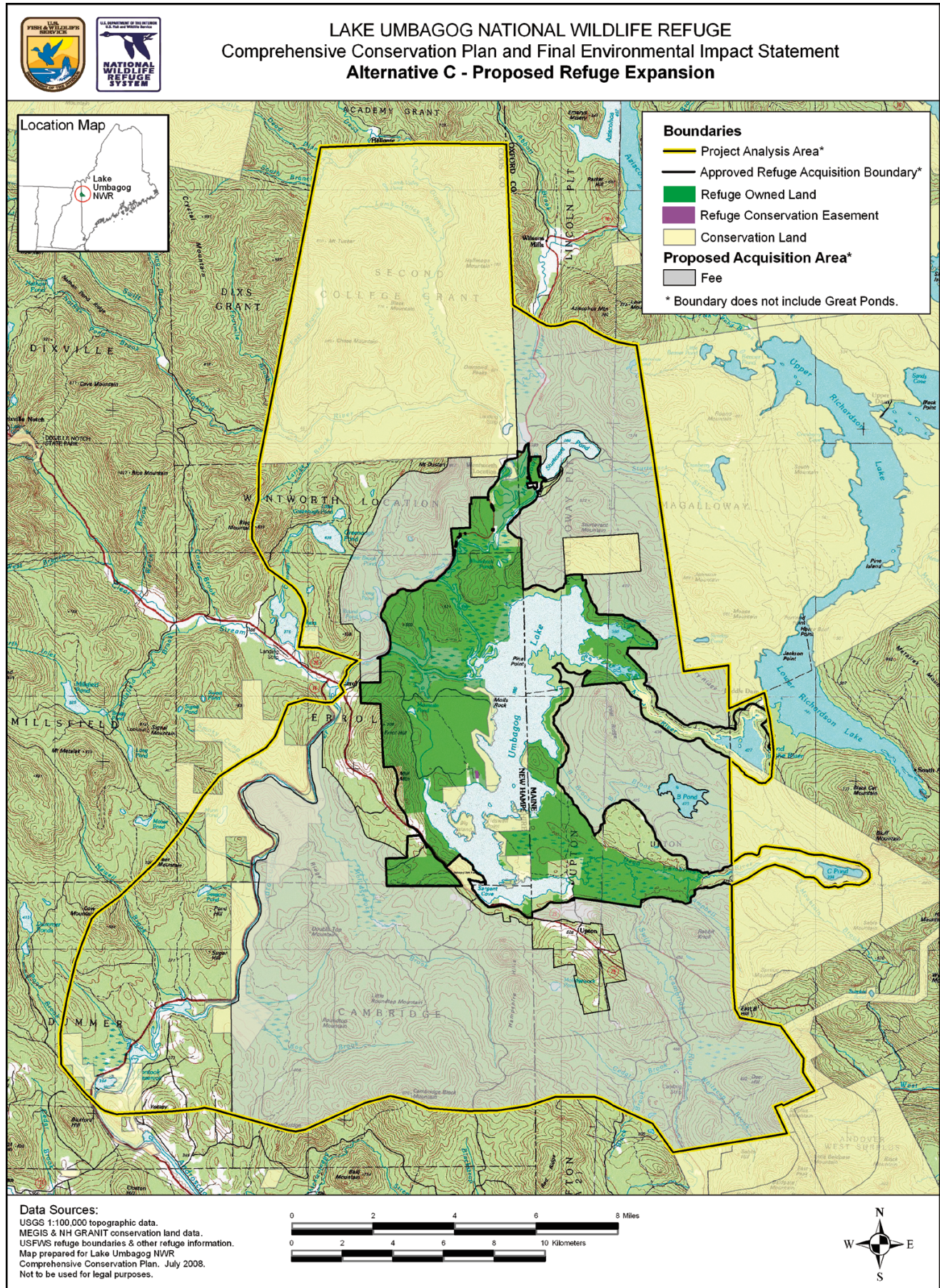
would also pursue restoration projects where past land uses hinder natural hydrological flow and wetlands development.

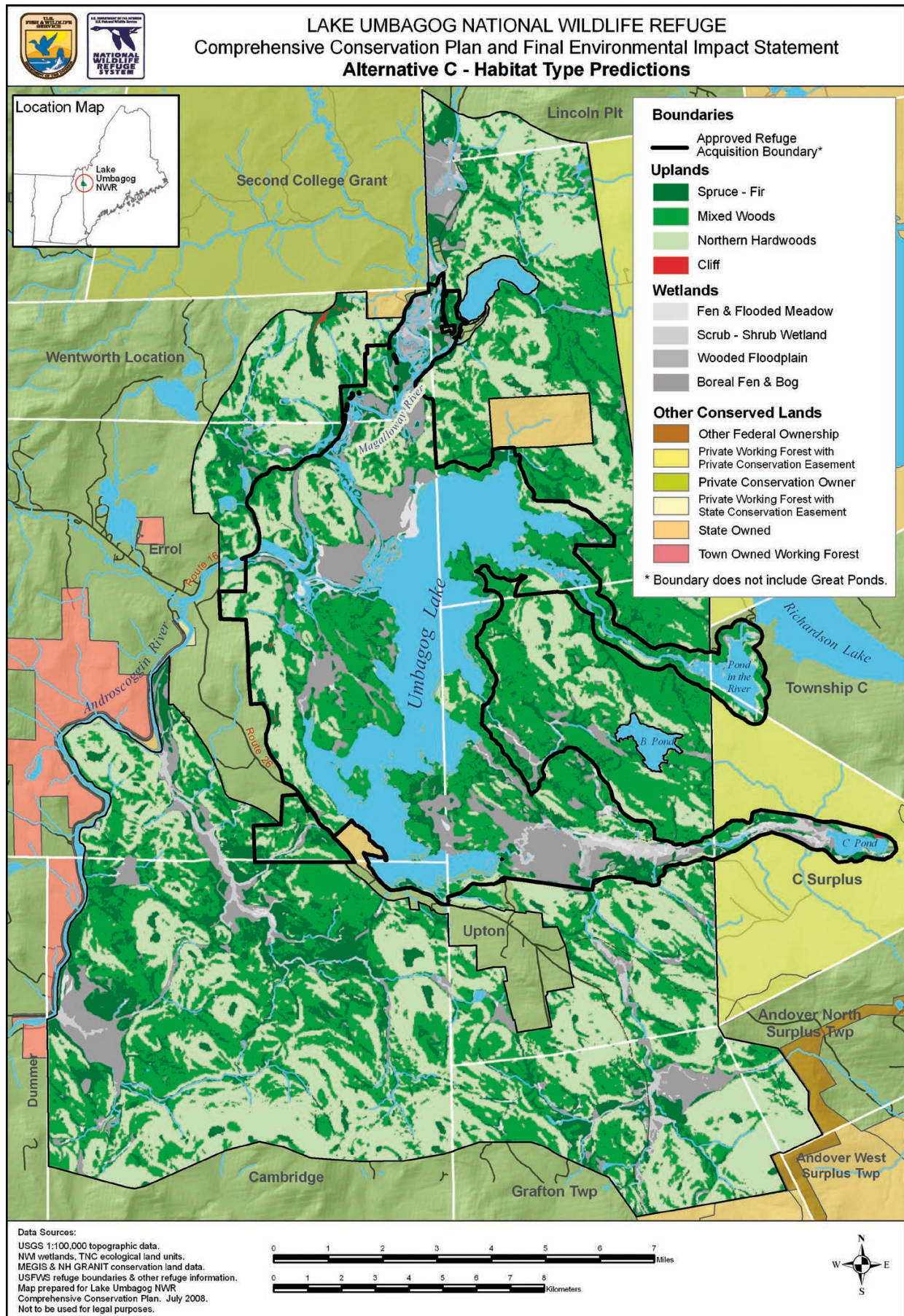
In refuge uplands, we would manage to restore the forest communities predicted as the “potential natural vegetation,” using both Kuchler’s delineations of types and ELU’s, as the basis to determine which types are best -suited and most capable of growing on these sites (Kuchler 1964; Anderson 1999). Our management would be designed to create similar mature stand structural conditions that would be expected from natural disturbance events which shaped the Northern Forest landscape. These disturbance events include hurricanes, flooding, ice storms, and small blow-downs. The frequency and intensity of these events may change in light of predictions on climate change. As we describe earlier in this chapter under “Actions Common to All Alternatives” this uncertainty necessitates our use of an adaptive management approach.

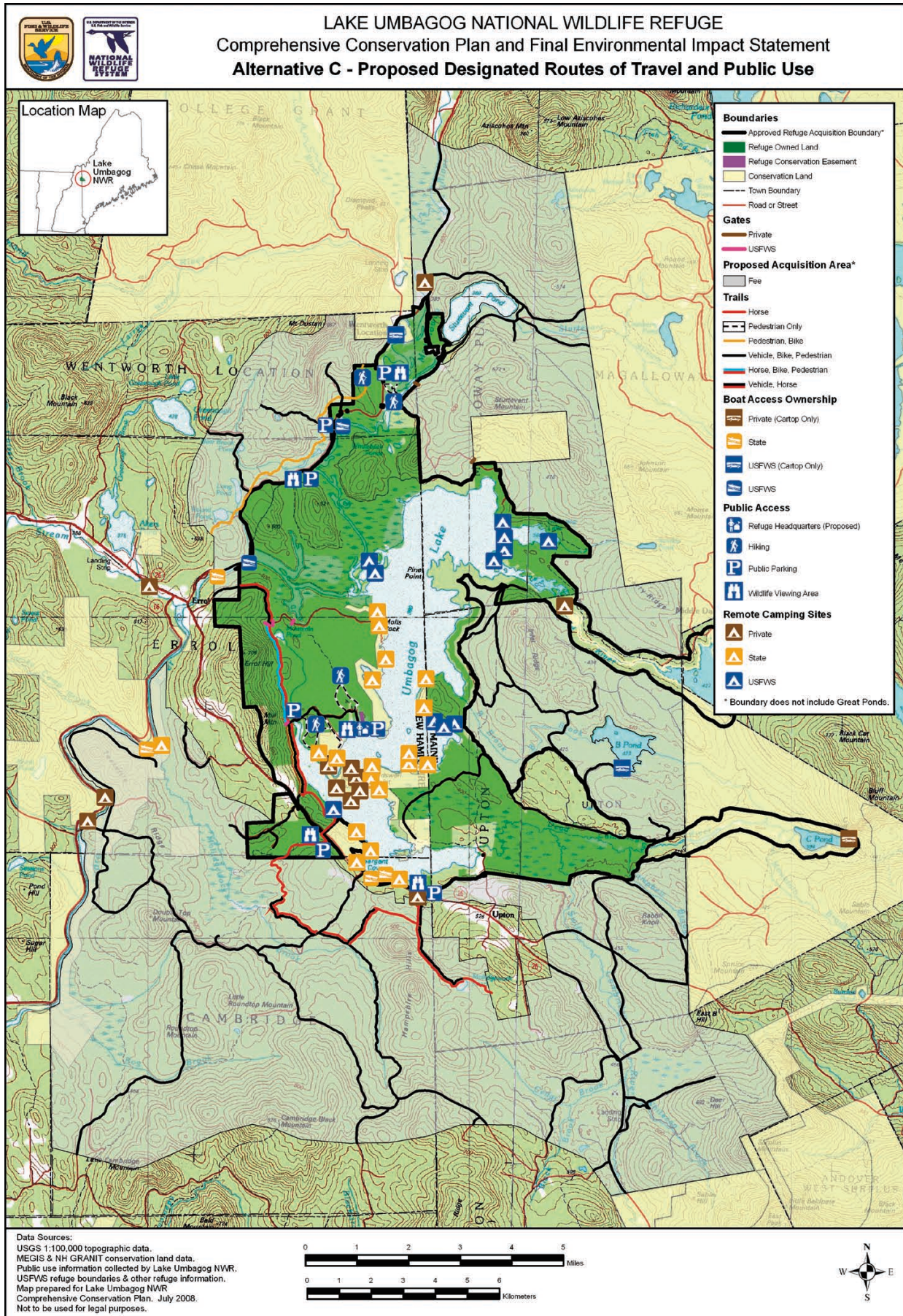
We would manage forest age-class, species, and diameter distribution, understory development, amount of dead and dying and cavity trees, large and old trees, coarse woody debris, and canopy closure indicated by historic accounts and/or as described by experts. Notwithstanding these actions, we would also ensure protection of current or future threatened and endangered species, and control the establishment and spread of any non-native, invasive species. Introduced pests and pathogens, including beech-scale disease, gypsy moth, and hemlock and balsam wooly adelgid, may present management issues in the future that require intervention. Map 2-12 depicts the broad habitat types we predict would result after approximately 150 years of implementing alternative C management objectives.

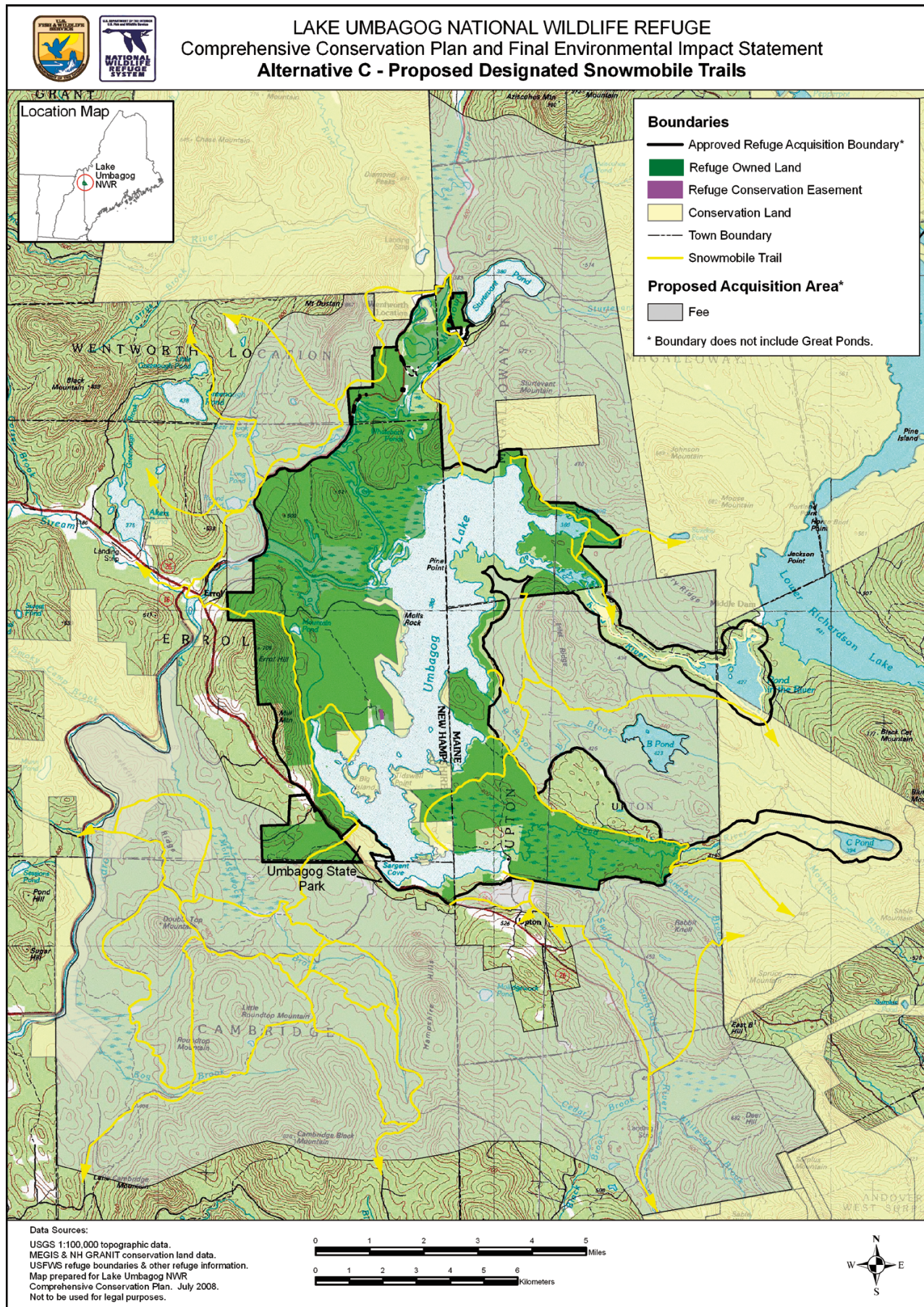
The proposed refuge expansion of 74,414 acres is essential to the success of alternative C (map 2-11). Experts have suggested that 25,000 contiguous acres, connected hydrologically and in a relatively undisturbed condition, is a reasonable approximation of the minimum size within which ecological processes, structure and function, and including the disturbance events identified above, could occur naturally (Anderson 1999; Roe and Ruesink 2004). As such, our expansion proposal under alternative C is designed to protect and conserve large, contiguous habitat blocks exceeding 25,000 acres and connect them to other conserved lands. Unlike alternative B, our need for adjacent conservation landowners to work cooperatively and complement our management is less important because the extent of lands we propose to acquire would allow us to meet our objectives independent of adjacent lands. All 76,304 acres identified would be acquired from willing sellers in fee simple by the Service. Fee simple acquisition ensures full management control and flexibility. As we acquire these lands, we would manage them by the goals, objectives, and strategies under this alternative.

Compared to the alternative B proposals for visitor services programs and refuge uses, alternative C would limit new infrastructure for wildlife observation, photography, and interpretation to those around the Potter Farm facility and roadside pullouts along Routes 16 and 26; however, it would similarly enhance the existing opportunities for hunting and fishing (map 2-13). Similar to alternative B, it proposes to pursue additional analysis in support of a furbearer management plan within 3 years of CCP approval. If the refuge is opened to furbearer trapping under permit, we would expect the alternative C program to emphasize natural furbearer population dynamics. Like alternative B, remote camping on the existing designated lake sites would continue to be allowed, although we would increase monitoring of individual sites, and rehabilitate, or close permanently or seasonally those in need of restoration. Snowmobiling would also continue to be allowed on designated trails (see map 2-14).









*Refuge forest, fen and
flooded meadow,
and open
water habitats
on the refuge*



Bill Zimm/USFWS

Also similar to alternative B, under alternative C, we would enhance local community outreach and partnerships, continue to support a Friends Group, and provide valuable volunteer experiences. We would also pursue the establishment of a LMRD site on the refuge to promote research, and the development of applied management practices, to sustain and enhance the natural composition, patterns and processes within their range of natural in the Northern Forest.

Goal 1 Manage open water and submerged aquatic vegetation and wetlands to benefit Federal trust species and other species of conservation concern.

Objective 1.1 (Fen and Flooded Meadow)

Manage 775 acres of fen and flooded meadow on Service-owned lands, within the current and expanded refuge boundaries, to reflect the composition, function and diversity of these wetlands as they would occur under natural environmental influences.

Rationale

Dan Sperduto and Bill Nichols of the NHNHI surveyed peatlands in the Umbagog area in 1998 and reported the peatlands in and around the refuge to be among the state's largest and most diverse. The fen and flooded meadows of Leonard Marsh and Harper's Meadow form an extensive acidic fen complex. These marshes and peatlands support a diverse array of waterfowl, marsh birds, shorebirds, songbirds, and amphibians as well as rare plants. Bird species associated with shrubby swamps and bogs include palm warbler, olive-sided flycatcher, yellow-bellied flycatcher, Nashville warbler, black-backed woodpecker, and rusty blackbird among others. These natural communities and associated plants and animals have developed over the past several hundred years following the damming of the Androscoggin River and concomitant water level changes.

As in the other alternatives, under alternative C we would conduct an ecological systems analysis to create an historical profile of Umbagog Lake and associated wetlands processes and succession. This would help provide a strong foundation for managing the wetlands within a natural range of variability, and within the context of an impounded system.

Strategies

In addition to objective 1.1 strategies under alternative A,

Within 5 years of CCP approval:

- Conduct a literature review of historical wetland distribution, vegetative composition, and bird communities to establish a benchmark of natural environmental influences. Manage to attain this historical distribution and composition where feasible and reasonable

Within 5-10 years of CCP approval:

- Remove roads, culverts, and any other obstructions that affect natural wetlands development, or interfere with natural hydrologic flow, unless human health or safety would be compromised.
- Determine the area of influence around wetlands (e.g. the area affecting flow and nutrient input) and define an ecological protection boundary within which no degradation of wetlands would occur
- Acquire 209 acres of this habitat type in fee simple, from willing sellers, and manage as described in the objective 1.1 under alternative C.

Within 10-15 years of CCP approval:

- Open discussions with hydropower facility owner/operator, FPLE, to discuss the feasibility of managing water levels, within the limits of the FERC license, to mimic a more natural hydrologic flow throughout the year.

Objective 1.2 (Boreal Fen and Bog)

Manage 4,624 acres of boreal fen and bog on Service-owned lands, within the current and expanded refuge, boundaries to reflect the composition, function and diversity of these peatlands as they would occur under natural environmental influences.

Rationale

Same as objective 1.1 immediately above; also see objective 1.2 under alternative B.

Strategies

In addition to objective 1.2 strategies under alternative B,

Within 5 years of CCP approval:

- Implement a peat coring study to determine the age of these peatlands and whether peat accumulation rates have changed over time.

Within 5-10 years of CCP approval:

- Conduct pollen analysis of peat cores to study changes in forest composition around the peatlands over time.
- Acquire 3,222 of this habitat type in fee simple, from willing sellers, and manage as described in objective 1.2 under alternative C.

Objective 1.3 (Northern White Cedar)

Manage 1,031 acres of northern white cedar forest on Service-owned lands, within the current and expanded refuge boundaries, to reflect the composition, function and diversity of this habitat type as it would occur under natural environmental influences.

Rationale

Northern white cedar swamps have the highest plant species diversity of any of the refuge's plant community types. The largest northern white cedar swamp in New Hampshire occurs north of Whaleback Ponds and is also found in the Mountain Pond drainage and the Dead Cambridge River. Sperduto and Nichols (2004) provide a detailed description of the plant species associates and ecological conditions typical of a northern white cedar swamp with the Umbagog Lake vicinity offering good examples. Northern white cedar is a long-lived species with individual trees over 100 years old. Magnolia warbler, red-eyed vireo, olive-sided flycatcher, Swainson's thrush, winter wren, and Canada warbler are some of the bird species found in this habitat. Northern white cedar swamps provide important winter cover and food source (as evidenced by browsing) for white-tailed deer. Beaver are often present in these swamps that are associated with perennial streams playing an important role in the natural disturbance regime (Thompson and Sorenson 2000).

As mentioned under alternative B, there are likely scattered stands of this habitat type in the expansion area, but it was not discernable in the datasets we used for vegetation mapping. If this type is acquired by the Service in fee, it would be managed as stated under this objective.

Strategies

In addition to objective 1.3 strategies under alternative A,

Within 5 years of CCP approval:

- Consult experts and literature to determine what natural disturbances historically shaped the structure, composition, and regeneration of this cover type

Within 5-10 years of CCP approval:

- Evaluate land use changes and management actions (e.g., timber harvest) to determine how they might have affected the natural development of this habitat type on the refuge
- Establish management boundaries based on soil conditions, wetness, and topography to be able to effectively manage these sensitive cover types using best management practices developed by states; evaluate and quantify appropriate protective buffer widths and their effectiveness over time
- Work closely with state non-game and natural heritage programs to conduct more detailed surveys of rare plant and animal occurrences in, and the overall condition, of this cover type

Objective 1.4 (Scrub-Shrub Wetland)

Manage 1,981 acres of scrub-shrub wetlands on Service-owned lands, within the current and expanded refuge boundaries, to reflect the composition, function and diversity of these wetlands as they would occur under natural environmental influences.

Rationale

The alder shrubland is found on mineral soils along stream floodplains that experience overbank flooding with shrubs dominating the vegetation community (70% or more). The most extensive areas are found in the Dead Cambridge

River floodplain. Similar scrub-shrub wetland communities include speckled alder swamp and speckled alder peatland lagg—alder swamps on peat or muck substrate that are not influenced by alluvial processes (i.e., river flooding). The sweetgale mixed shrub thicket occurs in lakeshores, beaver meadows, and fens (Rapp 2003).

Shrubland communities that are affected by periodic flooding typically persist for long periods, perhaps decades or centuries, without some other major disturbance. Alder swamps without flooding influences may succeed to forest wetlands in relatively short periods (Thompson and Sorenson 2000). Beaver can play a role in maintaining the shrubby conditions as well. These scrub-shrub wetlands provide breeding and/or foraging habitat for alder flycatcher, common yellowthroat, yellow warbler, swamp sparrow, catbird, veery, and American woodcock and year round habitat for wood turtle, river otter, mink, muskrat, and beaver.

Strategies

In addition to objective 1.4 strategies under alternative A:

Within 5 years of CCP approval:

- Manage to encourage the natural role of beaver in maintaining this wetland type; manage habitat to encourage numbers comparable to those within the natural, historic range of density found in suitable habitat in northern New Hampshire and Maine.

Within 10-15 years of CCP approval:

- Acquire 1,041 acres of this habitat type in fee simple from willing sellers, and manage as described in objective 1.4

Objective 1.5 (Open Water and Submerged Aquatic Vegetation)

In partnership with the states of Maine and New Hampshire, and the holder of the FERC license for Errol Project, FPLE, manage an estimated 5,934 acres of open water and floating-leaved and submerged aquatic vegetation on Service-owned lands, within the current and expanded refuge boundaries, to maintain a healthy aquatic system, including native species diversity, consistent with the results of the wetlands system analysis.

Rationale

Same as objective 1.5 under alternative B

Strategies

In addition to the strategies under “Actions Common to all of the Alternatives” affecting this program:

Within 5 years of CCP approval:

- Map and monitor native mussel beds.

Within 5-10 years of CCP approval:

- Monitor water quality, chemistry, and water levels for potential effects on aquatic vegetation, fish, and waterfowl.
- Evaluate macro-invertebrates and fishery resources.
- Acquire an estimated 100 acres of this habitat type in fee simple from willing sellers, and manage as described in objective 1.5

Within 10-15 years of CCP approval:

- Implement actions, where practical, that would re-establish or maintain naturally sustainable native fish and aquatic plant species; utilize Umbagog Lake Working Group partnership to identify which resources would be a priority

- Evaluate point and non-point sources of pollution in the entire Upper Androscoggin Watershed and work with private, State, and local entities to improve water quality.

Objective 1.6 (Common Loon)

Manage wetlands according to objective 1.1 under alternative C, with no particular emphasis on enhancing habitats specifically for common loon, except to protect active nesting sites from human disturbance.

Strategies

Same as objective 1.6 under alternative A

Goal 2 Manage floodplain and lakeshore habitats to benefit Federal trust species and other species of conservation concern.

Objective 2.1 (Wooded Floodplain)

Manage 1,433 acres of wooded floodplain on Service-owned lands, within the current and expanded refuge boundaries, to reflect the composition, function and diversity of these habitats as they would occur under natural environmental influences.

Lakeshore pine-hemlock forest along the Androscoggin River



Ian Drew/USFWS

Rationale

Sperduto and Nichols (2004) highlight the balsam fir floodplain along the Magalloway River as a good example of this S2 community type. Red maple floodplain forest, currently described as a more southern community type, occurs over an extensive area along the Magalloway River (Rapp 2003). These riparian ecosystems are areas with high species richness with dynamic and complex biophysical processes. Cavity nesting birds, waterfowl with broods, a diverse amphibian community, and roosting and foraging bats are among the wildlife community that utilizes the wooded floodplain.

Wooded floodplains throughout the region are heavily impacted by agriculture and development, making the Umbagog area floodplains of particular importance to maintaining biological diversity. A priority of the refuge under this alternative is to restore the developed floodplain following removal of cabins and other structures.

Disturbance is an essential and regular dynamic within wooded floodplains. This feature also makes them particularly vulnerable to non-native invasive plants that thrive in disturbed areas. Exposed soils offer prime sites for invasive species to colonize and spread. Although not yet documented on the refuge, floodplain forests in other areas are particularly affected by several invasive plant species including garlic mustard, common buckthorn, ground-ivy, European bush honeysuckle, Tartarian honeysuckle, moneywort, and Japanese knotweed (Thompson and Sorenson 2000). If any of these species become established, the refuge may need to intervene with control measures to maintain the ecological integrity of the floodplain ecosystem.

The refuge currently owns, or has approval for, 1,293 acres of this habitat type. The alternative C expansion proposal includes Service acquisition in fee simple ownership of an additional 140 acres of this habitat type. Fee ownership allows for full management capability on these lands.

Strategies

In addition to objective 2.1 strategies under alternative A,

Within 5 years of CCP approval:

- Assess floodplain community ecology and dynamics to conserve the natural range of variability in species, density, distribution, and diameter of standing snags (standing dead trees), downed woody debris and live riparian trees. Create standing snags and downed logs, and manage live vegetation, as warranted. While active management may be required within the next 15 years to establish some minimum structural or composition thresholds, ultimately, the objective is to create a habitat complex that is sustained by natural processes.

Within 5-10 years of CCP approval:

- Restore the hydrology of the Day Flats area by plugging ditches and re-contouring the disturbed areas, assuming that preliminary site surveys determine that invasive plants would not be a threat
- Acquire 140 acres of this habitat type in fee simple, within the expansion area, from willing sellers, and manage as described in the objective 2.1 and to preclude development and maintain flood control and storage capabilities.

Objective 2.2 (Lakeshore Pine-Hemlock)

Manage 520 acres of lakeshore pine-hemlock on Service-owned lands, within the current and expanded refuge boundaries, to more closely reflect the composition, function, and diversity of this habitat as it would occur under natural environmental influences.

Rationale

Same as objective 2.2 under alternative B

As mentioned under alternative B, there are likely scattered stands of this habitat type in the expansion area, but it was not discernable in the datasets we used for vegetation mapping. If this type is acquired by the Service in fee, it would be managed as stated under this objective.

Strategies

In addition to objective 2.2 strategies under alternative A,

Within 5 years of CCP approval:

- Develop and implement a habitat management plan to perpetuate this habitat type, giving priority to water quality protection and aesthetic values.

Within 5-10 years of CCP approval:

- Allow windthrow events to occur. No salvage harvest to occur after these events.

Objective 2.3 (Bald Eagle and Osprey)

Same as objective 2.3 under alternative B

Goal 3 Manage upland forested habitats, consistent with site capabilities, to benefit Federal trust species and other species of conservation concern.

Objective 3.1 (Mixed Spruce-Fir/Northern Hardwoods Forest Matrix)

Conserve the mixed forest matrix, by managing 3 dominant forest habitat types: spruce-fir (approximately 14,770 acres); conifer-hardwoods mixed woods (approximately 34,231 acres; and, northern hardwoods (approximately

36,384 acres) on Service-owned lands within the current and expanded refuge boundaries, in $\geq 25,000$ acre contiguous, unfragmented blocks. Create a mosaic of forested stands in a mix of age, composition, and structure that would occur under natural environmental influences.

Rationale

As we described under alternative B, goal 3, the forest matrix in the Upper Androscoggin River watershed was historically, and is currently, an overall mixed spruce-fir/northern hardwoods forest. We also mentioned that there are 3 habitat types embedded within this mixed forest matrix. We describe these habitat types in more detail below.

The refuge currently owns, or has approval to acquire, 15,683 acres of mixed forest matrix, composed of the 3 habitat types. Under the alternative B expansion proposal, we recommend Service fee simple acquisition of an additional 69,702 acres of the mixed forest matrix. Fee acquisition would allow for full management capability on these lands.

Spruce-Fir Habitat Type

Red spruce and balsam fir are the late successional dominant tree species in the lowland spruce-fir habitat type. Species composition varies depending on soil conditions; black spruce is common on wetter soils and white pine is often a component of the canopy on dryer soils. Hardwoods such as red maple, yellow birch, and paper birch can be mixed in as well, and white spruce is common in some areas. Overall plant diversity in lowland spruce-fir forests is low compared to other forest types. Shrubs such as mountain holly and wild raisin are scattered in the understory, while mosses and liverworts often dominate the ground layer. Scattered patches of herbs such as common wood sorrel, bluebead lily, and shining clubmoss persist in dense shade on the forest floor (Roe and Ruesink 2004).

Insect outbreaks are the most frequent and influential natural disturbance in lowland spruce-fir habitat type. Pests such as spruce budworm and spruce bark beetle occur in 50 to 100 year cycles, creating large patches of dead and dying trees up to 2,500 acres in area. Wind and fire also affect these forests, with wind the more important of the two. Red spruce tends to experience a long disturbance cycle of 200 or more years, which is driven by wind, fire, or insects. Balsam fir stands cycle at an interval of roughly 75 years primarily in response to insect outbreaks. The canopy is not continuous; lowland spruce-fir forests tend to have a moth-eaten appearance, with a coarse-grained uneven mosaic of medium and large patches (25 to 2,500 acres in size) in a patchwork of multi-cohort stands (Roe and Ruesink 2004). Lorimer (1977) estimated that pre-settlement spruce-fir forests in Maine supported about 2 percent recently disturbed stands (0-10 years old) and 60 percent older aged stands (>150 years).

Lowland spruce-fir forest is a common community type on the refuge, forming large stands in lower elevation areas on gentle slopes and flats, although logging disturbed much of the habitat. The largest remaining stands are in the Mountain Pond and Sunday Cove areas as well as in the Whaleback Ponds, Mile Long West, and Dead Cambridge areas. Other spruce-fir types include black spruce-red spruce forest such as the area near Sunday Cove and the moose wallow 1.5 miles northeast of the refuge headquarters. Red spruce-rocky summit occurs on ridge tops and steep, rocky slopes in the Errol Hill, Mile Long, and Whaleback Pond areas (Rapp 2003).

The New Hampshire Forest Resources Plan noted declines in mature spruce fir forests and concluded that this habitat type supports more rare animal species in New Hampshire than other major forest types (New Hampshire Division of Forests and Lands 1995). Bird species associated with this habitat type include boreal chickadee, magnolia and blackburnian warblers, yellow-bellied

flycatcher, purple finch, red crossbill, spruce grouse, pine grosbeak, gray jay, and black-backed and American three-toed woodpeckers. Several of these species' populations fluctuate with spruce budworm outbreaks. Although spruce budworm was present in pre-settlement forests, the frequency and intensity of outbreaks is unknown, with some evidence that budworm was not a major disturbance factor until the early 1800s and now occurring on shorter cycles (Lorimer 1977; Charlie Cogbill, personal communication, 2004). Black-backed and American three-toed woodpeckers specialize on wood-boring insects in spruce and fir while magnolia warbler and yellow-bellied woodpecker inhabit young spruce-fir stands.

Mixed Woods Habitat Type

Red spruce-northern hardwood or mixed woods occurs on shallow soils or those with a hardpan that creates moist soils conditions. Mean gap size tends to be larger than in northern hardwoods, as the shallow, moist soils make it more likely that small groups of softwoods topple to the ground. Small, frequent gaps may range up to 0.5 acres in size. Several long-lived tree species – especially red spruce and hemlock – that can live for 400 to 500 years are abundant in these forests. Currently, natural species composition is significantly altered on many sites that should support a spruce/fir-northern hardwood forest. According to historical records, red maple was an uncommon tree in pre-settlement forests, yet it is common in mixed forests today. Current conditions, such as low soil pH, high soil aluminum concentrations, and selective removal of softwood species on moist sites, appear to favor red maple germination and growth. In addition, previous logging activities have reduced softwood abundance below natural levels on many sites (Roe and Ruesink 2004).

Northern Hardwood Habitat Type

Northern hardwood forests, dominated by American beech, yellow birch, and sugar maple, occur at elevations less than 2,700 feet. Striped maple, hobblebush, and shadbush are common understory shrubs. Tree fall gaps are dispersed and frequent. Moderate-sized blow downs occur at 25-year intervals, while large stand-replacing disturbances occur at 500 to 1,000 year intervals. Fires and pathogens are not significant factors in northern hardwood forests. Natural conditions within northern hardwood forests include an all-aged structure, trees 150-200 years old on average, the oldest trees reaching 300 years, and less than 1% of the canopy disturbed annually by tree mortality (Roe and Ruesink 2004).

Overall, most northern hardwood forests currently under management would need a long “recovery” period to create all-aged stands that include trees in the oldest age classes. Any restoration silviculture should use small and dispersed single-tree and small group selection cuts with no canopy openings greater than 0.25 acres. This will lead to a very fine-grained, all-aged condition. Large legacy trees and other structural elements, such as large standing and downed dead wood, should be retained. Median canopy tree age should be approximately 150 years, and stands should include mature trees that are 300+ years old (Roe and Ruesink 2004).

Strategies

In addition to objective 3.1 strategies under alternative A,

Specific Strategies for the Spruce-Fir Habitat Type

Within 5 years of CCP approval:

- Identify and protect biological legacies such as large diameter dead and dying trees.

Within 5-10 years of CCP approval:

- Develop recently disturbed stands with only young spruce and fir under a canopy of aspen and white birch.

- Acquire 11,468 acres of this habitat type within the expansion area, from willing sellers, and manage as described in the objective 3.1.
- Across refuge, develop multi-cohort stands with scattered canopy red spruce >150 yrs old and an understory of spruce and fir up to 75 yrs old (Roe and Ruesink 2004).
- Develop multi-cohort stands with canopy red spruce 75-150 yrs old.

Specific Strategies for the Mixed Woods Habitat Type

Within 5-10 years of CCP approval:

- Increase the softwood component to approach the natural range of variation of the mixed cover type by using small group selection on up to 0.5 acres (Roe and Ruesink 2004).

Within 10-15 years of CCP approval:

- Acquire 27,918 acres of this habitat type from willing sellers, and manage as described in objective 3.1.

Specific Strategies for the Northern Hardwood Habitat Type

Within 5 years of CCP approval:

- Identify and protect biological legacies such as large-diameter coarse woody debris and standing snags (standing dead trees).

Within 5-10 years of CCP approval:

- Promote natural tree species composition and reproduction.

- Promote natural, all-aged stand structure.

Within 10-15 years of CCP approval:

- Acquire 30,316 acres of this cover type from willing sellers, and manage as described in the objective 3.1.

Goal 4 Provide high quality wildlife-dependent activities such as hunting, fishing, wildlife observation and photography, as well as camping and boating in support of those activities.

Objective 4.1 (Hunting)

Within 3 years of CCP approval, create a high-quality hunt program (as defined by alternative B), that is designed for a backcountry, remote, low density and with generally unimproved access.

Strategies

Same as objective 4.1 strategies under alternative B, except:

Within 5 years of CCP approval:

- Limit access; no developments or facilities; no improved access, emphasis is on a back-country experience. Much is walk-in only

Within 5-10 years of CCP approval:

- Consider a permit system and designated hunt areas once quality of hunt is affected by numbers and/or distribution or the ability to achieve refuge resource objectives are compromised

Objective 4.2 (Fishing)

Within 15 years of CCP approval, provide an angler experience that is remote, low density, and generally, with unimproved access. On the Rapid and Dead

Cambridge rivers, the angling experience would be based on a native brook trout fishery.

Strategies

Same as objective 4.2 strategies under alternative B, except:

Within 5 years of CCP approval:

- Limit access; no developments or facilities; no improved access

Within 5-10 years of CCP approval:

- Consider a permit system and designated fishing areas once quality of angling experience is affected by numbers and/or distribution or the ability to achieve refuge resource objectives are compromised

Objective 4.3 (Wildlife Observation and Photography)

Same as objective 4.3 under alternative B

Strategies

Same as objective 4.3 under alternative B, except:

Within 5 years of CCP approval:

- No new infrastructure except near visitor contact facility, wildlife viewing pull-outs along Routes 16 and 26, and we would complete Magalloway River Trail expansion
- Establish restrictions on access to sensitive, easily impacted areas such the unique fens and bogs

Objective 4.4 (Camping)

Same as objective 4.4 under alternative B

Strategies

Similar to objective 4.4 strategies under alternative B, except:

Within 5 years of CCP approval:

- Infrastructure at sites will be reduced to a low impact, leave-no-trace program, requiring campers to bring portable toilets, and no fires will be allowed.

Objective 4.5 (Boating)

Within 4 years of CCP approval, at least 80% of boaters passing through the refuge will report they had a high quality experience based on the following criteria: a) backcountry boating experience b) few contacts with other users; c) a positive, personally-challenging experience; and d) a reasonable chance to view wildlife in a natural setting.

Strategies

In addition to objective 4.6 strategies under alternative A,

Within 5 years of CCP approval:

- Limit interpretive tours by staff, volunteers, or partners, especially those that involve large groups > 20

Within 5-10 years of CCP approval:

- Limit boat access to canoe and kayaks only; car-top launching only from refuge lands; acquire other boat accesses

Goal 5 Develop high quality interpretative opportunities, and facilitate environmental education, to promote an understanding and appreciation for the conservation of fish and wildlife and their habitats, as well as the role of the refuge in the Northern Forest.

Objective 5.1 (Interpretative Programs: on-refuge emphasis)

Every year, at least 80% of visitors attending refuge interpretive programs will be able to identify one of the following: 1) be able to identify the refuge's purposes and describe its role in conserving the Northern Forest, 2) identify at least one community type and its associated species, 3) identify how natural and human processes have altered the landscape over time.

Strategies

Same as objective 5.1 strategies under alternative B, except limit new developments to:

Within 10-15 years of CCP approval:

- Develop an interpretive trail at the Potter Farm once the refuge headquarters is constructed; make it ADA compliant to the extent feasible. With the exception of new wildlife viewing pullouts, no other new facilities would be constructed

Objective 5.2 (Community Outreach)

Same as objective 5.2 strategies under alternative B

Strategies

Same as alternative B, except:

Within 5 years of CCP approval:

- Expand activities to include more activities off-site since fewer facilities on refuge.

Objective 5.3 (Visitor Awareness)

Same as objective 5.3 under alternative B

Strategies

Within 5-10 years of CCP approval:

- Develop an access management plan working with States and other partners providing public access to Umbagog Lake; establish thresholds of acceptable change which restriction would occur. Emphasis in uplands will be dispersed, back-country recreational opportunities, with limited developments (e.g. Trails and roads).

Objective 5.4 (Environmental Educational Opportunities)

Facilitate environmental education opportunities on the refuge, in partnership with other educators, to explain the importance of conserving and managing the natural resources in the Northern Forest to students, teachers, and other visitors. All who participate in environmental education programs on the refuge will be able to 1) understand the need for migratory bird conservation; 2) understand the role of natural processes in the development of the forest ecosystem; 3) identify the refuge's role in the Refuge System and in conserving the Northern Forest; and, 4) name at least one natural community type in the Northern Forest.

Strategies

Same as objective 5.4 strategies under alternative B

Goal 6 Enhance the conservation and management of fish and wildlife resources in the Northern Forest Region through partnerships with public and private conservation groups, private landowners, State and local entities.

Objective 6.1 (Partnerships)

Same as objective 6.1 under alternative B

Goal 7 Develop Umbagog National Wildlife Refuge as an outstanding center for research and development of applied management practices to sustain and enhance the natural resources in the Northern Forest in concert with the Refuge System Land Management Research Demonstration (LMRD) program.

Objective 7.1 (Research and Applied Management)

Same as objective 7.1 under alternative B except:

The focus of research and applied management would be on natural systems and ecological processes of the Northern Forest

Objective 7.2 (Outreach for Research and Applied Management Program)

Same as objective 7.2 under alternative B, except:

Demonstrate management techniques to partners, the scientific community, and public that enhance the natural diversity and promote natural ecological processes of the Northern Forest.



Ian Drew/USFWS

Studying bald eagles on the refuge

Summary Comparison of Management Actions by Alternative

Introduction

Chapter 2, Part III, “Actions Common to All the Alternatives” describes many important actions which are not discussed in the table below. Those actions include: developing refuge step-down plans, coordinating lake water level management, implementing and prioritizing a biological monitoring and inventory program, protecting deer winter yards, protecting vernal pools and other unique or rare communities, expanding and protecting the Floating Island National Natural Landmark, maintaining partnerships, permitting special uses, distributing refuge revenue sharing payments, conducting wilderness and wild and scenic rivers reviews, protecting cultural resources, and refuge staffing and administration. The reader is encouraged to review this section for a complete perspective on each alternative.

Table 2.2 highlights those actions that distinguish the alternatives, how they relate to our goals, and how they address the significant issues identified in chapter 1. Please refer to the glossary to interpret any acronyms.

Table 2.2. Highlights of respective alternative’s actions as they relate to goals and significant issues

Refuge Resource or Program	Alternative A Current Management	Alternative B Service-preferred alternative	Alternative C
<p>Goal 1. Manage open water and wetlands to benefit Federal trust species and other species of conservation concern</p>	<p><i>Responds to Issues: Which wetlands habitats and dependent species should be a management priority? How will we manage for them on the refuge? How will we manage fur-bearer populations?</i></p>		
<p>Fen and Flooded Meadow; Boreal Fen and Bog</p>	<p>Continue “passive” management on 1,722 acres of these habitat types; we define passive management as protecting, monitoring key resources, and conducting baseline inventories to improve our knowledge of the ecosystem</p> <p>Continue spring and fall migratory waterfowl and shorebird surveys and breeding marsh bird surveys</p> <p>Conduct other baseline species and vegetation monitoring and inventories as funding allows, including in the 860 acre Floating Island NNL</p> <p>Continue to support research to determine impacts on resources of concern from water level management</p>	<p>In addition to alternative A:</p> <p>Actively manage to promote high quality habitat for focal species identified in objective 1.1 and 1.2 (e.g. various waterfowl, marsh and wading birds), to the extent possible under the existing FERC license</p> <p>Expand alternative A bird surveys to include nesting, brood-rearing and migrating waterfowl, shorebird and marsh wading birds</p> <p>Evaluate recreational impacts on waterfowl and water bird brood rearing in the Magalloway and Dead Cambridge river areas</p> <p>Expand production of wild rice and other high energy food sources for waterfowl</p> <p>Initiate studies to determine a more favorable year round water level management regime for conserving priority habitats and focal species, including NNL, and initiate dialogue with the holder of the FERC license for the Errol Project (currently FPLE) to determine feasibility of implementation</p>	<p>In addition to alternative A:</p> <p>Remove roads, culverts, and any other obstructions not needed for administrative purposes or priority programs, that affect natural wetlands development or interfere with natural hydrologic flow</p> <p>Determine historical distribution, composition, and development of wetlands prior to dam establishment and evaluate whether historical context can be reestablished</p> <p>Determine an annual hydrologic flow that more closely mimics a natural regime, and initiate dialogue with the holder of the FERC license for the Errol Project (currently FPLE) to determine feasibility of implementation</p>

Refuge Resource or Program	Alternative A Current Management	Alternative B Service-preferred alternative	Alternative C
<p>Goal 1. (cont'd) Manage open water and wetlands to benefit Federal trust species and other species of conservation concern</p>	<p>Conduct other baseline species and vegetation monitoring and inventories as funding allows, including in the 860 acre Floating Island NNL</p> <p>In cooperation with NPS, expand NNL boundary to include 2,181 total acres, and establish permanent monitoring program to insure no loss of diversity or integrity</p> <p>Continue to support research to determine impacts on resources of concern from water level management</p> <p>Continue to acquire up to 170 acres from willing sellers within current, approved boundary</p>	<p>Expand production of wild rice and other high energy food sources for waterfowl</p> <p>Determine a more favorable year round water level management regime for conserving priority habitats and focal species, including NNL, and initiate dialogue with the holder of the FERC license for the Errol Project (currently FPLE) to determine feasibility of implementation</p> <p>Conduct a hydrologic study of groundwater and nutrient flow in Leonard Marsh and Harpers Meadow</p> <p>In addition to alternative A acquisition, increase permanent conservation of these habitat types through Service acquisition in fee simple of 2,573 acres, and 358 acres in conservation easement; all acquisition would be from willing sellers</p>	<p>Determine an annual hydrologic flow that more closely mimics a natural regime, and initiate dialogue with the holder of the FERC license for the Errol Project (currently FPLE) to determine feasibility of implementation</p> <p>Increase permanent conservation of these habitat types through Service acquisition in fee simple of 3,551 acres; all acquisition would be from willing sellers</p>
<p>Northern White Cedar</p>	<p>Continue passive management on the 829 acres in this habitat type</p> <p>Continue to inventory small mammals and amphibians as funding allows</p> <p>Continue to acquire up to 202 acres from willing sellers within current, approved boundary</p>	<p>Expand alternative A surveys to include more detailed surveys of rare plant and animal occurrences; and, working with state Heritage Programs, establish measures of ecological integrity and develop a monitoring program to evaluate overall condition</p> <p>Restore northern white cedar on sites where land use converted it to another type; treat competing vegetation on up to 150 acres in 15 years</p> <p>Evaluate habitat needs of boreal species using this habitat type; manage to enhance those features, if not present</p>	<p>In addition to alternative A: Determine historical distribution, composition, and development of this habitat type prior to dam establishment and evaluate whether historical context can be reestablished</p> <p>In cooperation with state heritage programs, conduct baseline studies of rare plant and animal occurrences within this type, establish measures of ecological integrity and develop a monitoring program to evaluate overall condition</p>

Refuge Resource or Program	Alternative A Current Management	Alternative B Service-preferred alternative	Alternative C
Goal 1. (cont'd)	Manage open water and wetlands to benefit Federal trust species and other species of conservation concern		
Scrub-Shrub	<p>Continue passive management on the 682 acres in this habitat type</p> <p>Continue to acquire up to 258 acres from willing sellers within current, approved boundary</p> <p>Continue to support research to determine impacts from water level management</p>	<p>In addition alternative A research:</p> <p>In woodcock focus areas which overlap this habitat type, identify treatment areas and actively enhance woodcock foraging and brood-rearing habitat by creating and maintaining alder on approximately 20-year rotations</p> <p>Begin NEPA analysis, including public involvement, associated with developing a furbearer management plan to help manage beaver populations where practical and consistent with habitat objective.</p> <p>In addition to alternative A acquisition, increase permanent conservation of these habitat types through Service acquisition in fee simple of 790 acres, and 77 acres in conservation easement; all acquisition would be from willing sellers</p>	<p>In addition alternative A:</p> <p>Use beaver to sustain this habitat type; begin NEPA analysis, including public involvement, associated with developing a furbearer management plan to help manage beaver populations within their historic, natural range of density/mile (in suitable habitat in northern NH and ME)</p> <p>Increase permanent conservation of this habitat type through Service acquisition in fee simple of 1,041 acres; all acquisition would be from willing sellers</p>
Open Water and Submerged Aquatic Vegetation	<p>Continue passive management on the 5,033 acres in this habitat type</p> <p>Continue to map distribution of SAV beds as funding allows</p> <p>Continue to acquire up to 801 acres from willing sellers within current, approved boundary</p>	<p>Work with states, to protect and enhance SAV beds, improve water quality, and increase production of native brook trout</p> <p>Initiate mapping and monitoring of native mussel and SAV beds</p> <p>In addition to alternative A acquisition, increase permanent conservation of these habitat types through Service acquisition in fee simple of 46 acres, and 23 acres in conservation easement; all acquisition would be from willing sellers</p>	<p>In addition to alternative A:</p> <p>Establish water quality monitoring program, identify pollution sources in the Upper Androscoggin River watershed, and determine impacts on aquatic resources;</p> <p>Increase permanent conservation of this habitat types through Service acquisition in fee simple of 100 acres; all acquisition would be from willing sellers</p>
Common Loon	<p>Continue to monitor and actively protect loon nesting sites (e.g. restricted public access, buoy lines, nest observers and monitors, outreach and education) in partnership with states and with the holder of the FERC license for the Errol Project, FPLE</p>	<p>In addition to alternative A, initiate surveys and studies to:</p> <p>Map and monitor recreational use and pressure near loon nesting territories</p> <p>Evaluate loon interactions with waterfowl during the breeding season and determine impact of predators in loon nesting success; manage loon predators as warranted</p>	<p>Same as alternative A</p>

Refuge Resource or Program	Alternative A Current Management	Alternative B Service-preferred alternative	Alternative C
Goal 1. (cont'd) Manage open water and wetlands to benefit Federal trust species and other species of conservation concern			
Common Loon (cont'd)	Continue annual meetings with FERC licensee or representative to advise on lake water level management; continue to use breeding and nesting loons as bio-indicators of water-level management impacts	Once study and inventory results available, review loon nesting carrying capacities identified in objective 1.6. Evaluate availability and quality of natural nesting sites	
Furbearer Management	No management	Within 3 years, begin NEPA analysis, including public involvement, associated with developing a Furbearer Management Plan. The plan will evaluate the need for active management, and where and how this might occur. This does not preclude the refuge manager from using trapping as a tool in the interim if safety, health or resource values are jeopardized when it is done as an administrative activity by refuge staff, their agent, or a contractor.	Same as alternative B
Goal 2. Manage floodplain and lakeshore habitats to benefit Federal trust species and other species of conservation concern			
<i>Responds to Issue: Which habitats and dependent species should be a management priority? How will we manage for them on the refuge?</i>			
Wooded Floodplain	Continue passive management on the 1,140 acres in this habitat type Continue to restore natural vegetation on unauthorized camp sites and surplus cabins sites that have been removed Continue vernal pool, small mammal, amphibian and breeding bird surveys as funding allows	In addition alternative A: Actively manage to promote high quality habitat for focal species identified in objective 2.1 (northern parula and rusty blackbird); where practical, create those forest stand structural attributes determined to be a limiting factor for breeding and nesting focal species (e.g. cavity trees, rich understorey) Protect/retain large legacy trees, and large standing and downed dead wood for cavity tree-dependent wildlife	In addition to alternative A: Determine historical distribution, composition, and development of this habitat type and evaluate whether historical context can be reestablished; management objective would be to create a habitat complex that would eventually be sustained through natural ecological processes without further intervention

Refuge Resource or Program	Alternative A Current Management	Alternative B Service-preferred alternative	Alternative C
Goal 2. (cont'd) Manage floodplain and lakeshore habitats to benefit Federal trust species and other species of conservation concern			
Wooded Floodplain (cont'd)	<p>Continue to acquire up to 153 acres from willing sellers within current, approved boundary</p>	<p>Restore the hydrology of the Day Flats area by plugging ditches and re-contouring the disturbed areas</p> <p>Work with NHHB to define the rare Magalloway River floodplain type, and establish measures of ecological integrity; implement a monitoring program</p> <p>Evaluate isolated backwater areas with high potential for waterfowl brood rearing habitat to determine if seasonal boat access closures would enhance habitat quality; implement closures if determined beneficial</p> <p>In addition to alternative A acquisition, increase permanent conservation of these habitat types through Service acquisition in fee simple of 123 acres, and 13 acres in conservation easement; all acquisition would be from willing sellers</p>	<p>Restore the hydrology of the Day Flats area by plugging ditches and re-contouring the disturbed areas</p> <p>Increase permanent conservation of this habitat type through Service acquisition in fee simple of 140 acres; all acquisition would be from willing sellers</p>
Lakeshore Pine-Hemlock	<p>Continue passive management on the 232 acres in this habitat type</p> <p>Continue to restore natural vegetation on unauthorized camp sites and surplus cabins sites that have been removed</p> <p>Monitor habitat impacts from public use and record wildlife use when staffing and funding allows</p> <p>Continue to acquire up to 288 acres from willing sellers within current, approved boundary</p>	<p>In addition alternative A:</p> <p>Work with NHHB to establish measures of ecological integrity and implement a monitoring program in the jack pine type</p> <p>Protect/retain large legacy trees, and large standing and downed dead wood, or any tree observed to be used by eagles and osprey for perching</p>	<p>In addition to alternative A:</p> <p>Determine historical distribution, composition, and development of this habitat type and evaluate whether historical context can be reestablished; overall objective would be to create a habitat complex that would eventually be sustained through natural ecological processes with minimal intervention</p>
Bald Eagle and Osprey	<p>In partnership with NHFG, MDIFW, and other conservation partners, continue to conduct annual bald eagle and osprey nest surveys</p>	<p>In addition to alternative A, protect:</p> <p>All active nest trees with a 600 foot no-disturbance buffer</p>	<p>Same as alternative B</p>

Refuge Resource or Program	Alternative A Current Management	Alternative B Service-preferred alternative	Alternative C
<p>Goal 2. (cont'd) Bald Eagle and Osprey (cont'd)</p>	<p>Manage floodplain and lakeshore habitats to benefit Federal trust species and other species of conservation concern</p>	<p>Manage floodplain and lakeshore habitats to benefit Federal trust species and other species of conservation concern</p>	<p>Manage floodplain and lakeshore habitats to benefit Federal trust species and other species of conservation concern</p>
<p>Bald Eagle and Osprey (cont'd)</p>	<p>Continue to actively protect nest sites where warranted (e.g. restricted public access, buoy lines, predator guards, outreach and education) Protect super-canopy trees Support efforts to eliminate practices that contribute to lead and other contaminants</p>	<p>All historic nest sites, nest trees, and partially constructed nest trees All stands with replacement potential as nesting habitat</p>	<p>All historic nest sites, nest trees, and partially constructed nest trees All stands with replacement potential as nesting habitat</p>
<p>Goal 3. Manage upland forested habitats, consistent with site capabilities, to benefit Federal trust species and other species of conservation concern</p> <p><i>Responds to Issues: Which upland forest habitats and forest-dependent species should be a management priority? How will we manage for them on the refuge?</i></p>	<p>Continue passive management on the 10,845 acres in this habitat type Continue to work with NHFG and MDIFW to identify and protect all deer winter yards Continue to conduct annual breeding bird surveys Continue to acquire up to 4,838 acres from willing sellers within current, approved boundary</p>	<p>Actively manage to promote and sustain high quality habitat for refuge focal species identified in objective 3.1 (e.g. blackburnian, Canada, and black-throated green warblers, and American woodcock); within habitat management units, establish treatment areas and manage to promote desired forest stand conditions using accepted silvicultural practices. Protect/retain large legacy trees, and large standing and downed dead wood and favor the spruce component in management activities. See appendix K for additional details on forest management guidelines. Continue to conduct alternative A breeding bird surveys; cooperate with NHFG and MDIFW in developing management plans, consistent with priority focal species management, for critical deer winter yards to ensure their effectiveness over the long-term Work with lynx recovery team to determine any future management potential</p>	<p>Manage mixed forest matrix development across the refuge landscape to approximate the native species and the ecological processes, including natural disturbance regime, characteristic of the mixed forest matrix within their natural range of variation; overall objective would be to create a mosaic of habitat types that would eventually be sustained through natural ecological processes with minimal intervention Utilize the TNC publication "Natural Dynamics Silviculture" (Roe and Ruesink 2004) as a guide for management In addition to alternative A acquisition, increase permanent conservation of the mixed forest matrix through Service acquisition in fee simple of 69,702 acres; all acquisition would be from willing sellers</p>
<p>Mixed Forest Matrix</p> <p>With 3 embedded habitat types:</p> <ol style="list-style-type: none"> 1) Spruce-Fir 2) Mixed Woods (spruce-fir-hardwood mix) 3) Northern Hardwood 	<p>Continue passive management on the 10,845 acres in this habitat type Continue to work with NHFG and MDIFW to identify and protect all deer winter yards Continue to conduct annual breeding bird surveys Continue to acquire up to 4,838 acres from willing sellers within current, approved boundary</p>	<p>Actively manage to promote and sustain high quality habitat for refuge focal species identified in objective 3.1 (e.g. blackburnian, Canada, and black-throated green warblers, and American woodcock); within habitat management units, establish treatment areas and manage to promote desired forest stand conditions using accepted silvicultural practices. Protect/retain large legacy trees, and large standing and downed dead wood and favor the spruce component in management activities. See appendix K for additional details on forest management guidelines. Continue to conduct alternative A breeding bird surveys; cooperate with NHFG and MDIFW in developing management plans, consistent with priority focal species management, for critical deer winter yards to ensure their effectiveness over the long-term Work with lynx recovery team to determine any future management potential</p>	<p>Manage mixed forest matrix development across the refuge landscape to approximate the native species and the ecological processes, including natural disturbance regime, characteristic of the mixed forest matrix within their natural range of variation; overall objective would be to create a mosaic of habitat types that would eventually be sustained through natural ecological processes with minimal intervention Utilize the TNC publication "Natural Dynamics Silviculture" (Roe and Ruesink 2004) as a guide for management In addition to alternative A acquisition, increase permanent conservation of the mixed forest matrix through Service acquisition in fee simple of 69,702 acres; all acquisition would be from willing sellers</p>

Refuge Resource or Program	Alternative A Current Management	Alternative B Service-preferred alternative	Alternative C
<p>Goal 4. Provide high quality wildlife-dependent activities such as hunting, fishing, wildlife observation and photography, as well as camping and boating in support of those activities</p> <p><i>Responds to Issues: What is the appropriate level of use for each of the six priority public use programs on the refuge: hunting, fishing, wildlife observation and photography, environmental education and interpretation? What means of access will we allow for these activities? How will we manage remote camping on the refuge?</i></p>			
<p>Hunting</p>	<p>Continue to offer a hunt program, consistent with respective state regulations and seasons and annual Refuge Hunt Plan, except no turkey hunting on refuge lands, and no bobcat hunting on refuge lands in Maine</p> <p>Continue to maintain 6 waterfowl hunt blinds and allow use under a reservation system</p>	<p>In addition to alternative A: Improve information materials provided to hunters (e.g. allowed access, other restrictions)</p> <p>Increase knowledge of refuge harvest information and hunter satisfaction; in cooperation with state, local hunt clubs, volunteers, or other partners, establish refuge check stations and/or issue free special use permits and require reporting</p> <p>Within 2 years of CCP approval, evaluate the potential for a turkey hunt on refuge lands in both NH and ME and a bobcat hunt on refuge lands in Maine, consistent with respective states' regulations. If appropriate, develop a new Hunt Plan opening package, including new NEPA document, Federal Register notice, and public involvement opportunities</p>	<p>Same as alternative B, except the objective is to promote a backcountry, low density hunt experience. Actions that would differ include:</p> <p>Establish hunting units and distribute use and limit numbers through free special use permit program;</p> <p>No new developments, facilities, or improved access would be provided; majority of area is walk-in use only</p>
<p>Fishing</p>	<p>Continue to allow fishing, consistent with respective state regulations and seasons; except public access may be restricted in certain areas to protect loon, bald eagle, and osprey nests</p> <p>Continue to host Take Me Fishing event</p>	<p>In addition to alternative A: Complete all administrative actions to officially open the refuge to fishing</p> <p>Provide improved lake and river shoreline access at designated sites, and new proposed sites, including provisions for anglers with disabilities at new Mountain Pond fishing access</p> <p>In cooperation with the states of New Hampshire and Maine, increase knowledge of refuge harvest information and angler satisfaction through creel surveys; and</p> <p>Work with NHFG and MIDIFW to maintain a high quality brook trout fishery in the Rapid, Dead Diamond, B Brook, and Dead Cambridge river drainages.</p>	<p>Same as alternative B, except the objective is to promote a remote, low density angling experience. Actions that would differ include:</p> <p>Consider permit system once thresholds have been breached</p> <p>No new developments, facilities, or improved access would be provided; majority of area is walk-in use only</p>

Refuge Resource or Program	Alternative A Current Management	Alternative B Service-preferred alternative	Alternative C
<p>Goal 4. (cont'd) Provide high quality wildlife-dependent activities such as hunting, fishing, wildlife observation and photography, as well as camping and boating in support of those activities</p>			
<p>Wildlife Observation and Nature Photography</p>	<p>Continue to maintain Magalloway River trail and viewing platform</p> <p>Continue to allow use of waterfowl blinds under a reservation system which, in addition to hunting, provides for observing and photographing wildlife</p>	<p>In addition to alternative A:</p> <p>Create safe, accessible wildlife viewing pull-outs on Route 16 and 26 in partnership with NHFG, MDIFW, and state highway departments</p> <p>Provide other new infrastructure, including trails, identified under "Goal 5: Interpretation" discussion</p> <p>Work with NHFG, MDIFW and other partners to develop regional wildlife viewing trails across ownerships (e.g. auto, canoe/kayak, walking, snowmobile, etc) with associated visitor contact materials</p> <p>Develop a wildlife viewing reporting system (e.g. on-line web-based)</p>	<p>In addition to alternative A, the objective is to promote a backcountry, low density wildlife observation and photography experience.</p> <p>The only new developments would be around Potter Farm facility and the roadside pullouts on Routes 16 and 26. No other facilities, or improved access on-refuge would be provided; majority of area is walk-in use only.</p>
<p>Camping</p>	<p>Continue cooperative program with NH DRED-Parks and Recreation allowing them to administer 14 remote, designated camp sites on refuge lands (12 sites on lake; 2 on river)</p> <p>Continue to maintain and improve campsites on an annual basis</p> <p>Continue seasonal closures of certain sites when warranted to reduce impacts to nesting loons and other wildlife</p>	<p>In addition to alternative A:</p> <p>Complete cooperative agreement with NH DRED-Division of Parks and Recreation to formalize administration, implementation and stipulations;</p> <p>Close the two river camp sites and rehabilitate them to native vegetation</p> <p>Utilize the proposed Umbagog Lake Working Group to help develop a voluntary, interagency plan for remote camping across ownerships and jurisdictions. Such considerations as setting fees, limits on camper numbers and use restrictions, distribution of sites, safety, site protection and restoration, season length, and reservation system would be explored</p>	<p>Same as alternative B, except the objective is to promote a primitive, low impact experience. Actions that would differ include:</p> <p>Limit infrastructure at camping sites, limit number of campers/site, do not allow fires, and require campers to bring portable toilets</p>

Refuge Resource or Program	Alternative A Current Management	Alternative B Service-preferred alternative	Alternative C
<p>Goal 5. Develop high quality interpretive opportunities, and facilitate environmental education, to promote an understanding and appreciation for the conservation of fish and wildlife and their habitats, as well as the role of the refuge in the Northern Forest.</p> <p><i>Responds to Issues: What is the appropriate level of use for each of the six priority public use programs on the refuge: hunting, fishing, wildlife observation and photography, environmental education and interpretation? What means of access will we allow for these activities?</i></p>			
<p>Interpretation</p>	<p>Continue to respond to requests for Continue to respond to requests for programs when staffing and funding allows; demand would continue to far exceed staff's ability to respond</p> <p>Continue efforts to complete Magalloway River interpretive trail, including its ¼ mile loop expansion, and the Magalloway River self-guided canoe and kayak trail</p>	<p>In addition to alternative A: Develop Visitor Services Plan and implement all programs identified under goals 4 and 5; seek funding to hire a VSP Increase interpretive programs by providing guided walks and boat trips, or other programs at state campground Improve self-guided interpretive information at Magalloway River trail and along approved, designated snowmobile trails. Insure proposed walking and canoe/kayak trails (e.g. new walking trails at Potter Farm, Thurston Cove, and Mountain Pond areas, and along Route 16; and, Magalloway River self-guided boat trail) have high quality, self-guiding interpretive materials See also Goal 6: "Partner-managed visitor facilities"</p>	<p>Same as alternative B, except, only the Potter Farm trail loop, which requires new construction, would be included. Other trail options may be considered in the future if no new construction is necessary. The overall objective is to promote a backcountry, low density experience. Actions that would differ include: Limit group size to <20 individuals Maintain interpretive signage only at trailheads</p>
<p>Community Outreach</p>	<p>Continue to coordinate two annual community events: Umbagog Wildlife Festival, and Take Me Fishing. While the main venue for these programs are in town, include coordinated on-refuge programs when staffing and funding are available Continue to distribute brochures and literature on impacts to wildlife from lead fishing tackle</p>	<p>In addition to alternative A: Create new, and improve existing outreach materials (newsletter, website, media and press kits, fact sheets, virtual tours of refuge and webcams at bald eagle and loon nesting sites) Coordinate with states and Umbagog Lake Working Group to develop lake access management plan and outreach materials; better explain where public access is allowed and why there are area closures and other restrictions to protect resources; also, cooperatively implement an informational sign program in visitor concentration areas Conduct outreach specifically targeted at refuge neighbors to encourage their awareness, interest and involvement in refuge activities See also Goal 6: "Partner-managed visitor facilities"</p>	<p>Same as alternative B</p>

Refuge Resource or Program	Alternative A Current Management	Alternative B Service-preferred alternative	Alternative C
Goal 5. (cont'd)	Develop high quality interpretive opportunities, and facilitate environmental education, to promote an understanding and appreciation for the conservation of fish and wildlife and their habitats, as well as the role of the refuge in the Northern Forest.		
Environmental Education	No current program	Facilitate partner-led educational program development and implementation on the refuge; refuge staff and resources would be limited Evaluate potential for adult educational partnerships through universities or programs such as Elder Hostel	Same as alternative B
New Refuge Headquarters and Visitor Contact Facility	No change	Seek a new location for the main administrative and program headquarters office and visitor contact facility. Preferred location is the Potter Farm site. The size of the facility would be "small", as defined by the new Service facility standards. The existing headquarters building would be maintained as a research or auxiliary field office; however the adjacent small cabin would be removed.	Same as alternative B except the size of the facility would be "medium" as defined by the new Service facility standards.
Goal 6. Enhance the conservation and management of fish and wildlife resources in the Northern Forest Region through partnerships with public and private conservation groups, private landowners, State and local entities			
<i>Responds to Issues: What should be the refuge's role in land conservation efforts in the Upper Androscoggin River watershed? Should we pursue a refuge expansion? How can the refuge and its staff be an asset to local communities and support their respective vision and goals for the area?</i>			
Regional and Community Partnerships	Continue working with the numerous partners identified under objective 6.1 to address both regional (e.g. Northern Forest and Upper Androscoggin watershed) and local (town, individual resource or program) issues and opportunities	In addition to alternative A: Explore the potential for a regional Umbagog Area Friends Group Participate in regional and local community economic development and conservation partnerships and initiatives, such as Upper Androscoggin Advisory Committee	Same as alternative B

Refuge Resource or Program	Alternative A Current Management	Alternative B Service-preferred alternative	Alternative C
Goal 6. (cont'd) Enhance the conservation and management of fish and wildlife resources in the Northern Forest Region through partnerships with public and private conservation groups, private landowners, State and local entities			
Cooperative Management of Umbagog Lake	Nothing formal established, but continue to work with NHFG and MDIFW to conduct boater and angler safety and ethics outreach during festivals and individual visitor contacts	In addition to alternative A: Promote the establishment of an interagency, inter-jurisdictional Umbagog Lake Working Group to recommend consistent regulations and best management practices, and to address user and resource issues that cross ownerships	Same as alternative B
Partner-managed Visitor Facilities	None	With local business and town officials and state partners, develop a visitor contact facility in Errol to orient visitors to the Umbagog region	Same as alternative B
Goal 7. Develop Umbagog National Wildlife Refuge as an outstanding center for research and development of applied management practices to sustain and enhance the natural resources in the Northern Forest in concert with the Land Management Research Demonstration (LMRD) Program			
<i>Responds to Issues: Same as goals 1-3 and 6.</i>			
Research and Applied Management	No program	Seek support and funding to establish the refuge as an LMRD site; hire an LMRD coordinator to facilitate implementation Conduct a research needs assessment for the refuge and develop a mission and framework for a research program	Same as alternative B, except program emphasis is on natural landscape composition, patterns, and processes
Outreach for Research and Management Programs	None	Facilitate demonstration area on-refuge, and on other conservation ownerships, that showcase applied management to benefit natural resources Cooperate with Partners for Wildlife program to accomplish outreach, demonstration projects, and seek funding Conduct workshops, courses, and other technical forums Publish research findings in peer-reviewed publications	Same as alternative B

Chapter 3



Ian Drew/USFWS

Vernal pool

Affected Environment

Introduction

This chapter describes the physical and socioeconomic settings of the refuge in both a regional and local context. We first describe the regional landscape, including its historical and contemporary influences. Next, we describe the refuge and its resources in a local context.

The Upper Androscoggin River Watershed and the Northern Forest

The Landscape Setting

The refuge lies in the Upper Androscoggin River watershed, in a broad valley near the rugged White Mountains, where dozens of peaks rise more than 3,500 feet in elevation. Mount Washington lies to the south at 6,288 feet. It is the highest peak in the Northeast (Publicover and Weihrauch 2003). These lands, clothed in trees, are part of the 26-million-acre region known as the Northern Forest, which stretches from eastern Maine through northern New Hampshire, Vermont, and New York (Northern Forest Lands Council 1994).

Maine and New Hampshire are the most heavily forested states in the Nation, and the Northern Forest one of its largest contiguously forested regions. Those forests, waters, and wildlife profoundly influence the culture and economies of the northern reaches of the two states. The refuge lies in the transition zone between the vast spruce-fir, boreal forests of Canada and the maple-beech-birch northern hardwoods to the south. That mixing of forest types, combined with the rugged terrain, diverse geology, and myriad lakes, bogs, and other wetlands supports a richness of flora and fauna (Dobbs and Ober 1995).

The Northern Forest produced more timber than any place in the world during the 1800s (Dobbs and Ober 1995). Until the 1980s, nearly 85 percent of the Northern Forest was privately owned: much of that by large paper companies. The culture of the region is rooted in the traditions of hunting, fishing, and working in the woods. By the 1980s however, 75 million people lived within a day's drive of the region, and the expanding global economy was putting pressure on the large commercial landowners. In 1988, 1 million acres of land formerly owned by Diamond International Corporation went on the market. That marked the beginning of major shifts in land ownership patterns that continue today (Northern Forests Lands Council 1994).

The Historical Picture

Glaciation

The Earth has experienced several glacial periods; the last, known as the Pleistocene Ice Age, began about 2 million years ago. Glaciers advanced and retreated over time as temperatures fluctuated. The most recent period to affect Northern New England was the Wisconsin Glaciation, which reached its maximum extent about 18,000 years ago. A one-mile-thick sheet of ice, known as the Laurentide Ice Sheet, covered the region until its retreat from the Upper Androscoggin River watershed 10,000 years ago.

As glaciers retreat, they leave behind piles or layers of sediments, rocks and other debris known as glacial drift. These surficial deposits over bedrock come in two types in our region: glacial till and glacio-fluvial. Glacial till is a mixture of sand, silt, clay, and rock ground up by the glacier and dropped as it retreated. It covers most of our region, deepest on lower slopes, and thin or absent on mountaintops and ridges. Glacio-fluvial drift develops from the transport, sorting, and deposit of material by flowing glacial meltwater. Larger gravels and stones settle out at higher gradients, while finer silts, sands, and clays settle out at as the waters slow at valley bottoms (Sperduto and Nichols 2004).

After the Ice Age

Ten thousand to 12,000 years ago, the retreating ice sheet scraped and molded the valleys, slopes and mountaintops, leaving behind a landscape bare of

vegetation. However, at the southern edge of the glacier, plants survived and immediately began to re-colonize the newly exposed soils (Marchand 1987). Large mammals, including mastodons, wandered the spruce parkland and grassy savanna, but disappeared quickly at the same time as the glacier receded and humans advanced across the region. Thirty-five to 40 large mammal species became extinct 9,000 to 12,000 years ago, while other mammals that were around then, such as timber wolf and white-tailed deer, are still present today (Pielou 1991; Askins 2000).

Continual weathering and erosion of rock over time released nutrients and created new soils for plants to grow. Sedges and dwarf shrubs dominated the tundra-like landscape for several thousand years. As the climate warmed, these plants and animals followed the glacier as it receded north. The tundra continued to retreat, eventually restricted to the highest mountaintops (Davis 1983; Marchand 1987).

Hardwood and softwood tree species advanced independently of one another, creating different forest communities through time (Davis 1983). Graham (1992) reported a similar individualistic response by mammals to the post-glacier climate changes. Spruces were the first trees to colonize, nearly 2,000 years after the ice melted. Pollen records show balsam poplar and dwarf birch in the mix with spruce (Davis 1983). The sequence of plant species arrivals as the glacier receded was different at different sites (Davis 1981). In Northern New England, northern hardwoods—American beech, sugar maple, and yellow birch—established their dominance 2,000 years ago, while spruce regained dominance on the middle slopes, following an earlier dieback (Davis 1981, 1983; Marchand 1987; Pielou 1991).

Native People

Evidence from archaeological sites in the region documents human habitation in the Umbagog Lake area as far back as 11,000 years ago (Hanson 1996). Those early inhabitants traveled along the region's waterways and camped at numerous sites along headwaters of the Androscoggin River watershed (Hermes and Pollock 2001; Gramly 1982, 1984). Native American influences on the spruce-hardwood forests of northern New Hampshire, however, were thought to be minor compared to those of indigenous populations further south. They used fire to clear land for agriculture, improve habitat for game, or facilitate travel through the forest in the drier hardwood forests of southern New England (Cronin 1983). The more sedentary, concentrated populations in coastal southern New England likely set repeated fires that had a more lasting impact on the landscape. In interior and northern New England, native people were more mobile, traveling by boat rather than on foot, gathering food from rivers and the sea rather than by farming, and rarely using fire. Wild foods, including fish, game, roots, and berries were abundant, and the local climate was unsuitable for growing crops (Patterson and Sassaman 1988).

Human Land Use Last 200 Years

Farming, harvesting timber, building dams, and developing land are the primary forces that have shaped the Upper Androscoggin River watershed region in the past 200 years.

The first explorers did not reach this region until the 1780s. Early pioneers arrived in Errol in 1806, and by 1831 there were enough inhabitants to hold the first town meeting (Annis et al. 1999). The first residents settled along the river, where they cleared land for agriculture. Many families brought cows, sheep, and pigs from their previous homes, and needed to raise feed for the livestock as well as grain for their own use (Littlehale et al. 1975).

Agriculture remained the primary land use of the fertile floodplain soils well into the twentieth century, as evidenced by the presence of open fields in the major valleys today. Horse logging required hay and grain to maintain the logging company teams from the late 1800s into the 1930s, when diesel engines began to

take over. Dairy herds were introduced during the 1940s, but many farms were abandoned as people sought other work (Annis et al. 1999; Littlehale et al. 1975), and some of the agricultural lands have reverted to forest.

Timber harvesting

In the 1820s, commercial logging began in earnest as mills were built in the towns along the Androscoggin and Magalloway rivers to facilitate the transport of logs. Early loggers used hand axes and crosscut saws, skidded the logs using horses, and floated the logs to the mills on the rivers. That was the typical practice until the Great Depression in the 1930s. Thereafter, chain saws, motorized skidding, and overland hauling of logs replaced axes, horses, and most of the river drives. The railroad arrived in Gorham in 1851 and in Berlin in 1855. The last long-log river drive on the Androscoggin River occurred in 1937, although pulpwood was moved downriver until the early 1960s (Publicover and Weihrauch 2003). The boom piers visible in the river north of Berlin are stone and wood structures used until the mid-1960s by the two large paper companies, International Paper Company and Brown Company, to separate their respective logs traveling downriver. The boom piers were also used to separate long lumber logs from the shorter length pulpwood (Northern White Mountain Chamber of Commerce, 2005).

White pine was harvested for local building material and, eventually, for export downriver. Those trees, up to 7 feet in diameter, grew abundantly along the shores of lakes and rivers (Wood 1961). The New Hampshire Legislature chartered a toll dam in Errol in 1837, and incorporated the Androscoggin Boom Company in 1851 to control the rafting of pine logs down the river. The use of red spruce for lumber began in 1845 on the Penobscot River, and spread to the headwaters of the Kennebec in 1850. Although not as massive as the pines, spruce trees grew to diameters of 2 feet. The abundant spruce of the Magalloway region impressed the crews surveying the Maine-New Hampshire boundary during the 1850s, and the first drive of spruce logs on the Androscoggin River occurred in the 1860s. Other tree species used included hemlock bark for tanning, tamarack for ship knees, northern white cedar for shingles, and balsam fir for boxes (Foss 2003).

The demand for lumber increased dramatically after the Civil War (Whitney 1994). That increased logging pressure depleted the growing stock of large pine, and spruce had become the primary lumber species by the 1890s. The pulp and paper industry began during the 1870s and 1880s, providing a market for smaller diameter spruce trees. The consolidation of family businesses and local cooperatives led to the formation of large industrial logging companies in the late 1890s, and the rate of harvest continued to increase. Berlin Mills Company and International Paper Company began to buy up land and control the harvest in the Androscoggin River valley (Smith 1972). By the first decades of the twentieth century, little virgin forest remained in the Northeast.

Harvesting declined following the boom years of the mid-1800s to the early 1900s, but started up again in the economic expansion following World War II. The early twentieth century saw the emergence of silviculture: the application of forest management principles to the growing and harvesting of trees to sustain a wood flow over time. New and bigger mechanized equipment was introduced to the forest, allowing more trees to be harvested in a shorter time, providing additional flexibility in applying silvicultural practices, and improving worker safety. Today, sustainable forestry and the global economy are the driving, and sometimes opposing, forces behind the timber industry in the Northern Forest (Publicover and Weihrauch 2003).

Dam Building

For hundreds of years logging has been a central part of the region's economy. Prior to the mid-1800s logs were floated downriver without the aid of dams to

control water levels. Log drives were limited to spring flood events and took up to four years to reach their destination. The desire to move logs more quickly led to the first dams built on the Rangeley Lakes by the mid-1800s. The power of flowing water aided the onset of the Industrial Revolution. Greater demands for power led to rebuilding the dams to allow larger volumes of water storage. Union Water Power Company incorporated in 1878 and took over management of the dams in the Rangeley chain of lakes with an interest in power generation. Today, water flows are regulated to generate electricity for paper mills and other uses, control the impacts of flooding, create recreational opportunities, and manage community wastewater treatment systems (FPLE undated).

Errol dam



Ian Drew/USFWS

The first dam in the Upper Androscoggin River watershed was built in 1836 on Rangeley Lake. Over the next 75 years, several more dams were built on the lakes and rivers in the watershed. The major water users of the time signed an operating agreement in 1909 that regulated water flow and storage; the agreement was modified in 1983, and still largely governs the region today. In 1999, FPLE purchased the rights to operate the dams and manage the reservoir storage in the headwaters of the Androscoggin River. They are the current holder of the FERC license for the Errol Project. FPLE regulates water levels through a series of dams on the Androscoggin River (Errol Dam), Lower Richardson Lake (Middle Dam), Upper Richardson Lake (Upper Dam), Rangeley Lake, and Aziscohos Lake (FPLE undated). Map 1-1 includes the locations of major dams on those waterways.

The 1909 Androscoggin River Improvement Company agreement, as it is known, states that the river flow at Berlin should be maintained at “as high a point above the minimum as shall be consistent with proper and economical use of the stored water.” FLPE keeps the Berlin flow above 1,550 cubic feet per second (cfs) when possible. In 1998, a cooperative agreement among the power company, state and federal agencies, and conservation groups as part of the FERC license was signed to further guide the water levels and flows specifically to protect fish and wildlife.

Development

The Upper Androscoggin River watershed is still a largely undeveloped region; at least it was until the building boom of the 1980s opened the region to speculators and second home development. In the early decades of settlement, homes were clustered around towns and sparsely scattered along the rivers and lakes. With logging roads and bridges still the dominant features in the forested uplands and hinterlands, development along rivers and lakeshores has steadily increased in the past two decades. In just the past few years, more large landholdings were sold and subdivided, and homes are creeping up the hillsides.

Much of the shoreline of the Androscoggin River south of Milan, New Hampshire, has some low-density rural development, as does the shoreline of Rangeley and Mooselookmeguntic Lakes in Maine. The shorelines of Umbagog, Aziscohos, and Richardson lakes remain largely undeveloped (Publicover and Weihrauch 2003). The spurt of development that began in the 1980s prompted conservation groups to pursue permanent land conservation in the region, including supporting the creation of the refuge (Dobbs and Ober 1995).

Climatic Effects and Natural Disturbances

“It is said that nowhere else at the same latitude in the northern hemisphere is it as cold as in the Northeast, except perhaps in northeastern China and Hokkaido, Japan” (Marchand 1987). The reason for the region’s cold climate is partly a result of the pattern of atmospheric circulation in this hemisphere. Low-

pressure systems all converge on New England regardless of their origin, and pull cold Canadian air in behind them as they pass over the Northeast (Marchand 1987). New England weather conditions are influenced more by the North American landmass than by the Atlantic Ocean except along the coastline (Taylor et al. 1996).

Natural disturbances vary across New England, depending on geographic location, forest type, and local conditions. For example, hurricane damage is greater on exposed versus sheltered slopes, lightning fires are more frequent on exposed ridges and on sandy versus loamy soils, and shallow root systems make softwoods vulnerable to wind-throw, particularly on shallow and poorly drained soils.

In general, historically, a gradient of decreasing disturbance frequencies extends from coastal regions to interior uplands and mountains. In pre-settlement times, coastal oak-pine regions likely had >10 percent in early successional forest conditions, while interior northern hardwoods had 1 percent to 3 percent of young forest. The proportion of young forest in spruce swamps and spruce flats may have been as high as 7 percent. Northern hardwood and mixed woods may have higher proportions of early successional stages today than historically, based on disturbance patterns (Lorimer and White 2003).

Native insects and disease, ice storms, droughts, floods, landslides, and avalanches have caused minor and major disturbances. For example, spruce budworm periodically affects millions of acres of spruce-fir forest in northern New England and southern Canada, and the 1998 ice storm damaged forests, particularly hardwoods, across 12 million acres in northern New England (DeGraaf and Yamasaki 2001). Lorimer and White (2003) depict hurricane frequencies as varying from 85 years in southeastern New England, 150 years through central Massachusetts and the southeast corner of New Hampshire, to 380 years or more in northern New England. Lorimer (1977) estimated catastrophic disturbances from fire and wind throw at intervals of 800 and 1,150 years, respectively. In contrast, small gap disturbances were frequent in our forests, and may have occurred at scales smaller than what are currently delineated as “stands” today (Seymour et al. 2002).

Although called “spruce budworm,” this native insect has a significant impact on balsam fir during periodic outbreaks that are part of the natural cycle in northern forests. Records dating back to the late 1500s indicate that budworm outbreaks occur on about a 40-year cycle. The last in northern New England occurred in the 1970s and 1980s. Large areas of balsam fir and white spruce are defoliated, followed by high tree mortality, then re-growth and recovery of the forest through seedling and sampling release in the newly opened canopy (Boulanger and Arseneault 2004).

Global climate changes will affect natural disturbance patterns over time (Lorimer 2001). The greatest effects of climate change will be on regional air and water temperatures, precipitation patterns, storm intensity, and sea levels. These effects are predicted to influence natural disturbances by resulting in an increase of freeze-free periods, decreased snow cover and lake ice duration, increased storm intensities and frequencies, increased likelihood and frequency of droughts, damaging ozone, and an increase in the spread of invasive species and disease (NH WAP 2005). The resulting effects on wildlife and habitats are expected to be variable and species-specific, with a predicted general trend of ranges shifting northward. Impacts will likely be most severe for habitats with narrow temperature and water level regimes, such as alpine, high and low elevation spruce-fir forests, coastal islands, vernal pools, and aquatic habitats (NH WAP 2005). The uncertainty about the future effects of climate change requires managers to use adaptive management to maintain healthy ecosystems in light of that unpredictability (Inkley et al. 2004).

Wildlife Changes

Wildlife populations ebb and flow as habitat conditions vary in space and time. Change is inevitable and natural, although human activities in the last 200 years have significantly altered the landscape compared to the previous 10,000 years when humans first colonized the Northeast (Foss 1992).

The 1800's witnessed the demise of many forest wildlife species in New England from the loss of habitat (forest clearing), bounty and market hunting, millinery trade, and natural history specimen collecting (Foster et al. 2002). Mountain lion, gray wolf, elk and caribou were extirpated by the mid-1800s or early 1900s, and only the gray wolf recently returned to the region in small numbers in Maine. Other forest species declined, including moose, black bear, beaver, wild turkey and pileated woodpecker. Heath hen, passenger pigeon, great auk, Labrador duck, and sea mink became extinct at the hand of humans during the same period (DeGraaf and Yamasaki 2001; Foster et al. 2002). In contrast, grassland species such as meadowlark, bobolink, upland sandpiper, and woodchuck increased as hayfields and pastures expanded during the early 19th century (Foss 1992; Foster and Motzkin 2003).

After farm abandonment escalated in the early 1900s, grassland species ebbed, while species of thickets, brush lands, and young forests surged (Litvaitis 2003). Populations of black bear, bobcat, and broad-winged hawks increased. At the same time, intense logging followed by intense fires and heavy rains continued to wreck havoc on forest habitat and associated wildlife species in northern New England (Foss 1992; DeGraaf and Yamasaki, 2001). The young hardwood forests that emerged in the 1920s and 1930s, after the old-field pine harvests, provided premier habitat for ruffed grouse and American woodcock (DeGraaf and Yamasaki 2001). Continued forest maturation caused those early successional species to decline to levels approaching pre-settlement levels (Litvaitis 2003).

Moose are common on the refuge

J. & K. Hollingsworth/USFWS



Nearly all the forest species that were extirpated or decimated have re-colonized the region. Some species arrived for the first time more recently. Eastern coyotes were first sighted in northern Maine in the 1930s, in Vermont and New Hampshire in the 1940s, and in Massachusetts in the 1950s (DeGraaf and Yamasaki 2001). DeGraaf and Yamasaki (2001) reported three major trends in New England's wildlife: forest species are increasing (e.g., bear, beaver, deer, wild turkey, pileated woodpecker), grassland and shrubland species are declining (e.g., bobolink, upland sandpiper, whip-poor-will), and many southern species are expanding their ranges northward (e.g., Carolina wren, northern cardinal, mockingbird, Virginia opossum). A few species,

such as raven, fisher, and moose are expanding southward. A group of species remains regionally extirpated, including wolverine and mountain lion, although lynx have returned to northern Maine and New Hampshire (DeGraaf and Yamasaki 2001).

Current Conditions

Climate

The climate of the Upper Androscoggin River watershed is temperate continental, with warm summers, cold winters, and a relatively even distribution of precipitation throughout the year. The region has four distinct seasons. Winter temperatures, December through February, average only 14° F, with minimum temperatures as low as -34°F. The summer months, June through August, average 62°F, reaching highs of 96°F or more. In Errol, the town closest to the refuge headquarters at Wentworth Location, summers average about 60°–70°F. Precipitation in the watershed varies from 33 inches to more than 80 inches per year; most towns in the watershed receive 40 inches to 45 inches

per year. The average precipitation in Errol is 36 inches per year (Publicover and Weihrauch 2003).

Generally, Umbagog Lake freezes in December or January, and “ice-out” typically occurs in May. Ice on the lake can reach depths of 18–24 inches or more. Areas near river inputs and outputs can remain open throughout the year. The rivers associated with Umbagog Lake also freeze intermittently in the winter.

Hydrology

The Upper Androscoggin River watershed is part of the larger Gulf of Maine watershed: the latter being the geographic area from which all water drains into the Gulf. It is an immense area, extending from eastern Quebec to Cape Cod, Massachusetts, with a land base of 69,115 square miles and a water surface of 33,054 square miles. Maine is the only state located entirely within its boundary.

The waters of the Androscoggin River begin their journey in Maine along the anadian border. Rainfall and snowmelt gathers in small streams that eventually join to form the northern tributaries to the Androscoggin River: the Swift and Dead Diamond, Magalloway, Cupsuptic, and Kennebago. Those rivers flow into these lakes of the Rangeley Lake chain: Rangeley, Mooselookmeguntic, Cupsuptic, Upper and Lower Richardson, Aziscohos and Umbagog lakes. The Androscoggin River begins at Umbagog Lake and flows south, then turns east back toward Maine. Many other tributaries flow into the Androscoggin River as it continues its journey through Maine before finally meeting the Kennebec River in Merrymeeting Bay and emptying into the Gulf of Maine (Publicover and Weihrauch 2003).

Water Quality

Historically, the Androscoggin River experienced a period of degradation followed by recovery. Even as late as 1970, the river was considered one of the most polluted in the United States. Untreated effluent discharged into the river from the large paper mill was sufficiently noxious before the middle of the 20th century to produce fumes “rumored to peel the paint off houses.” Low dissolved oxygen in the river made it unsuitable for most aquatic life, while foam and dark colors made it unappealing. The river made a remarkable recovery after the passage of the Clean Water Act in 1972, which forced the cleanup of point source pollution sources, including wastewater treatment plants and paper mills (Publicover and Weihrauch 2003).

Under the Clean Air Act, the Environmental Protection Agency (EPA) sets standards on a set of “criteria pollutants”: carbon monoxide (CO), nitrogen dioxide (NO₂), ozone (O₃), sulfur dioxide (SO₂), particulate matter (PM₁₀ and PM_{2.5}), and lead (Pb) (EPA 1993). Those standards are referred to as the National Ambient Air Quality Standards (NAAQS). Areas that do not meet the standard for a particular pollutant are considered “non-attainment areas.” The states of Maine and New Hampshire also have standards on other toxic pollutants. The only non-attainment areas in Maine and New Hampshire are in their southern portions, around more urban areas for ozone and in New Hampshire for small particles (PM_{2.5}). Coos County in New Hampshire and Oxford County in Maine meet the standards for all six criteria pollutants (US EPA 2005).

Evers (2005) documents a growing concern over mercury emissions and accumulation in aquatic and terrestrial systems in the Northeast. Mercury is emitted into the air as a byproduct from coal-burning power plants, incinerators, and other industrial plants. Once emitted into the air, mercury can travel for days before deposition through dry gases and particles, rain, or snow. The impact of mercury on humans and the environment depends on whether it converts into the toxic form of methylmercury. That form, if consumed, bioaccumulates as it

moves up the food chain, causing various reproductive and neurological problems for fish and wildlife. New models indicate that the greatest amount of mercury is deposited in forested and mountainous terrain, and scientists detected mercury accumulation in birds of mountain areas (e.g., Bicknell's thrush) as well as at lower elevations (e.g., northern waterthrush). Evers (2005) reports a suite of "biological hotspots," where mercury concentrations are elevated in fish and wildlife, which included the Rangeley Lakes region. All surface waters in New Hampshire and Maine are impaired for fish and shellfish consumption due to elevated levels of mercury in tissue (NHDES 2004; MDEP 2004).

Several water bodies in the Upper Androscoggin River watershed are listed as impaired waters that do not meet one or more of their uses, with the added condition that they require a total maximum daily load study. This study is designed to identify and reduce pollutants that are present in a lake or stream in order to attain an acceptable water quality standard. The Upper and Lower Richardson Lakes, parts of the Azicoshos Lake, Signal Pond, and the Androscoggin and Diamond rivers are in this category (NRCM 2005).


Air Quality

EPA regulates six criteria pollutants under the Clean Air Act of 1990 (CAA): ozone, carbon monoxide, nitrogen dioxide, particulate matter, sulfur dioxide and lead as well as hazardous and other toxic air pollutants, including mercury, under the CAA Amendments of 1990. States, tribal governments, and some local governments manage air quality in their administrative jurisdictions. The New Hampshire Department of Environmental Services (NHDES), Air Resources Division and the Main Department of Environmental Protection (Maine DEP), Bureau of Air Quality regulate criteria pollutants emitted in or transported into their respective States.

For each criteria pollutant, EPA has established a maximum concentration above which adverse effects on human health may occur. These threshold concentrations are called National Ambient Air Quality Standards (NAAQS). Areas of the country where air pollution levels persistently exceed the NAAQS may be designated "nonattainment." When an area does not meet the air quality standard for one of the criteria pollutants, it may be subject to the formal rule-making process to designate it as nonattainment. The Clean Air Act further classifies ozone, carbon monoxide, and some particulate matter nonattainment areas based on the magnitude of an area's problem. Nonattainment classifications may be used to specify what air pollution reduction measures an area must adopt, and when the area must reach attainment (40 CFR 81).

September 2005 data indicate that southern NH and coastal ME are nonattainment areas for ozone but the refuge counties of COOS County, NH and Oxford County, ME are in attainment for all criteria pollutants. Of recent

The CAA Amendments of 1977 established a program for the prevention of significant deterioration of air quality. Certain wildernesses and National Parks established before August 1977 were designated by the CAA as mandatory Class I areas. A Class I designation allows small increments of additional air pollution above baseline levels within the area so long as the national ambient air quality standards are complied with and the Air Quality Related Values (AQRVs) of the Class I area are not adversely affected. (USFS, 1991) Class I areas in the New England states are shown here:



The map shows the New England region with several Class I areas highlighted. The areas are: Roosevelt Campobello IP (located in the northern part of the region), Moosehorn (in the northeast), Acadia (in the east), Presidential Range-Dry River (in the central part), Great Gulf (in the south), and Lyle Brook (in the southwest).

concern, however, in the refuge area are ground-level ozone and fine particulate matter (PM_{2.5}). Both are respiratory irritants (text box) that can cause serious health effects in susceptible individuals; though ozone is a concern in the Umbagog area only during the warmer months (text box).

Air quality monitoring records for Coos County, NH and Oxford County, ME (EPA 2005) indicate that ozone and PM_{2.5} have recently exceeded levels considered safe for sensitive subgroups. Air quality index measures show that in 2004, O₃ exceeded safe levels on 3 days and PM_{2.5} exceeded safe levels on 2 days in Coos County. Oxford County had a single day in 2004 with unhealthy PM_{2.5} levels. Monitoring in 2005 through September indicates O₃ and PM_{2.5} levels in the moderate range just below unhealthy levels.

A related concern in the region is the effect of air pollutants on visibility. Visibility is affected by ozone and by fine particulate matter (PM_{2.5}) which manifests as regional haze in rural areas and is of particular concern in the Class I areas of designated wildernesses (text box), including the nearby Great Gulf Wilderness and Presidential Range – Dry River Wilderness, located about 50 miles south of Umbagog NWR in the White Mountains NF. (USFS 1991)

On a global scale, carbon emissions and other greenhouse gases (GHG) are recognized as contributing to global warming. Carbon sequestration, creation of complex organic matter through photosynthesis, locks up carbon organically in forest and other biomass “sinks” such as peat soils. The potential for managing carbon levels through forestry is significant. The Intergovernmental Panel on Climate Change’s (IPCC) Second Assessment Report found that during the period 1995–2050, slowing deforestation, promoting natural forest regeneration, and encouraging global reforestation could offset 220–320 billion tons of CO₂ (12–15%) of fossil emissions. Carbon sequestration may be accomplished through forest preservation to reduce deforestation; forest management techniques to enhance existing carbon sinks; creating new carbon sinks by planting on pasture, agricultural land, or degraded forest sites; and storing carbon in wood products (Dayal 2000). In the refuge area, acquiring forested lands that might otherwise be developed would allow preservation of forest cover, managing refuge forest lands for older-age stands would lock up more carbon for a longer time, and using tree plantings to restore old logging roads and camps would create additional forested land.

Ozone (O₃) (ground-level) – A colorless gas formed in chemical reactions between oxygen, volatile organic compounds (VOCs), and oxides of nitrogen (NO_x) is the major constituent of photochemical smog. Sources include vehicles, factories, landfills, industrial solvents, gas stations, lawn equipment. Irritates the respiratory tract; impairs lung functions such as ability to take a deep breath; causes throat irritation, chest pain, cough, lung inflammation, and possibly susceptibility to lung infection; aggravates existing respiratory conditions like asthma in certain individuals; may reduce yield of agricultural crops and injure forest and other vegetation. Ground-level ozone, more commonly called summertime smog, is measured in parts per billion (ppb). The federal health based standard for an 8-hour concentration is set at 80 ppb so levels above this standard are considered to be unhealthy. Ozone is a summertime pollutant so wintertime monitoring is limited and no wintertime forecast is provided. Full monitoring, reporting, and forecasting for ozone occurs from April through September.

Particulate Matter (PM) – Solid matter or liquid droplets from smoke, dust, fly ash, and condensing vapors from burning of wood, diesel and other fuels; industrial plants; agriculture (plowing, burning off fields); unpaved roads and construction. Causes nose and throat irritation, lung damage, bronchitis, and possibly premature death. Children, the elderly, and people suffering from heart or lung disease are especially at risk. Also damages paint, soils clothing and furniture, and reduces visibility. Particulate pollution (small particles) consists of both solid and liquid particles that are less than 2.5 microns in diameter (a micron is a millionth of a meter). Particle concentrations are measured in micrograms per cubic meter (ug/m³) and levels above 40 ug/m³ over 24 hours are considered to be unhealthy. Monitoring and reporting of small particles occur year-round.

(Source: NH DES 2005)

The ability of forests to serve as carbon sinks is related in turn to air quality. The forests of the New England region currently store 20 million metric tons of carbon per year, but poor air quality adversely impacts potential photosynthetic capacity, especially in sensitive species. Exposure of white pine to ozone in excess of 60-80 ppb, will result in a 15-20% reduction in annual wood production. If air quality can be improved for the region, wood production (carbon sequestration) would increase. Reducing CO₂ and NO_x emissions by improving gas mileage and reducing automobile traffic would effectively reduce ground-level ozone, and thus improve the carbon sequestration capabilities of regional forests (NERA 2002).

Conserved Lands Network

About 25 percent of the Upper Androscoggin River watershed is under some form of permanent conservation (map 1-1). This includes more than 200,000 acres owned in fee simple by federal and state agencies or conservation groups, and about 165,000 acres covered by conservation easements (Publicover and Weihrauch 2003). In addition to the refuge, the primary conservation lands in the Upper Androscoggin River watershed include the White Mountains National Forest, Appalachian Trail, Connecticut Lakes Headwaters, Pond of Safety, Connecticut Lakes Headwaters, Maine Bureau of Parks and Lands, Rangeley Lakes Heritage Trust lands, and Pingree Forest Partnership easements.

Regional and Local Economic Setting

We have taken the following information from a U.S. Geological Service, Fort Collins Science Center report (Koontz et al. 2006), which we funded as part of this CCP/EIS. Appendix G holds the entire report.

Regional and local demographics

The refuge is located in Coos County, New Hampshire, and Oxford County, Maine. Table 3.1 shows the population estimates and trends for the regional area and communities near the refuge. Although Coos is the largest New Hampshire county in total land area, it is the smallest in population, accounting for less than 3 percent of New Hampshire's total population in 2000 (U.S. Census Bureau 2000). From 1990 to 2000, New Hampshire's overall population increased by 11.4 percent, while Coos was the only county to lose population, decreasing by 4.9 percent over the same period. According to High et al. (2004), Coos County has not been able to benefit from population growth that accompanies economic development or interstate access to the same extent as counties in south and central New Hampshire.

In 2000, Oxford County accounted for approximately 4 percent of Maine's total population (U.S. Census Bureau 2000). From 1990 to 2000, the population growth rate for Oxford County was approximately 4 percent, which was similar to Maine's overall population increase (table 3.1).

The towns of Upton and Bethel in Oxford County and the towns of Errol, Berlin, Gorham, and Colebrook in Coos County are the primary communities near the refuge. Errol and Upton are closest to the refuge, and are the smallest communities in the area near it. The town of Errol is close to the western side of the refuge, and is the town nearest the refuge headquarters. In 2000, the population of Errol was 298 residents, averaging 4.9 persons per square mile. Upton is a very small community near the southern end of the refuge, with a population of 62 residents averaging 1.6 persons per square mile. Berlin is the northernmost city in New Hampshire, and is located approximately 30 miles south of the refuge near the White Mountain National Forest. The town of Gorham is located just south of Berlin. Colebrook is approximately 25 miles northeast of the refuge in northern Coos County, at the junction of the Connecticut and Mohawk rivers. Bethel is located approximately 35 miles southeast of the refuge on the Androscoggin River.

Table 3.1. Local and regional population estimates and characteristics

	Population in 2000			% Population Change	Projected % Population Change
	Residents	Persons per Square Mile	Median Age	1990 to 2000	2000 to 2010
New Hampshire	1,235,786	137.8	37.1	+11.4	+12.7
Coos County, NH	33,111	18.4	41.5	-4.9	-6.0
<i>NH Communities near refuge</i>					
Berlin	10,331	167.4	42.5	-13.0	-7.0
Colebrook	2,321	56.6	41.2	-5.3	-6.4
Errol	298	4.9	47.2	+2.1	-7.1
Gorham	2,895	90.7	42.0	-9.5	-6.7
Maine	1,274,923	41.3	38.6	+3.8	+4.6
Oxford County, ME	54,755	26.3	40.2	+4.1	+3.5
<i>ME Communities near refuge</i>					
Bethel	2,411	37.2	40.8	+3.2	+2.6
Upton	62	1.6	56.0	-13.9	+16.1

Source: U.S. Census Bureau (2005), Maine State Planning Office (projections compiled Dec. 2001 based on past trends), and New Hampshire Office of Energy and Planning (projections compiled Sept. 2004 based on past trends).

Economic Sectors, Including Timber and Tourism

According to the U.S. Department of Commerce, most jobs in Coos and Oxford counties were in the industries of manufacturing, health care and social assistance services, retail trade and government agencies. Compared to counties in southern New Hampshire and Maine, Coos and Oxford Counties have slower economic growth and a greater dependence on traditional natural resource based manufacturing activities (High et al. 2004). According to the New Hampshire Economic and Labor Market Information Bureau (2003), Coos County employment projections for 2000 to 2010 suggest most new jobs will be in service-related industries, especially in the fields of health services, amusement and recreation services, and business. Timber and tourism, the prominent natural-resource-based industries with ties to the refuge, are described in more detail below.

Timber Harvesting and Production Industries

Forests cover 95 percent (17.7 million acres) of Maine and 84 percent (4.7 million acres) of New Hampshire (NEFA 2004a, 2004b). Maine is the major timber producer of the larger North East State Foresters Association (NEFA) region (Maine, New Hampshire, Vermont, and New York), accounting for roughly half of wood produced annually (NEFA 2004a). In 2003, Maine harvested 5.9 million cords and processed almost as much (5.6 million cords) in-state (MDOC 2004). According to NEFA (2001a), imports to Maine in 2001 were dominated by pulpwood, and nearly 67 percent of its exports were high-value softwood sawlogs. In 2003, Oxford County accounted for 8 percent of the total amount of timber (sawlogs and pulpwood) harvested in Maine, ranking sixth in the state (MDOC 2004).

In contrast to the timber industry in Maine, New Hampshire is cutting much more timber than it is processing (High et al. 2004). In 2001, the amount of timber processed in New Hampshire accounted for approximately 83 percent of the

amount harvested within the state (NEFA 2001b). However, part of that difference could be due to the brief closing of the primary pulp mill near Berlin from October 2001 to June 2002. In 2002, Coos County accounted for 16.5 percent of the total timber harvested in New Hampshire, ranking second in the state to Cheshire County (USFS 2002).

In 2001, forest-based industries employed more than 21,600 people in Maine and 9,800 in New Hampshire, and generated more than \$1 billion in income in Maine and \$333 million in income in New Hampshire (NEFA 2004a, 2004b). According to NEFA, each 1,000 acres of forestland in New Hampshire supports 2.0 forest-based jobs, while 1,000 acres of forestland in Maine supports 1.2 forest-based jobs.

The New Hampshire Economic and Labor Market Information Bureau (2003) identifies the lumber and paper products industries as the mainstay of employment in Coos County. One integrated pulp and paper mill in the region is located between Berlin and Gorham. When the mills shut down between October 2001 and June 2002, they reopened under the ownership of Nexfor, Inc., of Toronto, Canada, and now employ about 500 union workers and 100 salaried workers (USFS 2005).

Pulp and paper industries accounted for the largest portion of regional forest related output (67 percent) and employment (44 percent), followed by the timber harvesting and logging industries, which account for approximately 15 percent of output and 24 percent of employment. Four thousand one hundred forty-eight jobs link directly to forest related industries, and account for 9.5 percent of the overall employment (43,570 jobs) in Coos and Oxford counties. This picture has changed in recent years.

In recent years, employment in the lumber and paper industries has declined (Maine State Planning Office 2005; New Hampshire Economic and Labor Market Information Bureau 2003). Coos County employment projections for 2000 to 2010 suggest the lumber and paper industries will continue to decline, possibly by a substantial amount, with workforce decreases of nearly 24 percent in paper industries and 39 percent in lumber industries (New Hampshire Economic and Labor Market Information Bureau 2005). Although employment and the number of mills in operation has decreased, the remaining mills maintain a production output for the region that is almost as large as it was four decades ago, due to improved machinery and greater yield from each log (NEFA 2004a, 2004b).

According to High et al. (2004), the increasing pressure from the global paper industry, increasing recycling of wastepaper, increasing efficiency in the pulping process, and the increasing loss of market share to other regions has contributed to the slower than expected growth in the regional pulpwood market. Trade agreements such as the North Atlantic Free Trade Agreement of 1994 also have affected trends in the regional timber market by creating opportunities for international trade, resulting in increases in exports from Maine and New Hampshire to Canada, while at the same time allowing new competitors into local markets (Innovative Natural Resource Solutions 2005; High et al. 2004).

Resource-based Recreation and Tourism

The travel and tourism industry continues to be a significant, growing contributor to the economies of Maine and New Hampshire. A survey of Maine visitors in 2003 estimated resident and nonresident visitors spent \$6.1 billion in Maine, which directly and indirectly (i.e., the multiplier effect as initial spending is recycled through the economy) generated: \$13.4 billion in sales of goods and services; 173,181 jobs; \$3.8 billion in income; and \$549 million in state and local tax revenue (Longwoods International 2004). Results suggest overnight visitors come to tour the state (36 percent), enjoy Maine's superb outdoors (24 percent),

take a beach vacation (12 percent), and attend a special event (10 percent). In 2003, the Maine lakes and mountains region was the primary regional destination for 15 percent, and was visited by 19 percent of those traveling in Maine (Longwoods International 2004).

In New Hampshire, resident and nonresident visitors spent \$3.7 billion in 2002 (an increase of 2.9 percent from 2000): accounting for the multiplier effect, that spending generated \$9.8 billion in sales of goods and services; 88,427 jobs; and \$419 million in state and local tax revenue (Goss 2003). A recent survey of New Hampshire visitors in 2003 and 2004 by the Institute for New Hampshire Studies reports that popular visitor activities include sightseeing, skiing or snowmobiling, shopping, and scenic drives (Thurston 2004). The White Mountain region of New Hampshire was reportedly the most visited region in all seasons, followed by the lakes region (except in winter). Although the White Mountain region includes the southern section of Coos County and extends into Oxford County, the area around the refuge is known as the Great North Woods region. Survey results reported New Hampshire's Great North Woods region was visited by 15 percent of the visitors to New Hampshire during the summer and fall, 10 percent of winter visitors, and 7 percent of spring visitors (Thurston 2004).

Located within the Northern Forest, Coos and Oxford counties provide abundant year-round recreational opportunities. For example, in Coos County, 271 recreation areas cover nearly 30 percent of the county's total acreage (New Hampshire Office of State Planning 2003). Coos County employment projections indicate the amusement and recreation services industry will contribute 260 new jobs between 2000 and 2010 (New Hampshire Economic and Labor Market Information Bureau 2003).

Popular activities on or near the refuge include hiking, camping, wildlife viewing, picnicking, snowmobiling, fishing, hunting, boating, canoeing, and cross-country skiing. The area is also a nationally recognized destination for fall foliage enthusiasts. Appendix G provides details about the economic contributions of wildlife viewing, fishing, hunting, boating, and other recreational activities in Maine and New Hampshire.

Land Values

With approximately 25 percent of the Upper Androscoggin River watershed under some form of conservation protection, some residents in northern New Hampshire have expressed their concern that those conservation ownerships are having an economic impact on land values. The protection of land from development has resulted in a high demand for private lands in the area and a subsequent increase in property taxes. About 75 percent of the shorefront properties on Umbagog Lake are protected from development through state or federal ownership, or through the dedication of development rights to land conservation groups. The limited supply of property available for development means that land in the private sector is in high demand (Personal communication: Mark Danowski 2003; Peggy Gallus 2003; Brian Lessard 2003). The limited supply of property available for development has increased that demand for land, and has led to spin-off development around Akers Pond, northwest of Errol (Personal communication: Mark Danowski 2003; Peggy Gallus 2003; Brian Lessard 2003). Although that new property development has increased local property tax collections, thus helping offset the loss in taxes from state and federal government ownership, it has also raised concerns about habitat fragmentation and the loss of traditional recreational access with future development.

The Refuge and its Resources

Refuge Administration

Establishment

The original proposal to establish the refuge represented a partnership of protective efforts, involving the participation of the states of New Hampshire

Bill Hanson FPLE Maine Hydro/USFWS



*Bald eagle chicks
in nest*

and Maine, timber companies, conservation organizations, private landowners, and the Service to cooperatively protect important lands surrounding Umbagog Lake. The larger effort was conceived to preserve existing land uses, including wildlife habitat, timber management, and traditional public uses on lands in the vicinity of the lake. The proposal was initiated in response to several events that were occurring in the region.

In the 1980s, the long standing tradition of timber companies owning the mills and the land shifted, and lands once thought to be held in perpetuity by the large timber companies started to come on the market. Nash Stream State Forest was created in 1988 when Diamond International put 90,000 acres up for sale in northern New Hampshire and Vermont, part of 1.5 million acres of forestland across northern New England and New York split off from the mills by an investor, and resold in smaller parcels for development. At the same time, despite a national economic slowdown, New England was experiencing an unprecedented building boom. Local residents and conservation groups were nervous about the possibility that James River would sell its high value shoreline property to developers and second-home buyers. Residents and environmentalists had stopped earlier threats to the lake, including plans to mine its shallow bottom, build a floating restaurant, and add a hydro dam with high-tension lines (Dobbs and Ober 1995).

In 1988, a pair of bald eagles started building a nest atop a tall white pine on the edge of Umbagog Lake in Leonard Pond. The following spring, they returned to that nest, built in the same tree that eagles had last nested in 40 years before. The desire of the James River Corporation to ensure the long term protection of the unique characteristics of the Umbagog lake area, and the establishment of a second pair of eagles in 1990, provided significant impetus for creating the refuge. Initially, many local residents strongly opposed federal ownership of the lands around Umbagog Lake. Through many meetings with small groups, the Service garnered the support of many who initially opposed the concept (Dobbs and Ober 1995).

As we mentioned in chapter 1, Congress authorized the establishment of the refuge for the purposes of conserving the unique diversity of wetlands habitats and associated wildlife and protecting water quality in the area. The Service has acquired 21,650 acres as of January 2008. An additional 7,482 acres are approved for acquisition from willing sellers.

Staffing and Budgets

The annual budget appropriation from 1997-2005, shown in table 3.2, has very little available discretionary funding. Operating budgets have increased as staffing levels have increased, and reflect annual funding for special projects, moving costs for new employees, and equipment purchases. Maintenance budgets remained relatively stable over the last 5 years.

Refuge operations and maintenance spending contribute directly to the local economy.

Table 3.2. Refuge staffing and budgets, 1998–2005

	Operations (Including Salaries)	Maintenance	Total	Full-Time¹ Staff	Seasonal Staff
1998	\$138,900	\$26,300	\$165,200	3	0
1999	\$232,500	\$0	\$232,500	3	1
2000	\$273,440	\$31,000	\$304,440	4	1
2001	\$264,620	\$33,000	\$297,620	4	1

	Operations (Including Salaries)	Maintenance	Total	Full-Time¹ Staff	Seasonal Staff
2002	\$450,890 ²	\$34,400	\$485,290	6	0
2003	\$423,162	\$390,553 ³	\$813,715	6	1
2004	\$416,620	\$169,341 ³	\$585,961	5	0
2005	\$410,926	\$163,906 ³	\$574,832	5	1
2006	\$430,630	\$259,271 ³	\$689,901	5.5	0
2007	\$395,970	\$99,600	\$495,570	4.5	0

Notes

¹ Appendix H depicts staffing positions currently filled and vacant.

² Includes two new staff positions and special funding to conduct wildlife surveys

³ Includes facility construction, building removal, and equipment replacement

Our staff has tracked refuge purchases in the local community for fiscal years 1999 through 2005, shown in table 3.3.

Table 3.3. Local purchases by Lake Umbagog refuge staff FY 1999–2005

	Errol/ Wentworth Location, NH/ Wilson's Mills, ME	Berlin/ Gorham/ Milan/ Dummer, NH	Colebrook, NH	Bethel/ Mexico/ Rumford, ME	Oquossoc/ Rangeley, ME	Annual TOTALS
1999						
# Vendors	10	18	2	5	2	37
Total expenditure	\$29,401	\$17,695	\$295	\$2,623	\$8,704	\$58,719
2000						
# Vendors	6	26	1	4	1	38
Total expenditure	\$77,320	\$7,696	\$2,000	\$4,729	\$4,209	\$95,954
2001						
# Vendors	6	26	1	4	1	38
Total expenditure	\$73,927	\$13,442	\$9,973	\$12,030	\$131	\$109,503
2002						
# Vendors	9	27	6	2	1	45
Total expenditure	\$67,361	\$16,995	\$5,257	\$347	\$294	\$90,255
2003						
# Vendors	10	27	9	7	1	54
Total expenditure	\$27,201	\$16,140	\$7,416	\$21,282	\$78	\$72,116
2004						
# Vendors	14	26	6	2	1	49
Total expenditure	\$53,270	\$12,002	\$3,638	\$468	\$85	\$69,481
2005						
# Vendors	20	21	8	4	0	53
Total expenditure	\$52,073	\$6,064	\$5,990	\$2,161	\$0	\$66,288

Refuge Revenue Sharing Payments

Land in the refuge is not on the local tax rolls. The Refuge Revenue Sharing Act (16 U.S.C. §715s) offsets the loss of local tax revenues from federal land ownership through payments to local taxing authorities. In both Maine and New Hampshire, those payments go to the townships. The annual payments are calculated on the appraised value for tax purposes, and are reduced proportionally based on the amount appropriated by Congress. For fiscal year (FY) 2005, payments represent 44 percent of the fully funded revenue sharing formula. Our sources of payment funds are revenues or income generated within the Refuge System from such programs as mineral and facility leases, timber harvest and grazing permits. As shown in table 3.4, the Service made the following refuge revenue sharing payments to local townships in recent years.

Table 3.4. Refuge revenue sharing payments to towns, 2001-2007

Township	2001	2002	2003	2004	2005	2006	2007
Magalloway, ME	\$5,543	\$5,657	\$5,285	\$5,709	\$5,049	\$5,702	\$5,278
Upton, ME	\$5,911	\$6,828	\$7,079	\$6,804	\$6,018	\$10,376	\$10,936
Cambridge, NH	\$744	\$759	\$709	\$681	\$603	\$681	\$630
Errol, NH	\$11,517	\$11,755	\$22,948	\$22,056	\$19,509	\$25,973	\$24,039
Wentworth Location, NH	\$3,112	\$4,959	\$6,057	\$6,119	\$6,467	\$7,304	\$7,041

Refuge Headquarters and other refuge buildings

The refuge headquarters is located in Wentworth Location on New Hampshire State Route 16, approximately five and a half miles north of the Town of Errol, New Hampshire. The office complex includes an office building, cabin, parking lot, and boat launch on the east side of Route 16, and a parking lot and storage shed on its west side. The office is on the bank of the Magalloway River, a major tributary to Umbagog Lake.

The office building was built in 1996 as the administrative headquarters, including staff offices, a lobby or reception area for visitors, literature and displays, a small meeting room, and public rest facilities. In addition to refuge staff, the office also hosts a Regional Refuge Field Biologist whose duties cover activities throughout the Northeast Region. The office working space is inadequate and cramped for existing staff. The visitor contact area in the front office is also very small with limited room for interpretation and information displays. A small cabin next to the office serves as overflow office space (particularly for seasonal interns), and houses a GIS lab, a biology lab, and storage. Parking for six visitor cars is next to the office building, but staff parking is across Route 16. The refuge places floating docks in the Magalloway River behind the office during ice-free months to moor refuge boats. A public docking area provides lake access for canoes, kayaks, and other boats. A picnic table and small parking area make this a popular stopping place for visitors.

Due to the configuration of the office site, which is on a parcel approximately 80 ft wide, the current office location does not comply with local and state setbacks from the river. The site also provides no room for expansion to alleviate that concern or mitigate its other shortcomings. For example, if the footprint of the building were expanded, parking adjacent to the building would be reduced, forcing most visitors to park across Route 16. That parking area is already a safety concern, as log truck traffic can be quite heavy on this road, which offers poor sight distance.

A maintenance shop that stores all of the refuge's large equipment was built in 2005 at the south end of the lake, off Mountain Pond Road. In addition to the refuge headquarters complex and maintenance building, other refuge facilities include the "Potter Farm" and three houses used as quarters for interns, volunteers, and researchers. The Potter Farm is located on the west central shore of the lake on Potter Cove, and includes a large, deteriorating farmhouse overlooking Umbagog Lake and a large barn. Both the house and barn have been determined unsafe for occupancy in their current condition. The fields associated with this property are used for events such as "Take Me Fishing." The three houses used as quarters are located north of the refuge office on Route 16 in Wentworth Location, New Hampshire, and Magalloway Plantation, Maine. We plan to remove some secondary outbuildings associated with those houses.

Research

Refuge staff, graduate students, conservation organizations, and others have conducted numerous surveys and studies on the refuge. A sampling of those efforts follows. Additional information on these studies can be obtained from refuge headquarters.

Regional amphibian monitoring: Regional study from 1999-2002 to gather baseline data on presence of breeding amphibians. Anuran call counts were conducted at four locations on the refuge: Leonard Marsh, Harper's Meadow/Sweat Meadow, Dead Cambridge River, Magalloway River.

National marshbird monitoring: Regional study from 1999-2005 to gather baseline data on breeding marsh birds. Call playback point counts were conducted at 3 locations on the refuge: Leonard Marsh, Harper's Meadow/Sweat Meadow, Dead Cambridge River.

Loon, bald eagle, and osprey breeding surveys: Annual surveys and reports prepared by various contractors for the refuge.

A study of the vegetation and floristic diversity of two peatland complexes of post-settlement origin in Lake Umbagog National Wildlife Refuge, Coos County, New Hampshire: Conducted by Maire Nazaire in 2005. Master's Thesis, University of Vermont, Burlington, Vermont (Nazaire 2005)

Macro-invertebrate assessment report: Umbagog National Wildlife Refuge. Conducted by Rick Van de Poll in 2004. Ecosystem Management Consultants, Sandwich, New Hampshire (Van de Poll 2004)

Ecological Communities of the Lake Umbagog National Wildlife Refuge: Classification and Mapping with the National Vegetation Classification System. Conducted by Josh Rapp 2003. University of Vermont, Burlington, Vermont. (Rapp 2003)

Inventory of wetland communities around Umbagog Lake. Conducted by D.D. Spurduto in 1999. New Hampshire Natural Heritage Inventory, Concord, New Hampshire. (Spurduto 1999)

Water quality surveys on the refuge between 1979-1995 by New Hampshire Department of Environmental Services, the U.S. Environmental Protection Agency, and the U.S. Fish and Wildlife Services, Ecological Services

Contaminant surveys, primarily focused on mercury in fish and fish-eating birds since the early 1990s. Conducted by the Biodiversity Research Institute, Maine and the U.S. Fish and Wildlife Service, Ecological Services (BRI 1997)

Special Use Permits

The refuge manager issues special use permits on a case-by-case basis after determining whether the use is compatible with refuge purposes. All special use permits have a one-year term. Since 2000, we have issued annual special use permits for such activities as surveying and monitoring wildlife, trimming brush; installing a fire hydrant; accessing private lands on Big Island; and, allowing hunters with disabilities to use ATVs for hunting big game.

Camps

We also issued special use permits for 25 cabins leased on the refuge. Most of the current cabin sites were acquired in an agreement when the original refuge lands were purchased from James River and Boise Cascade companies. With the purchase of lands from the Mead Paper Company in 2000, we agreed to an additional five leases. Most of the leases are located in Thurston Cove; five are in the Chapel Hill Road development; one is in Upton; and one is on Big Island.

Those privately owned cabins are on leased lands owned by the refuge and governed by special use permits. Those leases expire at the end of a 50-year period from when the refuge purchased the lands and include certain conditions, such as (1) the camps must be maintained in a manner compatible with the purposes of the refuge and produce the least amount of environmental disturbance; and, (2) no new permits will be issued for the construction of new camps on the properties. About a third of the lease owners are local residents from the Errol, Berlin, Gorham, and Milan area; a third are from other towns and cities in New Hampshire; and a third are from other states, including Maine, Georgia, and Texas. Approximately 10 leases have changed ownership at least once or twice since the refuge was established in 1992. The remaining camp lots have continued to be leased by the same individual(s) since 1992. Table 3.5 below identifies the annual revenues generated by issuing these camp lot leases. The proceeds from the camp lot leases go into the Refuge Revenue Sharing Account.

Table 3.5. Camp lot lease information and revenues generated, 1996–2007

Year	No. of leases	Range of fees charged	Total lease revenue for year
1996	24	\$50-\$1,881	\$27,461
1997	24	\$50-\$1,515	\$27,032
1998	24	\$50-\$1,515	\$27,077
1999	23	\$70-\$1,650	\$29,289
2000	26	\$1-\$1,650	\$31,603
2001	29	\$1-\$1,650	\$39,944
2002	25	\$1-\$1,650	\$32,524
2003	24	\$1-\$1,650	\$32,530
2004	26	\$1-\$1,650	\$31,160
2005	25	\$1-\$1,650	\$30,248
2006	28	\$1-\$1,650	\$33,773
2007	27	\$1-\$1,650	\$33,703

Status of Step-Down Plans and Compatibility Determinations

As we mentioned in chapter 1, Refuge System planning policy identifies at least 25 potential step-down plans. Although not all on that list are relevant for this refuge, we completed a Hunt Plan in 2000 and a Continuity of Operations Plan in 1999. See Chapter 2, “Description of the Alternatives,” for our schedule for completing additional step-down plans, including a HMP, IMP, FMP, and VS plans.

We have completed compatibility determinations for the special use permits mentioned above and for our hunting program. Appendix C includes new compatibility determinations for our current and proposed programs.

Refuge Natural Resources

Hydrology

Umbagog Lake is the centerpiece of the refuge, lying in a broad, flat basin along the Maine-New Hampshire border for a linear distance over 7 miles. The westernmost of the Rangeley Lakes chain, Umbagog Lake was only a thousand acres, until in 1851 a dam was built to power a sawmill. As the dam was enlarged and improved, it eventually flooded more than 7,000 additional acres of low-lying forest and floodplain. For more than 100 years, those saturated lands developed into peatlands, cedar swamps, floodplain forests, and lakeshore swamps (Dobbs and Ober 1995). Aerial photographs show a decrease in emergent vegetation in the Leonard Marsh and Harper’s Meadow area since the early 1970s, a time when impounded water may have been maintained at lower levels.

Three significant rivers drain into Umbagog Lake. The Magalloway River enters the lake on the northwest side, draining a 300-square-mile area of nearly undeveloped yet actively harvested forest. The Magalloway starts at the Canadian border, flows through Parmachenee Lake, Azischoos Lake, and Sturtevant Pond in Maine before entering New Hampshire and draining south into Umbagog Lake. From the west, the Swift and Dead Diamond rivers are major tributaries to the Magalloway as it enters the Umbagog Lake backwaters. The Rapid River enters Umbagog Lake from the east, draining the entire 500-square-mile Rangeley lakes region of western Maine. The much smaller Dead Cambridge River flows into Umbagog Lake from the southeast. The Androscoggin River forms the outlet, leaving Umbagog Lake near the mouth of the Magalloway River.

Magalloway River



Ian Drew/USFWS

The refuge encompasses four small ponds on the New Hampshire side of the lake: Mountain Pond (19 acres), East Whaleback and West Whaleback ponds (8 acres and 9 acres, respectively), and Brown Owl Pond (27 acres). Other small tributaries also feed into Umbagog Lake.

Errol Dam

The Androscoggin River Improvement Company originally built Errol Dam in 1852. The dam controls water flows and levels in Umbagog Lake. Union Water Power Company (UWP) owned and operated the dam from 1878 and was the owner-operator at the time the refuge was established. UWP managed the water levels in Umbagog Lake, along with those in other Rangeley lakes, to maintain flow in the Androscoggin River and provide hydropower under a license issued by FERC. Article 27 of FERC license #3133-001 for Errol Dam requires UWP, in consultation with appropriate agencies, to conduct a study to identify the reservoir surface elevation and time of year at which stable water levels are needed for the protection of nesting wildlife on Umbagog Lake, and to develop a reservoir level management plan (FERC 1983).

UWP developed a water level management plan in consultation with the Service, NHFG, MDIFW, and ASNH, represented by the LPC. One major objective of the plan was to “minimize impacts on fish and wildlife which result from the flow management of the Androscoggin River, while balancing commitments to downstream user, regulating flood flow protection, and maintaining the most expedient water level regime for enhancing fish and wildlife within the Umbagog Reservoir.” The plan also provided for continuing review and input into water level management through annual meetings of the power company with the state agencies, Service, and LPC.

UWP agreed to maintain water levels based on a level set on June 1, and to restrict change to no more than a six-inch increase or a one-foot decrease. That agreement was amended in 1998 to specify that the water level be maintained at a 1,246-foot mean sea level (msl) elevation as of June 1, and held constant until 75 percent of loon nests were established (generally by June 20). A gradual six-inch drawdown then was initiated over a two-week period. That lower level was to be held constant for an additional month, until after 75 percent of the nests had hatched, or approximately July 20. After July 20, UWP could fluctuate lake levels (Fair 1998; Paul Dunlop, UWP, telephone communication 1998). FPLE manages under the same FERC license as UWP, which require them to limit water level fluctuations during the loon nesting season of June and July, based on the annual conservation partner meetings. The reservoir water level management plan is for the benefit of wildlife species and the water users downstream of the Errol Project.

Over the past 10 years, the river levels at the Errol Dam generally were maintained at 1,245.5 feet to 1,247.5 feet msl from the end of April through early March. Levels are drawn down to 1,243 feet or lower between early March and the end of April. A less pronounced drawdown occurs from mid-September through the end of October. In approximately 1 out of every 5 years, unusually low or high water level “spikes” occur, making it difficult for UWP to manage water levels within the current agreement. Figure 3.1 displays daily Umbagog Lake headpond elevations from 1992 to 2002.

Soils

The Natural Resource Conservation Service completed an updated soil survey on the refuge in 2004 (USDA 2004). Most of the soils that cover the hillsides and upland forests in the refuge area derive from glacial till. The soils formed in alluvium, glacial outwash, lacustrine sediments, or organic materials, though less extensive in area, are significant, as they support diverse habitat types surrounding the lakeshore. Table 3.6 presents the major soil types on the refuge.

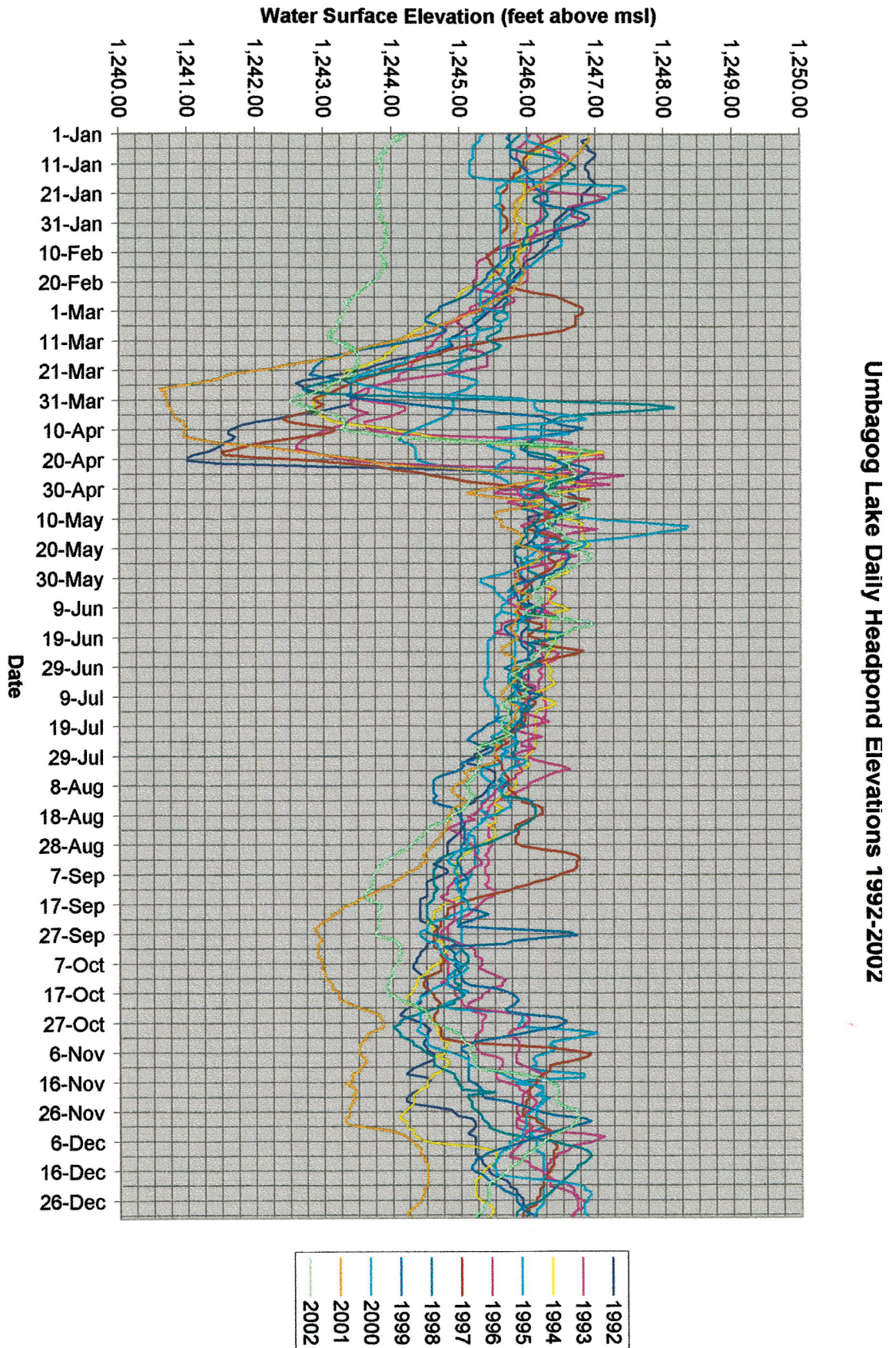


Table 3.6. Soils mapped on the Lake Umbagog refuge (USDA 2004)

Soil Code	Soil Name, Slope	Origin	Drainage
14B	Sheepscott cobbly fine sandy loam	Glacio-fluvial/outwash	Moderately well drained
27B/C	Groveton fine sandy loam	Glacio-fluvial/outwash	Well drained
28A	Madawaska very fine sandy loam	Glacio-fluvial/outwash	Moderately well drained
36B/C	Adams loamy sand	Glacio-fluvial/outwash	Excessively drained
55C	Hermon sandy loam	Glacial till	Somewhat excessively drained
57D	Becket fine sandy loam	Glacial till	Well drained
59B/C	Waumbek sandy loam	Glacial till	Moderately well drained
61C/D/E	Tunbridge-Lyman-Rock outcrop complex	Glacial till	Well drained
73D	Berkshire very fine sandy loam	Glacial till	Well drained
77C/D/E	Marlow gravelly fine sandy loam	Glacial till	Well drained
79B/C/D	Peru fine sandy loam	Glacial till	Moderately well drained
143C/D/E	Monadnock fine sandy loam	Glacial till	Well drained
169B/C/D	Sunapee fine sandy loam Sunapee	Glacial till	Moderately well drained
214B	Naumburg fine sandy loam	Glacio-fluvial	Poorly drained
247A/B	Lyme fine sandy loam	Glacial till	Poorly drained
415B	Moosilauke loam	Glacial till	Poorly drained
470B	Tunbridge-Peru complex	Glacial till	Well drained
523E	Stetson fine sandy loam	Glacio-fluvial	Well drained
549A	Peacham muck	Glacial till	Very poorly drained
559A	Skerry fine sandy loam	Glacial till	Moderately well drained
560C	Tunbridge-Plaisted-Lyman complex	Glacial till	Well drained
567B/C/D	Howland silt loam	Glacial till	Moderately well drained
579B/C/D	Dixmont very fine sandy loam	Glacial till	Moderately well drained
590A/B/C	Cabot gravelly silt loam	Glacial till	Poorly drained
613B	Croghan loamy fine sand	Glacio-fluvial	Moderately well drained
632B	Nicholville very fine sandy loam	Glacio-lacustrine	Moderately well drained
633A	Pemi silt loam	Glacio-lacustrine	Poorly drained
647B/C	Pillsbury sandy loam	Glacial till	Poorly drained
670C	Tunbridge-Berkshire-Lyman complex	Glacial till	Well drained
670D	Tunbridge-Plaisted-Lyman complex	Glacial till	Well drained
995A	Wonsqueak muck	Organic materials	Very poorly drained

A=0%–3% slope; B=3%–8% slope; C=8%–15% slope; D=15%–25% slope; E=25%–30% slope

The Mixed Forest Matrix and Habitat Types

We define the “forest matrix” as the most extensive, most connected, and most influential landscape type across the Upper Androscoggin River watershed basin. Knowing the matrix is important because it influences ecological processes that may affect biodiversity, including the amount and distribution of wildlife species. In the Upper Androscoggin River watershed, the forest matrix is not dominated by any one forest type, but is a mosaic of many types, and is often

referred to at the larger landscape scale as a mixed spruce-fir/northern hardwood forest (Kuchler 1964; Charlie Cogbill, personal communication 2004). As we further delineate the mixed forest matrix, at the refuge scale, we define three predominant forest types embedded in it: spruce-fir; conifer-hardwoods mixed woods; and, northern hardwoods. We refer to these three forest types in this document as “habitat types,” along with eight other habitat types we propose management objectives for: fen and flooded meadow, boreal fen and bog, northern white cedar, scrub-shrub wetlands, wooded floodplain, and lakeshore pine-hemlock. Each of those habitat types is found in varying amounts on the refuge and in the surrounding landscape.

Table 3.7 summarizes our classification of those habitat types for the refuge. We derived them from several sources. Our primary source was a cooperative mapping project with the University of Vermont, Spatial Analysis Laboratory, using the NVCS (Rapp 2003). We supplemented those data with aerial photo flights and interpretation generated in 2004 by the James W. Sewall Company of Old Town, Maine. The acreages in the table are approximations based on digital boundary mapping and photo-interpretation using a GIS database.

We grouped several natural communities into broader habitat types shown in table 3.7. The habitat groupings provide a coarser, more practical scale for mapping and applying management actions in the field. Wildlife, our main management focus, typically responds to habitat conditions at that broader scale. In addition, many of the natural communities we have grouped under a single habitat type occur naturally together as an ecologically system, often with one community merging into another. Thus, they often function ecologically as one habitat.

The following habitat type descriptions correspond to the list in table 3.7 and to the depictions on map 3-1. In addition, appendix M presents a cross-walk table of NVCS association, and various other vegetation classification systems and their relationship to refuge habitat types.

Table 3.7. Habitat types and acres in the approved Lake Umbagog Refuge boundary

Habitat Type	NVCS Association (UVM 2003)	Acres owned by the refuge*	Acres not owned by the refuge	Totals
Wetlands				
Fen and Flooded Meadow	Medium fen-wet phase Medium fen Cattail marsh Seasonally flooded mixed graminoid meadow Eastern tussock sedge meadow Spikerush shallow emergent marsh Few-seeded sedge-leatherleaf fen	487	79	566
Boreal Fen and Bog	Leatherleaf poor fen Medium shrub fen Sub-boreal dwarf-shrub fen Circumneutral pattern fen Spruce-fir swamp Black spruce wooded bog Black spruce-larch swamp	1,235	167	1402
Northern White Cedar	Northern white-cedar- balsam fir peatland swamp Northern white-cedar-black ash swamp Northern white-cedar-boreal conifer mesic forest Northern white-cedar peatland swamp Northern white-cedar seepage forest Northern white-cedar wooded fen	829	202	1,031

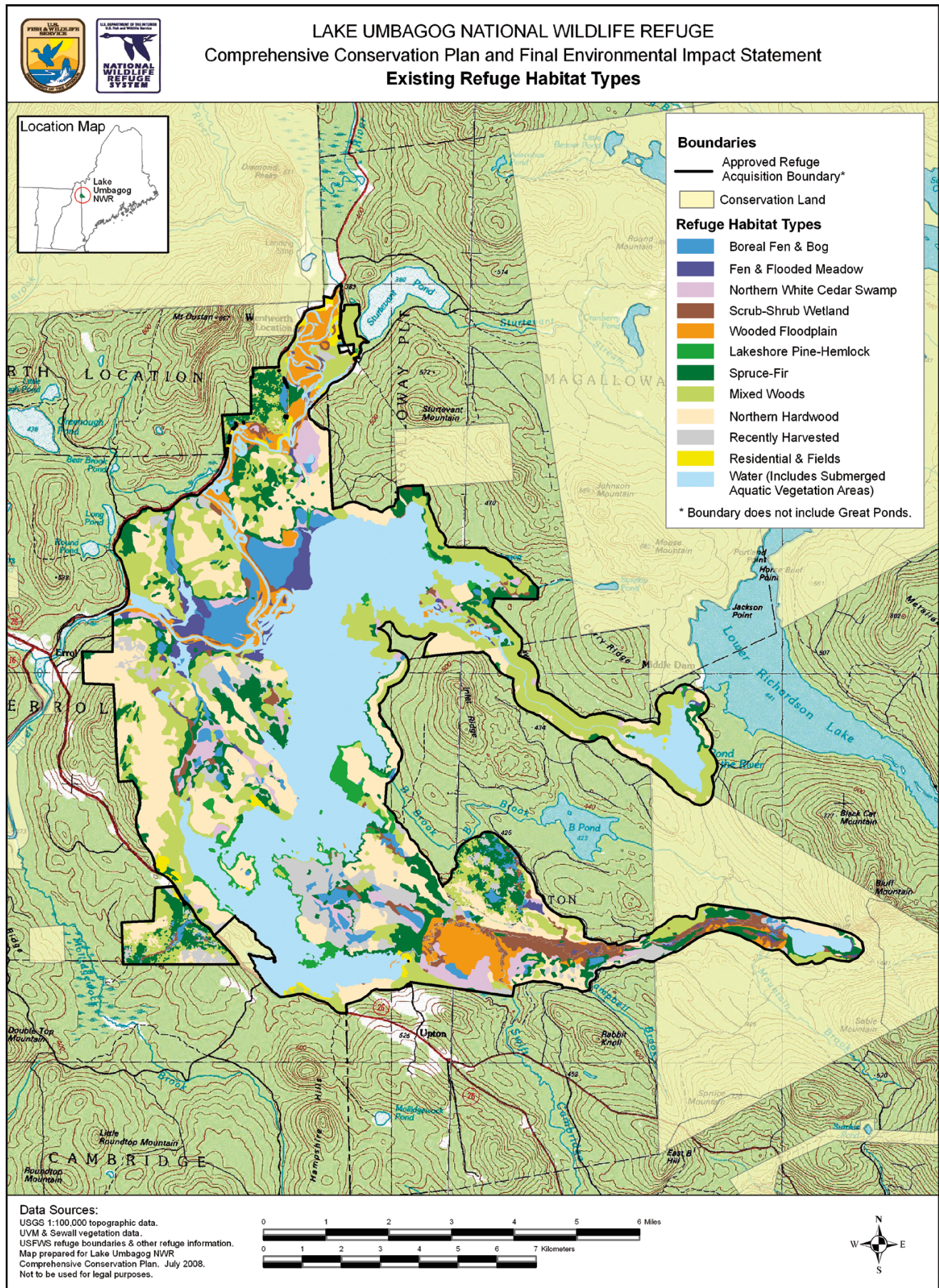
Habitat Type	NVCS Association (UVM 2003)	Acres owned by the refuge*	Acres not owned by the refuge	Totals
Wetlands (cont'd)				
Scrub-Shrub Wetlands	Speckled alder peatland lagg (Speckled, green) alder shrubland Speckled alder swamp Sweetgale mixed shrub thicket	682	258	940
Open Water and Submerged Aquatic Vegetation**	Water ***	5,033	801	5,834
Floodplain and Lakeshore				
Wooded Floodplain	Red maple floodplain forest Red maple-balsam fir floodplain forest White spruce-balsam fir berm woodland Red maple-tussock sedge floodplain woodland Black ash-mixed hardwoods swamp Red maple-black ash swamp	1,140	153	1,293
Lakeshore Pine-Hemlock	Hemlock mesic forest Hemlock-hardwoods forest Hemlock-white pine- red spruce forest Red pine-white pine forest Jack pine/blueberry/feathermoss forest	232	288	520
Uplands				
Spruce-fir	Lowland spruce-fir forest Red spruce rocky summit Black spruce - red spruce forest	2,346	956	3,302
Mixed Woods	Aspen-fir woodland Successional spruce-fir forest Red spruce- hardwoods forest	3,859	2,454	6,313
Northern Hardwoods	Early successional aspen-birch forest/woodland Red maple-yellow birch early successional woodland Northern hardwood forest Semi-rich northern hardwood forest Paper birch talus woodland	4,640	1,428	6,068
Other				
Recently Harvested	Recently disturbed	1,058	551	1,609
Fields and Residences	Residential	109	145	254
TOTAL		21,650	7,482	29,132

Table Notes

*These values primarily represent Service-owned refuge lands, fee ownership only. The only exception is a 6-acre Service easement in the Potter Farm area that is incorporated into the spruce-fir type. Data sources include a NVCS map created by University of Vermont, Spatial Analysis Laboratory in February 2003; supplemented with a timber stand map created by Sewell, Inc. in December 2003, and additional Service photo interpretation in 2005. The acres are approximations based on digital mapping in a GIS database.

**Water acreage does not include Great Ponds in either state, but does include acres under rivers and other small water bodies. Refuge ownership on Umbagog Lake includes all acquired shoreline extending to the original Great Ponds, which existed before the lake's impoundment.

***Floating-leaved and submerged aquatic vegetation communities have not been mapped, but likely include associations in the following NVCS Alliances: White Water-lily-Yellow Pond-lily species Permanently Flooded Temperate Herbaceous Alliance and Pondweed species-Coontail species-Waterweed species Permanently flooded Herbaceous Alliance.



Wetlands, Floodplains, and Open Water and Submerged Aquatic Vegetation Habitats

Approximately 10 percent of the wetlands in the entire upper Androscoggin River watershed is on the refuge, and those are the most extensive and diverse in the upper watershed (Publicover and Weihrauch 2003). The wetlands, floodplain and lakeshore forest, and open water cover 47 percent (9,555 acres) of the refuge.

Fen and Flooded Meadow

Fen and flooded meadow habitat covers <3 percent (482 acres) of refuge lands. This habitat type encompasses several plant communities defined by NVCS. Those include medium fen, cattail marsh, seasonally flooded mixed graminoid meadow, eastern tussock sedge meadow, spikerush shallow emergent marsh, and few-seeded sedge-leatherleaf fen (Rapp 2003). Fen and flooded meadow is found primarily in the backwaters of the Magalloway River, along the southern and eastern edges of Leonard Marsh, in Leonard Pond, Harper's Meadow, Sweat Meadow, and Chewonki Marsh, along the mouth of the Rapid River, and in the Mountain Pond and Dead Cambridge drainage.

These communities are found on seasonally or temporarily flooded to semi-permanently flooded areas with acidic soils. Depending on the specific community type, sedges, grasses, cattail, and sphagnum are the dominant herbaceous plants. Leatherleaf, sweet gale, and spireas are common shrubs in those communities. Although soil substrate and soil pH vary among these communities, all are located in stream floodplains, beaver meadows or along lake or pond shorelines. Snags are still visible in some areas of the fen and flooded meadow, an area of low-lying forest before the Errol Dam was built and raised the water levels (Little 1974).

Fen and flooded meadow is nesting and brood rearing habitat for American black duck, ring-necked duck, and mallard. Several marsh birds, including pied-billed grebe, sora, Virginia rail, American bittern, and Wilson's snipe, nest in these wetlands. Cavity-nesting wood duck, common goldeneye, common and hooded merganser also forage here with their broods. During fall migration, waterfowl—the nesters as well as migrant scaup, scoters, and snow geese—use the wetlands as secure foraging sites. When water levels are low during spring and fall migration, several shorebird species (e.g., greater yellowlegs, solitary sandpiper, killdeer) stop over at the refuge. Northern leopard frog and mink frog also occur in these wetland habitats.

Rare Plants in the Fen and Flooded Meadow

Meagre sedge is state-listed as threatened (S1) in New Hampshire. That rare plant was detected in the seasonally flooded graminoid meadow and in the circumneutral-patterned fen described below.

Boreal Fen and Bog

Boreal fens and bogs cover 6 percent (1,184 acres) of the refuge, and include the NVCS communities leatherleaf poor fen, medium shrub fen, sub-boreal dwarf-shrub fen, circumneutral-patterned fen, spruce-fir swamp, black spruce wooded

Peatlands

Peatlands are a wetland type whose soils are “peat”—partially decayed remains of dead plants. Peatlands are described by topography: flat or level, on slopes, or raised. They also are classified by their water and nutrient characteristics.

Minerotrophic peatlands receive water primarily from underground or surface sources; the water picks up nutrients as it passes through soil and bedrock. *Ombrotrophic* peatlands receive their water from precipitation. *Oligotrophic* peatlands are between the other two in nutrient richness.

A *fen* is a strongly enriched (primarily minerotrophic) peatland, while a *bog* is a rain-fed (largely ombrotrophic) peatland. The northeast supports a range of peatland types, with many different types often occurring together in large peatland complexes (Johnson, 1985).

bog, and black spruce-larch swamp. Distinctions among those community types are based upon water levels and pH as well as the extent of shrub layer present, and typically are classified as peatlands (see sidebar).

In addition to the rare and unique plant communities described below, these peatland complexes support many northern breeding species, including rusty blackbird, palm warbler, and mink frog. The peatlands also support diverse amphibians, including spring peeper, gray treefrog, bullfrog, American toad, and northern leopard, green, pickerel frog and wood frog.

On the western side of Umbagog Lake is an 870-acre peatland complex encompassing four areas: Leonard Marsh, Sweat Meadow, Harper's Meadow, and Chewonki Marsh. A 750-acre portion of the complex, known as "Floating Island Bog," was designated as a National Natural Landmark in 1972 (Nazaire 2005). Leonard Marsh and Harper's Meadow form an extensive acidic fen complex with a pH of 4.0–4.7. Fens differ from marshes and streamside meadows by the absence of mineral soils at the surface and the presence of peat deposits and extensive layer of Sphagnum moss. These areas and associated wetlands form one of the largest peatland complexes in New Hampshire. This acidic fen complex harbors a high diversity of vascular plants, mosses, and liverworts. For example, the NHNH found 16 species of Sphagnum moss at Sweat Meadow (Sperduto 1999).

The Leonard Marsh-Harper's Meadow peatland complex consists of a unique suite of open and wooded types identified by Sperduto (1999):

- extensive, open floating moss lawns dominated by aquatic Sphagnum sp. (e.g., Torrey's sphagnum and Golden Bog-moss)
- moss carpet fens dominated by non-aquatic Sphagnum species (e.g., peat moss) and dwarf and medium-height heath shrubs
- moss carpet fens dominated by sedges (such as few-seeded sedge, quagmire sedge, and other unique "bog plants" such as pod-grass)
- various mixes of black spruce-larch woodlands and sparse woodland fens dominated by heath shrubs and Sphagnum mosses.

Nazaire (2005) conducted a floristic inventory and vegetation analysis of the 452-acre Leonard Marsh from 2002 to 2004, documenting 14 community types and several rare plants, including narrow-leaved cotton-grass, heart-leaved twayblade, and creeping sedge. Peat depths in Leonard Marsh ranged from 26 to 92 inches (Nazaire 2005).

Floating Island National Natural Landmark

In 1972, the Secretary of the Interior designated part of the wetlands at Harper's Meadow as an NNL. That designation recognizes the floating bog and wetlands as a significant natural area, one of a very special group of places illustrating the diversity of the country's natural history (Favour 1971). The National Park Service administers the NNL program, which is a voluntary program for landowners (USDOI 1999). The current size of the NNL is 860 acres (map 2-1).

A rare fen of high regional significance, the circumneutral-patterned fen is found near the center of Tidswell Point. Most of that fen is on land owned by the State of New Hampshire as part of the Umbagog State Park, and a portion is on the refuge. The pH in the fen ranges from 6.3 to 8.4. Only a few locations in New England of this natural community type are known. Patterned fens consist of long, linear, raised hummocks and intervening low hollows. Circumneutral fens, typically part of larger peatlands, are calcium-enriched from groundwater,

supporting a characteristic set of plant species that are often rare. A large, high-quality northern white cedar swamp surrounds the fen (Sperduto 1999).

The patterned fen hummocks are dominated by stunted and heavily browsed northern white cedar. The hollows support several rare plants, including meager sedge, livid sedge, thin-flowered sedge, and moor rush. Other rare and uncommon plants growing in the fen include the state-listed endangered dragon's mouth and the state-listed threatened Pursh's goldenrod, cotton bulrush, orchids rose pogonia, and grass pink (Sperduto 1999).

The southern side of the more eastern Whaleback Pond supports an open floating bog mat dominated by *Sphagnum rubellum*, scattered dwarf heath shrubs, pitcher plants, and several other mosses (Sperduto 1999).

Black spruce wooded bog composes part of the large peatland complexes. Tree canopy cover of black spruce, larch, and hemlock varies from 10 percent to 60 percent. Shrub cover, dominated by Labrador tea and rhodora, reaches 80 percent. Sphagnum covers nearly the entire wooded bog. In addition to being part of the Floating Island, black spruce wooded bog occurs around Mountain Pond and Tidswell Point. Black spruce-larch swamp has many of the same species as the wooded bog, although it is not typically part of the large peatland complexes (Rapp 2003).

Northern White Cedar

Northern white cedar forest covers 4 percent (829 acres) of the refuge. The natural communities in this grouping all have northern white cedar (nwc) as a dominant plant. The communities include nwc-balsam fir peatland swamp, nwc-black ash swamp, nwc-boreal conifer mesic forest, nwc-peatland swamp, nwc-seepage forest, and nwc-wooded fen. These soils are typically moist to saturated peat or muck, and are highly to moderately acidic. Examples of northern white cedar communities on the refuge are in areas north of Whaleback Ponds, downstream of Mountain Pond, and above the outlet of the Dead Cambridge River into the lake.

Northern white cedar is a boreal species that occurs as far south as Carroll and Grafton counties in New Hampshire. The NHNHB considers northern white cedar swamps a "signature-community" of the north woods, and hence, an important component of the region's biodiversity (Sperduto and Engstrom 1998). The largest northern white cedar swamp in New Hampshire (80 to 100 acres) surrounds the Whaleback Ponds and extends toward the Magalloway River. This wetland basin lies within the refuge acquisition boundary, but only a portion is now under Service ownership. The acidic cedar swamp is large, uniform, and largely undisturbed, with an abundance of Sphagnum moss, shrubby understory and slightly stunted canopy cedars, and is 120 to 200 years old (Sperduto 1999).

The NHNHB identified a 20-acre mixed hardwood-conifer seepage swamp in a shallow bedrock basin that empties into Umbagog Lake near Thurston Cove. The seepage swamp contains a large amount of northern white cedar around the margins of a boreal dwarf shrub fen. The swamp shows evidence of past logging, but is currently more than 200 years old (Sperduto 1999).

Several northern bird species use this habitat type year-round, including boreal chickadee, gray jay, and spruce grouse. White-tailed deer find cover and forage in the northern white cedar. A dusky salamander was recorded from a cedar swamp near Harper's Meadow during a 1999–2002 amphibian and small mammal survey in cedar swamps and riparian habitats. American toads were abundant in that survey, and other amphibians were detected in the cedar swamp, including wood and green frogs, spotted and blue-spotted salamanders, spring peepers, and eastern newts. A diversity of small mammal species were identified in the

cedar swamp habitat, including masked, northern water and short-tailed shrews, southern red-backed voles, and several bog lemmings (species unknown).

Scrub-Shrub Wetlands

Scrub-shrub wetlands cover 3.2 percent (655 acres) of the refuge. Scrub-shrub is found in areas that are seasonally flooded, such as riparian areas, floodplains, or around the edges of beaver-flooded wetlands in patches that average 7.5 acres. The natural community types are speckled alder peatland lagg, (speckled, green) alder shrubland, speckled alder swamp, and sweetgale mixed shrub thicket. Shrub cover dominates those areas, with speckled alder, sweetgale, and leatherleaf as the most common species. Trees generally are absent or very sparsely distributed; if present, they typically include balsam fir and red maple. Sphagnum, ferns, dwarf black berry, sedges, and grasses dominate the understory. Soils vary from strongly to moderately acidic.

The largest example of alder shrub land is in the floodplain of the Dead Cambridge River above its confluence with the Swift Cambridge River. Smaller examples are in cut-off oxbows located along the Magalloway, Rapid, and Androscoggin rivers (Rapp 2003).

Beaver, American woodcock, and Canada warbler are wildlife species associated with scrub-shrub habitat.

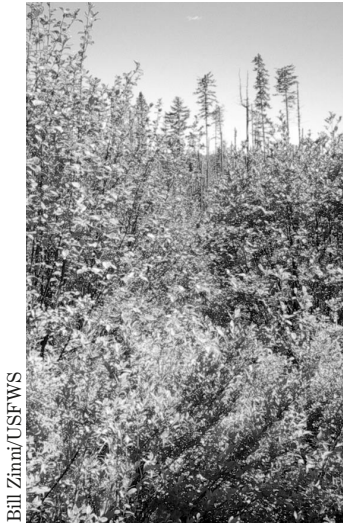
Open Water and Submerged Aquatic Vegetation

Open water, floating-leaved, and submerged aquatic vegetation habitat includes the aquatic bed (submerged lands extending from the current shoreline to the pre-dammed lake shoreline; or, the lake shoreline prior to impoundment) In addition, open water habitat includes the riverbeds and small ponds. Open water or submerged lands of the original Great Ponds in both Maine and New Hampshire are not included and are owned by the respective states. Open water and submerged and floating-leaved aquatic vegetation on the refuge encompasses 24.5 percent (5,033 acres) of current refuge ownership.

Umbagog Lake is the second largest lake in New Hampshire. Its average depth is 15 feet. It includes extensive shallow areas with unconsolidated bottom, a reflection of the historical conditions that created much of the lake: that is, the flooding of low-lying forest. Two deeper pools of more than 50 feet lie near the mouth of the Rapid River and off the northern cliffs of Sturtevant Cove (Van de Poll 2004).

Umbagog Lake is largely homothermous—the same temperature from top to bottom—creating warm summer temperatures (Boucher 2005). However, Umbagog Lake is important wintering habitat for native brook trout from the Diamond River watershed (Diane Timmons, NHFG, personal communication, 2004) and from the Rapid River. Smallmouth bass were introduced illegally into Umbagog Lake during the mid-1980s, and have since migrated to other connecting waters, including the Rapid River. Smallmouth bass, introduced into New Hampshire in 1865, are predators and competitors of brook trout (Boucher 2005).

We have very little information on the refuge open water habitat that is composed of the river tributaries and ponds. We have not conducted any bathymetry or water chemistry studies, nor have we conducted any fish or aquatic invertebrate studies. Our only wildlife study in this habitat was a stream salamander survey in a few locations in 2001 and 2002. Two-lined salamanders were abundant at those sites. A spring salamander was recorded in Bull Moose Stream at the southern end of the lake. A dusky salamander was reported in a stream flowing into Mountain Pond.



Bill Zimmi/USFWS

Scrub-shrub habitat on refuge

Wooded Floodplain

Wooded floodplain covers 5.5 percent (1,140 acres) of the refuge. Found primarily along the Magalloway, Dead, and Swift Cambridge rivers, its natural communities include red maple floodplain forest, red maple-balsam fir floodplain forest, white spruce-balsam fir berm woodland, red maple-tussock sedge floodplain woodland, black ash-mixed hardwoods, and red maple-black ash swamp. Red maple, silver maple, and balsam fir dominate the closed to intermittent canopy along with yellow birch and white spruce. Red maple floodplain forest approaches its northern limit on the Magalloway River.

The entire Magalloway River shoreline offers the best example of the wooded floodplain forest community on the lake. The NHNHB lists it as a good example of a “balsam fir floodplain forest” community type.

The wooded floodplain supports a rich diversity of wildlife, including cavity-nesting ducks (e.g., wood duck, common goldeneye, common and hooded merganser), nesting songbirds (e.g., rusty blackbird, northern parula), and foraging waterfowl (e.g., black duck). Large floodplain trees offer perching sites for bald eagle, osprey, belted kingfisher, and other birds. It also supports a rich diversity of amphibians, including mink, wood, green and pickerel frog, spotted and blue-spotted salamander, American toad, spring pepper, eastern newt, and bullfrog.

Woodplain floodplains also host several bat species, including little brown, hoary, and northern long-eared bats. Those bats roost in tree cavities, under loose bark or dense foliage (DeGraaf and Yamasaki 2001). Other small mammals detected in this habitat were masked, short-tailed and smokey shrews, southern red-backed vole, meadow jumping mouse, eastern chipmunk, and a bog lemming (species unknown).

Lakeshore Pine-Hemlock Forest

Lakeshore pine-hemlock forest covers 1.1 percent (232 acres) of the refuge. Natural communities in this habitat type include hemlock mesic forest, hemlock-hardwoods forest, hemlock-white pine-red spruce forest, red pine-white pine forest, and jack pine-blueberry-feathermoss forest. The canopy layer in each of those plant associations is dominated by varying mixtures of conifers (white pine, hemlock, red pine, red spruce, jack pine); all occur on well-drained to excessively well-drained soils, typically near lakeshores.

Some of the best examples of the lakeshore pine-hemlock natural communities occur along the lake near Tyler Point, Big Island, and Tidswell Point, as pines dominate the eastern shore of Umbagog Lake. The jack pine-blueberry-

A little brown bat



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feathermoss community occurs in small groups or as individuals along the lakeshore.

Jack pine is rare in New Hampshire, where it grows at the southern limit of its range (NH S1 rank). This community is the only low-elevation occurrence of this type in New Hampshire.

A northern occurrence of hemlock mesic (moderately moist) forest is found along the lake on Tyler Point.

Many of the large, mature, “super-canopy” trees are in the lakeshore pine-hemlock habitat. Their size and proximity to open water makes them ideal nest trees for bald eagle and osprey. Sharp-shinned hawk, merlin, and olive-sided flycatcher are a few of the other species that nest in this habitat.

Upland Habitats

Forests are the dominant landscape type in northern New England, and 90 percent of the Upper Androscoggin River watershed that encompasses Umbagog Lake is a mixed forest matrix as described above. However, it is important to note that the mixed forest matrix of today supports more hardwoods than over the last 150 years (Cogbill, personal communication, 2004). That reflects a forest composition affected by multiple cycles of timber harvesting. Selective harvesting of softwoods has converted many spruce-fir stands to mixed stands, and mixed stands to hardwood stands. In the absence of further human disturbance, these forests, through natural succession and disturbance patterns, will shift to a higher proportion of softwood (Publicover and Weihrauch 2003). That prediction is also consistent with the site capabilities of the refuge expressed through the ecological land units (a combination of elevation, bedrock geology, and topography).

As we mentioned previously, three broad upland habitat types embedded in the mixed forest matrix are found in varying amounts: spruce-fir, northern hardwoods, and mixed wood. These three habitat types encompass 48 percent (9,913 acres) of the refuge.

Spruce-Fir

The spruce-fir habitat type covers 9.5 percent (1,947 acres) of the refuge. Natural communities in this habitat type include lowland spruce-fir forest, red spruce rocky summit, and black spruce-red spruce forest.

This spruce-fir habitat type is dominated by red spruce, balsam fir, and paper birch. Other typical plant associates include lowbush blueberry, mountain ash, American fly-honeysuckle, bunchberry, wood sorrel, wild sarsaparilla, and bluebead lily, among others. Logging heavily affected the lowland spruce-fir community type, and large areas now mapped as successional spruce-fir forest or recently disturbed will likely shift to spruce-fir over time. The largest remaining stands grow on gentle slopes and flats in the Mountain Pond, Sunday Cove, Whaleback Ponds, Mile Long West, and Dead Cambridge areas (Rapp 2003).

Red spruce and balsam fir are both late successional, shade tolerant, and shallow rooted. Balsam fir is an abundant seed producer, is highly susceptible to heart-rot, and is at risk from wind damage and uprooting. Fir is the preferred host of spruce budworm, and is affected by balsam wooly adelgid. Spruce budworm outbreaks occur on 40- to 70-year cycles, although outbreaks may have been less frequent historically when balsam fir was less abundant. The life span of fir ranges between 40 and 70 years, depending on site conditions. Red spruce seeds infrequently, and is highly resistant to decay, resulting in a long life span (300+ years) (Seymour 1992).

The black spruce-red spruce community type is difficult to distinguish from the lowland spruce-fir. It occurs along wetland borders, and is dominated by red and black spruces. The canopy is typically quite dense, with little understory; mosses dominate the forest floor. The “fairy forest” near Sunday Cove is a good example of this type. Disturbed versions of this community type, such as the moose wallow 1.5 miles northeast of the refuge headquarters, typically have little spruce, and are instead dominated by balsam fir or larch (Rapp 2003).

The red spruce rocky summit community type is uncommon and restricted to ridge tops and steep, rocky slopes such as in the Errol Hill, Mile Long, and Whaleback Pond areas. Soils are usually acidic, and outcrops are evident. Red spruce is the dominant species, with lesser amounts of balsam fir and paper birch (Rapp 2003).

Lowland spruce-fir is important for a range of wildlife species that depend on it for nesting habitat and winter cover. Softwood-associated bird species include bay-breasted, Cape May and blackburnian warblers. Many other songbirds occur in this habitat including 13 other warblers: magnolia, northern parula, black-and-white, Canada, black-throated blue, American redstart, common yellowthroat, Nashville, black-throated-green, yellow-rumped, chestnut-sided, yellow, and northern waterthrush. Other bird species of note that appear here include hermit and Swainson’s thrushes, veery, winter wren, yellow-bellied flycatcher, yellow-bellied sapsucker, and swamp sparrow.

The spruce-fir habitat type supports some of the most important deer wintering areas. Bobcats use the conifer-dominated ridge tops, and martens are common inhabitants of spruce-fir.

Mixed Woods

The mixed conifer-hardwood habitat type covers 17 percent (3,478 acres) of the refuge, and includes red spruce-hardwood forest, successional spruce-fir forest, and aspen-fir woodland natural community types. The communities are distinguished primarily by the dominant canopy species that in turn are influenced in large part by specific site conditions and disturbance history.

This habitat type is the most widely distributed habitat type on the refuge, occurring on all but the highest elevations. It is especially prevalent in the Errol Hill, Mile Long, Whaleback Ponds, and Sunday Cove areas. In addition to red spruce, the dominant plant species include yellow birch, red maple, striped maple, and woodfern. Sugar maple and American beech are often present in this mixed woods habitat type. The successional spruce-fir forest type usually develops after disturbance to lowland spruce-fir. It usually has fewer northern hardwood species present with red spruce and balsam fir dominant in the understory. This community will typically succeed to lowland spruce-fir. Aspen-woodland is dominated by quaking aspen and balsam fir. It is most common around Mountain Pond but found in small patches throughout the refuge on lower slopes with well-drained loam soils (Rapp 2003).

This habitat type supports species that depend on a combination of hardwood and softwood tree species such as blackburnian and black-throated green warbler, or utilize a successional stage of this habitat such as Canada warbler and American woodcock. Mixed woods support many of the species mentioned under spruce-fir but in higher numbers.

Northern Hardwood

The northern hardwood habitat type covers 21.9 percent (4,488 acres) of the refuge. The natural community types include northern hardwood forest, semi-rich northern hardwood forest, early successional aspen-birch forest/woodland,

red maple-yellow birch early successional woodland, and paper birch talus woodland. These hardwood forests are dominated by sugar maple and yellow birch, with other common species including American beech, red spruce, striped maple, hobblebush, and woodfern.

Northern hardwoods occur on well-drained loam soils at mid elevations. The forests typically have a closed canopy with variable shrub and herbaceous layers depending on local conditions and disturbance history. Most of the northern hardwoods were logged once or more in the past. It is found throughout the refuge, with good examples on the eastern slopes of Errol Hill and Mill Mountain, on Tyler Point, south of the Whaleback Ponds, and at the base of C Bluff cliff. A small patch of the semi-rich northern hardwood forest occurs in the vicinity of C Bluff; small pockets of enriched soils occur within northern hardwoods elsewhere on the refuge (Rapp 2003).

The aspen-birch woodland types become established after logging or some other disturbance. The early successional aspen-birch woodland is dominated by quaking aspen or paper birch with high shrub density including beaked hazelnut and several viburnum species. Occurrences on the refuge include the Dead Cambridge, Tidswell Point, Mountain and Mile Long ponds, areas where logging has occurred in the last 50 years. A similar early successional type is one dominated more by red maple and yellow birch. This occurs in the Whaleback Ponds, Mile Long and Mountain ponds, on Big Island, and near the eastern lakeshore (Rapp 2003).

The paper birch talus woodland is a single occurrence at the base of C Bluff. Paper birch is growing on a stabilized granite boulder talus with slopes between 30 percent and 45 percent. Soils are thin and patchy. Shrub cover is high and dominated by mountain maple. These talus slopes provide denning habitat for mammals including porcupine and bobcat. A peregrine falcon was heard from in the C Bluff area, one of the largest cliffs in the area (Rapp 2003).

The northern hardwood habitat type is important to landbird species of concern such as black-throated-blue warbler, American woodcock, and Canada warbler. Black-throated blue warbler nest in hobblebush and other understory vegetation, while American woodcock and Canada warbler utilize the early successional stages of these same forest types. This type also supports high numbers of many common nesting songbirds, including red-eyed vireo, ovenbird, hermit thrush, winter wren, scarlet tanager, and yellow-bellied sapsucker.

Recently Harvested

Recently harvested, or early successional (disturbed) forest, covers 4.6 percent (938 acres) of the refuge. This community is more ephemeral than most others, because it has experienced recent disturbance, usually in the form of logging. One particularly notable example of this type covers much of the upland areas of Tidswell Point. We are not actively managing any of the upland cover types now. These early successional stages, as noted above, are important to a suite of species such as woodcock, chestnut-sided warbler, morning warbler, white-throated sparrow, and snowshoe hare. The latter is an important food source for lynx, bobcat, and other mammals.

Fields and Residences

Fields and residences cover 0.5 percent (107 acres) of refuge lands. These areas are actively maintained for human residential or commercial purposes, including buildings, lawns, and other development. The Potter Farm and the Chapel Hill Road community are two examples. These areas are maintained for administrative purposes and provide little or no wildlife habitat value.

Marvin Moriarty/USFWS



The former Potter Farm is now part of the refuge

Rare or Unique Habitat Types and Rare Plant Populations

Several rare or unique habitat types and rare plant populations are not displayed in this document because their small size does not show up in relationship to the map scale used for the other habitat types, or because the refuge has not identified all their specific locations. These areas include vernal pools (see discussion below) and other small, uncommon wetlands, cliffs, and talus slopes (see northern hardwoods discussion). In addition, appendix B lists more than 30 species of rare plant populations known on the refuge and their state status. Digital information on those rare habitat types and plant species we have mapped can be obtained at refuge headquarters.

Vernal Pools

A vernal pool is a small water body lacking a permanent aboveground outlet. In the northeast, vernal pools fill with winter snowmelt, spring rains, and autumn rains. They typically dry by mid to late summer or earlier in drought years. How long water stays in a vernal pool is known as its hydroperiod, which varies depending on the pool and the year. A vernal pool, because of its periodic drying, does not support breeding populations of fish. Vernal pools on the refuge provide essential habitat for several obligate amphibian species, including blue-spotted and spotted salamanders and wood frog, contributing to refuge biodiversity. Maintaining vernal pools with a range of hydroperiods is important in sustaining vernal pool biodiversity. Most of the vernal pools on the refuge are embedded within the floodplain and riparian habitats.

Invasive Plants

We have not carried out any systematic surveys for terrestrial or aquatic invasive plants. However, our staff and interns are continually on the lookout for these plants. We have mechanically treated or hand-pulled Phragmites, purple loosestrife, and Japanese knotweed from localized areas, often where fill has been brought in. Examples of areas we have treated include the refuge headquarters parking lot, the Magalloway River Trail, and skid roads.

We are not aware of any aquatic invasive plants, but continue to be vigilant for the presence of non-native milfoil.

Fish and Wildlife

The refuge's diverse assemblage of upland and wetland vegetation—the lake, the Androscoggin and Magalloway rivers, and many other ponds and streams—hosts a wide variety of terrestrial and aquatic animal species described below.

Federal- and State-Listed Wildlife Species

There are no federally listed species on the refuge, since the bald eagle was de-listed in 2007. Bald eagles nested near Umbagog Lake during the first half of the 20th century, but there was no successful nesting in the area from 1950 through 1988. One breeding pair established a nesting territory on the northern half of the lake in 1989. In 2000, biologists confirmed that a second breeding pair had established a territory on the southern half of the lake (Martin 2001). The refuge and surrounding area also support non-breeding immature bald eagles year-round. This includes some individuals migrating from as far away as Florida; those were tracked using satellite technology. For more on bald eagles, see below.

Thirteen bird species known to use the refuge are on the Maine or New Hampshire state lists of endangered and threatened wildlife (table 3.8). One species of New Hampshire threatened mammal has been confirmed to occur on the refuge.

Table 3.8. Maine and New Hampshire State-listed species that occur or likely occur on the refuge

BIRDS	STATE STATUS
American pipit	Endangered in ME (proposed breeding population only)
American Three-toed woodpecker	Threatened in NH
Bald eagle	Endangered in NH (proposed Threatened), Threatened in ME
Black tern	Endangered in ME
Common nighthawk	Threatened in NH
Common loon	Threatened in NH
Common nighthawk	Threatened in NH (proposed endangered)
Common tern	Endangered in NH (proposed Threatened)
Cooper’s hawk	Threatened in NH (proposed de-listed)
Golden eagle	Endangered in both NH and ME
Northern harrier	Endangered in NH
Osprey	Threatened in NH
Peregrine falcon	Endangered in NH (proposed Threatened), Endangered in ME
Pied billed grebe	Endangered in NH (proposed Threatened)
MAMMALS	
American marten	Threatened in NH
Northern bog lemming	Threatened in ME
Small-footed myotis	Endangered in NH

Birds

Written documentation on bird populations in the Umbagog Lake area extends back more than 130 years. Noted 19th-century ornithologist William Brewster spent extensive periods studying the birds of the area from 1871 through 1909 (Brewster 1924). Observations from the past 55 years by an increasing number of professional and amateur ornithologists contribute to a general understanding of local bird populations: for example, a series of periodicals published under various names by the ASNH from 1921 to 1982, the National Audubon Society’s Christmas Bird Count data for Errol, New Hampshire from 1958 to 2003, and the New Hampshire Bird Records database from 1982 to 2003. Our refuge bird list includes 229 species that have been observed on the refuge during one or more seasons.

In 1980, the NHTG and the ASNH initiated a statewide cooperative endangered and threatened species bird monitoring and management program (Robinson 1999). The Umbagog Lake area was included in the monitoring particularly for common loon, pied-billed grebe, bald eagle, osprey, peregrine falcon, and northern harrier.

Waterfowl

The refuge is unique in the region for the diversity of waterfowl that breed here. Umbagog Lake marshes and backwaters, forested and shrub wetlands, and adjacent forested and cutover uplands provide important nesting and brood-rearing habitat for such waterfowl as black duck, ring-necked duck, and cavity-nesters including common goldeneye, wood duck, common merganser, and hooded

merganser. The refuge supports the highest concentrations of nesting black and ring-necked ducks in New Hampshire (USFWS 1991). Blue-winged teal, green-winged teal, and mallard also nest in the area. It is one of three high priority waterfowl focus areas in New Hampshire (Atlantic Coast Joint Venture 2005). Ducks are most commonly observed in backwaters along the Magalloway and Androscoggin rivers, Leonard Pond, Leonard Marsh, Harper's Meadow, Sweat Meadow, Chewonki Marsh, the outlet of Umbagog Lake and, to a lesser extent, in Tyler Cove and near the outlet of the Dead Cambridge River.

Umbagog Lake is also an important migratory staging area for the waterfowl mentioned above, as well as for greater and lesser scaup, bufflehead, white-winged, surf and black scoters, and Canada and snow geese. The NHFG surveys waterfowl on the refuge annually, just before the duck-hunting season opens. We also conducted a few limited fall waterfowl surveys from 2000 to 2002.

In 1940, the most common nesting waterfowl on Umbagog Lake (in order of abundance) were goldeneye, black duck, common merganser, wood duck, hooded merganser, and blue-winged teal (Provost 1940). That survey reports goldeneye and common merganser as common ducks on the Androscoggin River above the Errol dam, and goldeneye, black duck and wood duck as the most common species in Harper's Meadow. According to Provost (1940), waterfowl were more abundant during the 1920s, when local hunting clubs planted wild rice around the lake. In 1940, emergent vegetation around the lake (presumably Leonard and Chewonki Marshes) produced an average of one duck per 1.5–2 acres (Provost 1940).

Although we have no quantitative data on nesting waterfowl, our observations indicate that the most common species in recent years are black ducks, common and hooded mergansers, and ring-necked ducks. This information is also based partly on waterfowl species observed during a general refuge breeding bird survey by Bob Quinn in 1999 and 2000.

Common Loon

Umbagog Lake supports one of the highest concentrations of breeding common loons in New Hampshire. However, it falls below other lakes in terms of hatching success, chick survivorship, and overall productivity (Taylor et al. 2004). In recent years, the number of territorial pairs on the lake is around 17. Loons arrive on territories as early as mid-May, particularly on the rivers. The nesting season of common loons on Umbagog Lake starts around May 20. In most years, the majority of nests are established between June 1 and June 20. Hatching generally occurs between July 1 and July 20.

The most productive loon territories, located primarily on the north end of the lake, are the Magalloway River, Harper's Meadow, Sweat Meadow, Pine Point and Sunday Cove. Moderately productive sites include Sturtevant Cove, Leonard Marsh, Leonard Pond, and Southeast Arm, at the southeast end of the lake. The least productive sites include Sargent Cove, B Brook, and Thibodeau, south of Sunday Cove.

In 1985, a water management agreement among the owners of the Errol dam and conservation agencies and organizations reduced the rate of water level change during the loon-nesting season (see hydrology discussion, page 3-20). In addition to managing water levels, buoy lines and educational signs are employed to minimize disturbance and promote increased hatching success. Artificial nesting rafts were deployed in the 1970s to increase productivity; however, those have since been removed, with the shift toward natural nesting structures.

The LPC has intensively monitored the loon population since 1976. Productivity was low at that time due to frequent flooding during the nesting season. The number of loon nesting territories increased from 9 in 1976 to 32 in 2000 around

the Umbagog Lake and on the Magalloway and Androscoggin rivers. The number dropped to 16 territorial pairs in 2002. Comparable declines were not observed on nearby lakes during the same period. Since then, the numbers have fluctuated around 18 to 20 territorial pairs: in 2003, 19; in 2004, 20; and in 2005, 20. The cause(s) of the 2000 to 2002 decline have not been identified. A dozen or so unpaired adult birds are on the lake each year as well.

Although 20 or more loon pairs establish territories on Umbagog Lake and its tributaries in a given year, 75 percent or less actually nest, and many fewer hatch chicks successfully. In 2005 for example, of 20 territorial pairs, 13 nested. Of those nesting pairs, six pairs successfully hatched a collective eight chicks and only four of those survived. Predation on eggs and chicks was the primary cause of nest failure. Raccoon, mink, fisher, herring gull, bald eagle, and raven are known to prey on loons; mammalian predation is the most prevalent (Taylor et al. 2005).

More than 75 individual common loons were banded and sampled for contaminants between 1993 and 2003 as part of a regional study on common loon reproduction and blood chemistry. Two loons were equipped with radio transmitters in 2003. Both of those birds migrated to the coast of Maine in the fall: one near Saco Bay and the other near Penobscot Bay. Another bird was equipped with a transmitter in 2004, and has also migrated to the coast of Maine to Muscongus Bay. Another 14 loons were captured, banded, and color-marked in 2005, and 12 loons were evaluated for eight different avian diseases (Yates and Evers 2005).

In 2002, the cause of death of three loons in Umbagog Lake was attributed to lead poisoning from ingesting lead sinkers. At least one loon was also infected with the West Nile virus. Blood samples from Umbagog Lake loons were analyzed for methylmercury, and were found to contain moderate levels lower than other reservoirs in the Rangeley Lakes chain. The highest mercury concentrations on the refuge were in loons nesting on the Magalloway River and in the southeastern section of Umbagog Lake (Biodiversity Research Institute 1998). Moderately high levels were also found in Leonard Pond, Potter Cove, Black Island Cove, Absalom, and Gull Island birds. The lowest levels of mercury were in birds on the Androscoggin River. Mercury levels were higher in males than in females. The Magalloway River flows out of Lake Aziscohos, which has high mercury levels (ECSMarin 2003).

Common snipe



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Marsh Birds

Marsh birds, including American bittern, Virginia rail, sora, Wilson's snipe, and pied-billed grebe breed in the marshes and other wetlands on the refuge. Two non-active great blue heron nests were reported on the refuge in 2002. Umbagog Lake is one of just a handful of locations in New Hampshire where the black tern is observed repeatedly during the breeding season, although no nests have been confirmed.

Volunteers using taped broadcast callbacks surveyed breeding marsh birds annually on the refuge from 1999 to 2002. Surveys were conducted along three transects: one each along the Dead Cambridge River, in Leonard Marsh/ Leonard Pond/Chewonki Marsh, and one in Harper's and Sweat Meadows. The most common targeted marsh birds recorded were Wilson's snipe, Virginia rail, American bittern, and alder flycatcher. Sora, pied-billed grebe, marsh wren, and belted kingfisher also were noted. Other birds that forage or nest in the wetlands were recorded on this or other surveys; they included common yellowthroat, great blue heron, Lincoln's sparrow, northern waterthrush, palm warbler, red-winged blackbird, rusty blackbird, and swamp sparrow.

Common terns have been observed perching on exposed rock outcrops on the lake both historically and in recent years. However, those records involve small groups of migrating or non-breeding individuals. They do not indicate that this species has ever attempted to breed in the Umbagog Lake area (Brewster 1924).

Shorebirds

Shorebirds migrate through the refuge mid- to late April through mid-June (spring) and late August through early to mid-November (fall), congregating in relatively low numbers on the margins of wetlands. Only a few species of shorebirds are known to breed on or near the refuge, including spotted sandpiper, Wilson's snipe, and American woodcock. We have not conducted woodcock surveys; however, in 2006 we plan to establish singing ground surveys on the refuge to gain additional information on their breeding status.

We conducted a few limited spring and fall shorebird surveys from 2000 to 2002. Bob Quinn compiled a list of shorebird sightings on the refuge from 1990 to 1998. The most common species are Wilson's snipe, spotted sandpiper, greater yellowlegs, solitary sandpiper, and killdeer. During migration, large mixed flocks are sporadically seen feeding on the exposed mud flats that appear when the water levels are low. Other migrant shorebirds that are seen on rare occasions include semi-palmated and black-bellied plover, red-necked phalarope, red knot, semi-palmated and least sandpipers, dunlin, short-billed dowitcher, Wilson's phalarope, and lesser yellowlegs (Quinn 2005).

Bald Eagle

Bald eagles were absent from the refuge between 1949 and 1989, a result of widespread use of DDT that caused major population declines across their range. The bald eagle made a remarkable recovery, along with many other raptors, after DDT was banned and the eagle was protected on the Endangered Species List. Since 1980, ASNH, through a contract with the NHTG, has monitored bald eagles and ospreys in New Hampshire.

Nesting bald eagles returned to Umbagog Lake in 1989, after a more than 30-year absence. In 1989, a pair nested in a live white pine tree on an island in Leonard Pond on the refuge, near the confluence of the Magalloway and Androscoggin rivers. That nest was continuously occupied until 1994. In 1994, the pair moved to a tree on Pine Point on the eastern shore of the lake. That year, the adult male eagle died, apparently from ingesting lead shot, and the Pine Point nest failed. The remaining adult female paired with another male and re-established the nest at the Leonard Pond site. That nest has continued to be occupied each year from 1994 to 2004. From 1990 to 2002, the nest produced an average 1.2 chicks/year. During that 12-year period, nest failures occurred four times (i.e., no chicks fledged): in 1994, 1997, 2000, and 2002. By 1992, the original nest tree had died, although nesting continued in the snag that remained. In 2002, the eagle pair dismantled the Leonard Pond nest, but remained in the vicinity. A mate change apparently occurred in 2001 (new male), and in 2003 the female was replaced. No eggs hatched successfully in either 2003 or 2004 (ASNH unpublished data).

In 2000, a second pair established a nest on the east side of the lake in a white pine tree on Tidswell Point, approximately half a mile inland from the lake. That nest produced two chicks in 2000, one chick in 2001, one in 2002, two in 2003, (only 1 of these survived to fledging), and two in 2004. In 2006, a third pair established a nest in Sweat Meadows and successfully fledged 2 young in 2007.

The refuge eagles likely remain in the general vicinity of the refuge year-round. The adult male was confirmed on or near the lake every month of the year except January (ASNH unpublished data).

The Leonard Pond eagles generally forage around the north end of the lake, from Errol Dam to the Rapid River and southeast to Tyler Cove. The Tidswell Point eagles were observed foraging primarily around the southern end of the lake. In 2005, ASNH documented three territorial pairs of eagles, although only one nest was successful: two young fledged. A varying number of immature eagles are also observed from time to time on the lake and rivers during the breeding season (Martin et al. 2006).

Umbagog Lake breeding eagles start nest building in March, and start incubating in early April. One to two eggs hatch around May 6 through May 22, and the young fledge between July 30 and August 17. Eagle fledglings typically disperse from mid-September to early October.

Public access to the Leonard Pond nest is restricted by buoys and signs placed about 500 feet away from the nest. Buoys are left out from shortly after ice-out through the end of October (ice-out on Umbagog Lake averages around May 2). Predator guards were installed on both the Leonard Pond and Tidswell nest trees. In 1990, ASNH surveyed boat activity around the Leonard Pond eagle nest during May through August. Visitation reached a high of 133 boat approaches to the nest site in one day (349 people). The highest visitation rates occurred on Saturdays (mean of 6.6 boats/hour) and on August weekends (mean of 9.4 boats/hour). Lowest levels of visitation were in June (mean of 3.3 boats/hr). The majority of the visitors obeyed the closure signs, although a few canoeists violated them. ASNH also observed some visitors attempting to feed fish to eagles (ASNH unpublished data).

Osprey



USFWS

Osprey

Ospreys were considered common summer residents around Umbagog Lake as far back as the late 1800s. Populations across the eastern United States declined precipitously beginning in the 1950s, and by the late 1970s, just three or four breeding pairs remained in the entire State of New Hampshire, all of which were located near the refuge.

Since 1980, ospreys have monitored by ASNH, NHPG, or the refuge. Within the refuge acquisition boundary, approximately 23 nest site locations are recorded for osprey over the past 20 years. However, in the past 10 years, a gradual decline was noted in the number of osprey pairs nesting within the four townships surrounding the refuge: Cambridge, Errol, Second College Grant, and Wentworth Location (Martin 2002). The factors contributing to that apparent local decline have not been completely identified. At the same time, osprey populations elsewhere in New Hampshire are increasing. An apparent decrease in active nests in the Umbagog Lake area occurred from about 1996 to 2001, and was followed by an apparent increase in 2002 (Martin et al. 2006).

In 2006, there were 11 territorial pairs of osprey engaged in active nesting attempts, and 15 fledglings were produced. The majority of nest trees have had predator guards placed around the bottom of the tree.

Other Raptors

Peregrine falcons, although never common in the area, were eliminated from their historical breeding sites in both Maine and New Hampshire, including several areas near Umbagog Lake, by the late 1950s. Four historical nesting cliffs are within view of the lake, likely chosen by peregrines for their proximity to a good food supply of ducks, shorebirds, and songbirds. Today, the lake, marshes, and other open areas on the refuge provide stopover habitat for migrating peregrines passing through the area in both the spring and the fall.

Confirmed intermittent sightings of individual golden eagles continue in areas near the refuge, mostly during migration and in winter, typically associated with

a temporary local abundance of carrion. For several decades, the Umbagog Lake area annually has supported from one to five breeding pairs of northern harriers. Cooper's hawks are longtime occupants of the Umbagog Lake area (Brewster 1924), and merlins are regular nesters on the refuge.

Other Birds

The upland forests and diverse wetland communities on the refuge support more than 100 breeding species of songbirds, and offer stopover habitat for dozens more during migration. The peatland communities in particular support a suite of birds with boreal forest affinities, such as gray jay, spruce grouse, black-backed woodpecker, and palm warbler, which approach their southern range limits in this area. Other northern coniferous forest birds known to breed on the refuge include pine grosbeak, white-winged crossbill, and red crossbill.

Bird surveys conducted on the New Hampshire side of the refuge from 1999 to 2004, mostly within the mixed woods and hardwood floodplain, recorded more than 40 bird species, including several species of conservation concern: ovenbird, black-throated-blue warbler, American redstart, veery, yellow-bellied sapsucker, black-throated-green warbler, Nashville warbler, and northern parula. In 2005, we established five additional transect surveys focused in softwood habitat types such as cedar swamps, black spruce, and spruce-fir. More than 67 landbird species were recorded, including the following species of concern: yellow-bellied flycatcher, Canada warbler, blackburnian warbler, ovenbird, black-throated blue warbler, American redstart, black-throated green warbler, bay-breasted warbler, chestnut-sided warbler, northern parula, veery, purple finch, boreal chickadee, yellow-bellied sapsucker, eastern wood peewee, Cape May warbler, and ruffed grouse.

Mammals

Based upon known regional distributions and habitat requirements, the refuge supports approximately 50 different mammal species. At least 36 of those are confirmed on the refuge, including 7 types of shrews or moles, 4 bats, 10 rodents, and 12 carnivores, as well as moose, white-tailed deer, and snowshoe hare. Common carnivores include black bear, eastern coyote, red fox, fisher, and river otter.

An American marten at a bait station on the refuge



USFWS

For 3 years, we conducted limited field surveys of small mammal populations to establish baseline data for the refuge. The masked shrew was most frequently detected. We also initiated surveys of mid-sized carnivores, including fisher, marten, bobcat, and lynx (see lynx discussion below), using techniques such as snow tracking and photography at remote bait stations. From 2002 to 2004, we assembled seven camera bait stations around the refuge. Most were kept up for approximately 1 month in January or February, except for two sites on Sunday Cove, which were up from March to early June. Fisher were detected at five sites; marten at three sites; and, bobcat at one site. Coyote and short- and long-tailed weasel also have been observed on the refuge.

Moose, white-tailed deer, and beaver are common in the area of the refuge, and are known elsewhere to exert particularly strong influences on the local plant community, affecting both the composition and age structure of the forest. However, we do not have local information to that effect. No surveys for these species have been conducted on the refuge.

From 1992 to 1995, refuge staff mapped active beaver colonies along the Magalloway and Androscoggin rivers, the Mountain Pond drainage, and the north end of Umbagog Lake. The colonies mapped range from 6 to 11. That mapping predates any of the current staff. Records on the methodology the

survey used are lacking. It appears to have been an effort to characterize wildlife activity in the area of the refuge and begin collecting baseline data.

Lynx

Lynx are Federal-listed as Threatened. As mentioned above, we used camera bait and tracking surveys from 2002 to 2004 to detect small mammals and mid-sized carnivores such as lynx. We detected no lynx on the refuge, although their presence has been confirmed approximately 10 miles away in Magalloway Plantation, Maine. State lynx experts have told us that those occurrences are considered to be individuals dispersing from their breeding areas, since the closest confirmed breeding location in Maine is approximately 90 miles from the refuge (J. Vashon, MDIFW, personal communication, 2006). In New Hampshire, researchers discovered a lynx track in January 2006 along Route 2 in the town of Jefferson, approximately 45 miles southeast of the refuge (NHFG 2006).

Lynx are medium-sized cats that are adapted to life in deep, deep snow and are specialist predators on the snowshoe hare. Their adaptations to life in a typically boreal forest give them a competitive edge over such other species as bobcat and coyote. Northern New Hampshire is the southern edge of lynx habitat. Given their dependency on snowshoe hare, lynx must occupy large home ranges to ensure access to sufficient prey. Snowshoe hare are most abundant in forests with dense understory that provide forage, escape cover, and protection during extreme weather, and therefore, hare densities are generally higher in regenerating, earlier successional forest. Lynx also require lots of coarse woody debris, such as downed logs and windfalls, as safe den sites (Federal Register 2005).

In Maine, lynx use spruce-fir dominated regenerating stands that develop 15 to 30 years after forest disturbance. The Service has proposed more than 10,000 acres in Maine as “critical habitat.” The refuge does not provide large areas of either the late- or the early seral conifer forest preferred by lynx, although refuge habitats may serve as dispersal habitat for lynx (Federal Register 2005). The Service has not proposed any areas as critical habitat solely because they provide habitat for dispersing animals.

White-tailed deer wintering areas

The NHFG and MDIFW identified many areas of lowland conifer forests on and near the refuge that provide critically important winter cover for white-tailed deer (map 2-10). Up to 100 deer are known to congregate in some of these areas on the refuge (Will Staats, NHFG, personal communication, 2003). Triggered to some extent by increasing snow depths, deer usually migrate to those areas in the late fall. Those areas are also important during periods of intense cold, even during snow free winters. The deer create a vast network of trails throughout the wintering area, traveling along those trails to search for food or escape predators.

Quality deer wintering habitat consists of two components and their proximity to each other: cover to protect the deer from the elements, and access to browse. Softwood stands (primarily spruce-fir) at least 35 feet tall with a crown closure that averages about 70 percent or more is ideal winter cover (Reay et al. 1990). Older, taller stands that are generally stronger provide the best cover-branch structure for intercepting snow. Those older stands often begin to develop gaps, which stimulate regeneration and provide browse for deer. Younger, denser stands are also desirable if they have small openings, about a quarter of an acre in size or less, so that the deer have access to browse and sunlight for warmth.

In the 1990s, MDIFW staff conducted aerial and ground surveys of Region D in Maine. Those surveys determined that Upton and Rangeley had the

most extensive wintering habitat for deer in the entire region, which includes 115 organized towns and townships (Chuck Hulsey, MDIFW, personal communication, 2006). Unregulated timber harvesting continues to threaten valuable winter shelter in Upton, which is strategically important to regional deer populations. The conservation of that habitat is of the highest importance for achieving deer population objectives set by public working groups (Chuck Hulsey, MDIFW, personal communications, 2006).

Fish

Based upon available local documentation and a list compiled by MDIFW, at least 24 fish species are present in water bodies on the refuge. Major changes in both the abundance and species composition of the Umbagog Lake fishery during the past 150 years have created a fishery today that bears very little resemblance to that present before the establishment of the first Errol Dam in the 1850s. During the 1800s, the lake supported a thriving brook trout population (Bonney, personal communication, 2002). Today, only portions of Umbagog Lake and the Rapid River support a native brook trout population.

Before 1900, however, Atlantic salmon, chain pickerel, rainbow smelt, brown bullhead, and several other species were introduced into the Androscoggin River or the Rangeley Lakes. Changes that are more recent include the introduction and subsequent population expansion of smallmouth bass, introduced into the lake in 1995. Northern pike have also been observed in the lake in recent years, but their present population status remains unclear (Bonney, personal communication).

Green frog



John Mosesso, Jr./NBH

Amphibians

Spring surveys of singing frogs (1999–2002) and stream surveys (2001–2002) have recorded 16 amphibian species on the refuge: seven salamanders, eight frogs, and one toad. Those include northern two-lined, northern red-backed, dusky, and spring salamander in or along streams. The fen and flooded meadows, peat lands, cedar swamps, and floodplains support diverse frogs and toads; the most common include bullfrog, green frog, spring peeper, American toad, and mink frog. Other species include northern leopard, pickerel, and wood frog. Blue-spotted and spotted salamanders and eastern newts were found in vernal pools in floodplains and cedar swamps.

Invertebrates

As part of a water quality study in 2003, 20 sites on Umbagog Lake, the lower Magalloway River, and the upper Androscoggin River were surveyed for aquatic macro-invertebrates (Van de Poll 2004). Van de Poll collected 120 taxa representing 14 classes, 28 orders, and 79 families of macro-invertebrates. No obvious indications of a reduction in community diversity or severe pollution were found. Some of the higher diversity sites for macro-invertebrates were the fringes of wetlands on the lake. The most groups of invertebrates collected were little pond snails and the shrimp-like scuds, followed by midges, mayflies, caddisflies, and beetles (Van de Poll 2004). We have not conducted any other invertebrate surveys.

Cultural and Historic Resources

Invasive Animals

We have not systematically surveyed for invasive terrestrial or aquatic animals. We are not aware of any invasive terrestrial animals on the refuge, and our primary concern about aquatic invasive species focuses on the many introduced fish species, such as smallmouth bass.

We have not conducted a detailed archeological and historic survey of all refuge lands. However, we have conducted some specific project surveys to determine further the eligibility of certain sites. In New Hampshire, we know of one historic

and three prehistoric archeological sites on refuge land. In Maine, we know of one prehistoric site on refuge land. We expect that a detailed, systematic survey would likely reveal many more sites that are prehistoric.

Several limited historical architectural surveys on the refuge determined that its buildings were not eligible for the National Register of Historic Places. In October 1992, the Maine SHPO concurred with our regional archeologist in finding the Stranger Farm ineligible. In 1993, our regional HPO determined that the Potter Farm, which includes a house and two outbuildings more than 50 years old, is ineligible, because they have been altered since their original construction. We forwarded that assessment to the New Hampshire SHPO but received no response, indicating tacit concurrence with the Service assessment. An associated cemetery, the Stone cemetery, lies on the private Kronck property, on which the Service owns an easement. In 1995, we also assessed and determined ineligible the now demolished Priest cabin. In 2004, our regional archeologist evaluated the cabins in the area of Chapel Hill Road, and determined none eligible. We have forwarded that assessment to the New Hampshire SHPO, and are awaiting their response.

We have not surveyed other cabins, several more than 50 years old, on refuge lands. The Service may acquire more cabins with future acquisitions.

The refuge has only a few archaeological artifacts for museum property. They are stored in the Regional Office. There are no important museum property issues at the refuge (D.H. Hurd and Company 1982; Dobbs and Ober 1995).

Priority Public Uses

We describe below current opportunities on the refuge for engaging in the six priority public uses of the Refuge System Improvement Act: hunting, fishing, wildlife observation and photography, and environmental education and interpretation.

The refuge area is a very popular destination, especially for water recreation. Many visitors return year after year. Refuge lands provide year-round activities; the most popular include motor boating, canoeing, kayaking, remote lake camping, observing and photographing wildlife, hunting, and snowmobiling. All activities are allowed from half an hour before sunrise to half an hour after sunset, with the exception of camping in designated sites on designated days, which provides for overnight use. The waters in and around the refuge undergo the most recreational pressure during the summer (USFWS 2000b).

We have not conducted formal surveys of annual refuge visitation, despite their desirability. Limited funding and staffing, numerous access points, and the confusion of many visitors about whether they are on refuge or state lands have proved challenging. However, for the purposes of this CCP/EIS, we have estimated annual visitation based on a variety of sources, including visitor contacts at refuge headquarters, boat activity surveys between 2000 and 2004, reservations for the duck hunting blinds, and general observations by refuge and state agency personnel. We estimate our total annual visitation at approximately 49,500 visitors over the last 5 years. Most visitors are non-local residents. Appendix G, table G.6, summarizes our 15-year projection of visitation by activity.

Hunting

After completing a refuge Hunt Plan, we opened the refuge officially in fall 2000 for hunting for waterfowl, migratory game birds, upland game and big game. We amended that Hunt Plan, and its accompanying EA, most recently in April 2007. Alternative 2 in that EA represents our current program. The objectives of the hunt program include providing the public with a safe, high-quality recreational experience, providing an opportunity to utilize a renewable natural resource, and

providing a tool to help maintain wildlife populations at levels within the carrying capacity of their habitat (USFWS, 2007). We estimate 5,650 hunter visits on refuge lands annually. The refuge lies in New Hampshire Wildlife Management Units (WMU) A and WMU C2, and Maine WMU 7.

All federal and the respective state hunting regulations apply, including seasons, bag limits and license requirements, along with additional, special refuge regulations (listed in 50 C.F.R. 32 sub-part B). The only exceptions to state regulations are that we do not currently allow turkey hunting on refuge lands and we do not allow bobcat hunting in Maine. Since the New Hampshire-Maine state line crosses the refuge, hunters are responsible for knowing which state they are in and hunting according to the regulations for that state. Hunting seasons generally are between early September and the end of March. No refuge permits are required, and no fees are charged. Enforcement is primarily by the respective state game wardens. The most commonly hunted species in and around the refuge are waterfowl, ruffed grouse, woodcock, moose, white-tailed deer, and snowshoe hare.

In 1999, we instituted a waterfowl blind reservations system allowing hunters to sign up on a first-come, first-served basis for one of six permanent waterfowl blinds on refuge waters (map 3-2). We do not have quantitative data on harvest levels, but hunters using blinds have recorded harvest of: black duck, mallard, common merganser, Canada goose, wood and ring-necked duck, blue-winged and green-winged teal, scaup, bufflehead, and Wilson's snipe.

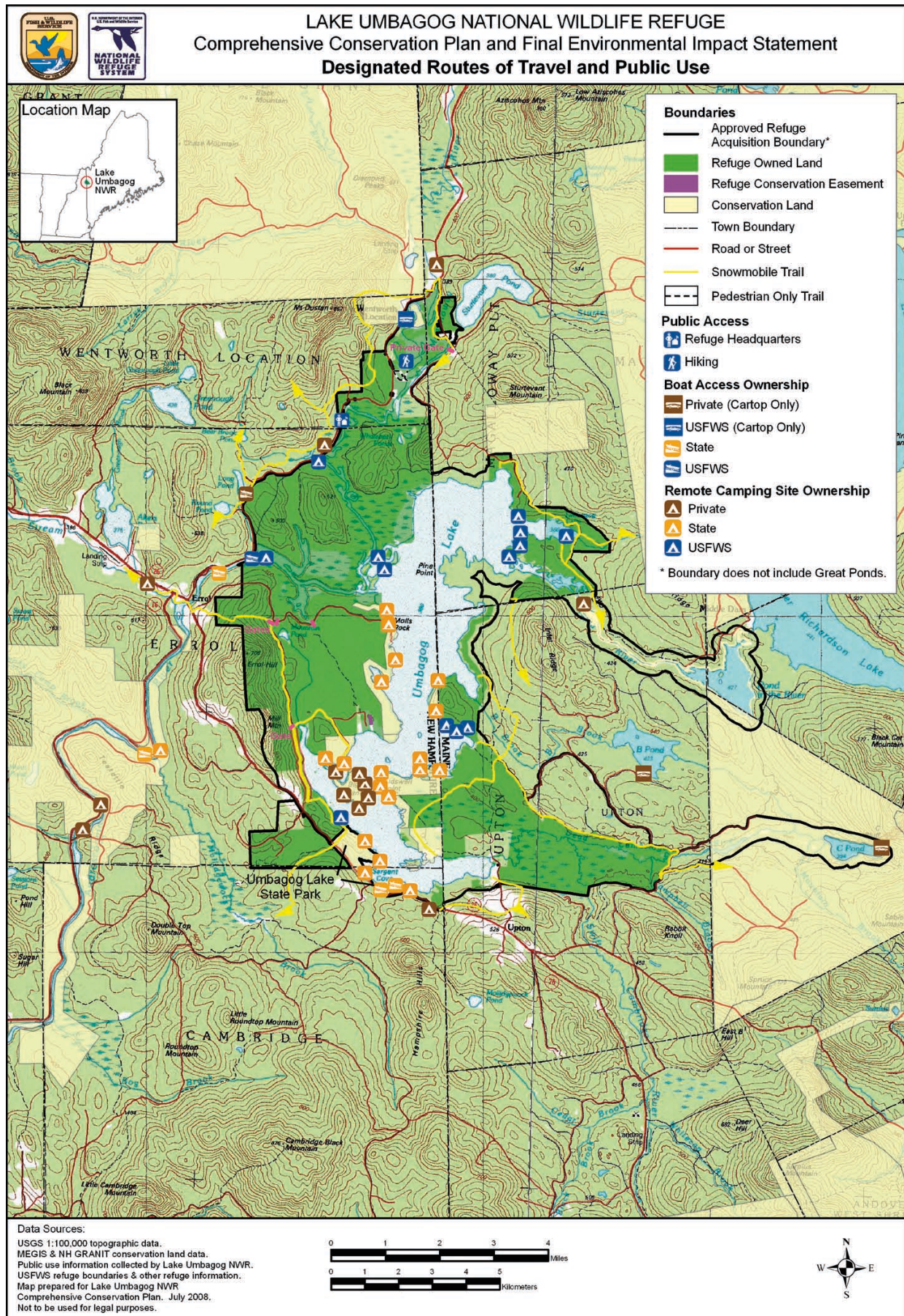
Harvest levels have not been determined for any mammal or upland game bird species taken from the refuge. However, NHFG and MDIFW data from both of the respective WMUs or associated townships provides some information on harvest rates. The refuge represents only a very small proportion of each WMU, 2.12% of WMU's in New Hampshire, and 0.57% of WMU 7 in Maine, and therefore, only a very small proportion of the reported harvest would be considered as coming directly from refuge lands. In 2004, New Hampshire deer harvest rates for the townships of Cambridge, Errol, and Wentworth Location were 0.41 deer/sq mile; 0.39 deer/sq mile, and 0.36 deer/sq mile, respectively. In Maine, deer harvest rates for WMU 7 were reported to be 0.37 deer/sq mile.

Also in 2004, 4 bear and 34 moose were taken in the township of Errol. In Maine's WMU 7, 198 bear and 112 moose were taken. Of the 198 bear taken, only 31 were taken using methods allowed on the refuge. In addition, 26 turkeys were harvested in New Hampshire's WMU C2, but only four were taken in towns next to the refuge.

Fishing

We have not officially opened refuge lands to fishing, but we plan to do so after completing the CCP. Most anglers who visit our area want to fish on the lake and in other state waters; fishing from the lake's shoreline is less popular. We estimate approximately 11,000 visitors per year are fishing on the refuge or accessing lake fishing through the refuge. We currently provide access to these state waters via several boat landings (map 3-2). Our primary concern about current fishing activities arises when anglers access sensitive resource areas administratively closed, such as the eagle, osprey, and loon nesting sites.

Fishing from boats on Umbagog Lake and its tributary rivers falls under state jurisdiction, and state regulations apply for seasons, creel limits, and license requirements. Licensed New Hampshire or Maine anglers may fish any part of the lake with their license, and certain sections of the rivers, including the Androscoggin River upstream of the Errol Dam and the Magalloway River within New Hampshire, and on the Rapid River in Maine upstream to the marker at Cedar Stump.

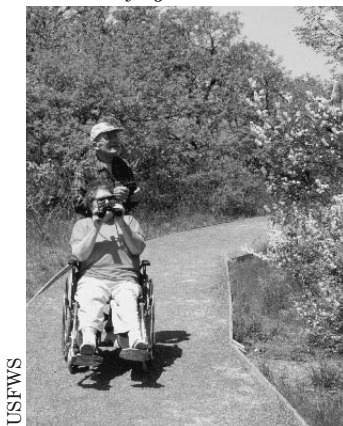


Anglers fish Umbagog Lake for a variety of both cold and warm water species. The most popular are smallmouth and largemouth bass, landlocked salmon, brook trout, and lake trout. Local streams and rivers, (e.g., the Magalloway, Androscoggin, and Rapid rivers), are also noted for their excellent fly-fishing opportunities.

The abundant, well-established population of smallmouth bass illegally introduced into the lake in the mid-1980s recently colonized the Rapid River as far as Pond-in-the-River, and are now a concern among state agencies managing the native brook trout. Since that introduction, the number of bass boats on the lake has increased, and bass tournaments there have become increasingly popular. The State of Maine sets restrictions on those tournaments to allow only one permit on a water body for a specific date, no tournaments until June 15, five tournaments annually on water bodies greater than 3,500 acres, and a maximum of 100 boats per tournament.

Ice fishing is also becoming increasingly popular, and ice-fishing camps appear on the lake throughout the winter, primarily on state jurisdiction. Although fishing remains popular, mercury contamination throughout the region has led to recommendations on limiting fish consumption (NH DES 2004). Mercury deposition affects all of the freshwater lakes in New Hampshire and Maine, not just Umbagog Lake (NH DES 2004; MDEP 2004).

Observing wildlife on the refuge



Wildlife Observation and Nature Photography

Wildlife observation and nature photography are major attractions in the Umbagog Lake area, and we have noticed public participation increasing over the past 5 years. Loon, bald eagle, and moose are the major viewing attractions, as are bird watching and leaf peeping in general. We allow access by foot, snowshoe, cross-country ski, and motorized or non-motorized boat. We estimate that 18,500 visitors annually engage in viewing and photographing wildlife on the refuge.

We maintain one trail, the Magalloway River Trail; accessed off Route 16 approximately 2 miles north of refuge headquarters (map 3-2). The trail follows a gravel road built for a proposed subdivision cul-de-sac, and is now part of the refuge in an area known as the “Day Flats.” That area supports a major moose wallow, and has the potential for restoration to a wooded wetland habitat. It is approximately one-third of a mile long, and has a viewing platform at its end that overlooks a backwater oxbow in the river. We plan a quarter-mile loop extension of that trail for 2006.

Interpretation and Environmental Education

Our staff conduct interpretive programs as funding and staff time allow, typically about three each year. The demand for programs from local schools, scouting, and other groups far exceeds our ability to provide them. A limited amount of interpretive literature (e.g., handouts or brochures) is available from displays at the refuge headquarters.

We participate in two very popular outreach events each year: the Wildlife Festival and the “Take Me Fishing” Day. Since 1997, our staff and the Umbagog Chamber of Commerce have sponsored the annual Wildlife Festival in Errol in early August. More than 300 people have attended this event in some years. The “Take Me Fishing” event, also held in August, recently was combined with the Wildlife Festival on the same day. The fishing event is also offered in cooperation with the Umbagog Chamber of Commerce, as well as Orvis, Shakespeare, and other local companies, and is held at the Potter Farm. Up to 50 people have participated in that fishing event in a given year.

We have not developed a curriculum for environmental education programs. We have been involved in fulfilling requests from teachers at local schools to provide programs that supplement their curriculum. Generally, one or two school programs are given in a given year.

We have regularly supported college interns: namely, graduate students from Vermont and New Hampshire universities who seek on-the-job experience while achieving college credit. They have completed a variety of projects: namely, research on habitat and species of concern to us.

Remote Camping on Umbagog Lake

The State of New Hampshire operates the Umbagog Lake state campground at the southern end of the lake: 37 developed shoreline sites and 30 remote lake camping sites in various locations on the lake (map 3-2). Twelve of the remote lake sites are located on refuge land. A cooperative agreement between the NHDRED and the Service will formalize the administration of those sites. They are a very popular destination, and typically are full to capacity in July and August, and often into September. A 3-year average from 2001 to 2003 showed 4,700 campers in July and 5,347 for August. Overall, use has declined in recent years, but only because several sites were closed to retain the remote backcountry quality of the camping facilities (New Hampshire Division of Parks and Recreation 2004). Two other river camp sites (North 1 and North 2) occur on refuge lands but their removal and restoration is planned. In addition to the state park, other private campgrounds with facilities are available in the surrounding area.

Boating

One improved and two unimproved public boat launch sites along the Magalloway River are on refuge land (upper Magalloway River car-top launch, a launch at refuge headquarters, and one at Parson's landing (map 3-2). One other launch site exists on refuge land on the Androscoggin River, above the Errol Dam (Steamer Diamond landing). The launch at Parson's landing has been heavily impacted, and is therefore, planned for closure. Improved launch sites are also located off refuge land near the Errol Dam on the Androscoggin River and at the south end of Umbagog Lake, at Umbagog State Park. The park rents boats and motors, and offers pontoon boat tours of the lake. The State of Maine requires that all motorized watercraft on inland waters, including Umbagog Lake, display a "Lake and River Protection" sticker.

We estimate that 14,000 visitors are boating on refuge waters, mostly in conjunction with viewing and photographing wildlife and fishing. Rough estimates by our interns in June and July indicate that the use of motorized boats and canoes or kayaks were roughly equal from 2000 through 2004. However, we have observed a rapid increase in motorized boating over the past few years, much of it attributed to bass fishing. A much smaller percentage of jet skis, sailboats, and pontoon boats are used on the lake.

The Androscoggin River, Umbagog Lake, and the Rapid River are highlighted as part of the Northern Forest Canoe Trail. That trail extends 740 miles from Old Forge, New York, to Fort Kent, Maine. At least six local outfitters and campgrounds offer canoe and kayak rentals and guided canoe or kayak tours of the lake, and some offer paddling instruction on the lake and in surrounding rivers and streams. College, school, and summer camp groups also use the lake for paddling trips. Canoe and kayak use has increased dramatically.

Snowmobiling

Snowmobiling is another activity we have observed increasing markedly on refuge and surrounding lands in recent years. With hundreds of miles of groomed

snowmobile trails, the Umbagog Lake area is very popular and local businesses target this audience through advertisements (Umbagog Chamber of Commerce 2005). It is a significant economic activity for the area during winter.

We estimate 20,000 snowmobile visits occur each year on refuge lands as part of a regional trail system (Gray, New Hampshire Bureau of Trails, personal communication, 2005). Snowmobile use on the refuge is permitted on designated trails only. Map 3-2 depicts trail locations authorized by the refuge manager on the refuge in both New Hampshire and Maine. Unfortunately, several unauthorized spur trails on the refuge are an enforcement issue.

*Snowmobiling on
the refuge*



Certain activities evaluated by the refuge manager were determined not to be appropriate on refuge lands including: ATV, ORV and dirtbike use, competitions or organized competitive group events (e.g. fishing derbies, dog trials, or bicycling, and cross-country skiing), and geocaching. Appendix C includes negative findings of appropriateness, which document the refuge manager's rationale.

Furbearer Trapping

The refuge is not open for trapping. However, we suspect that beaver trapping is occurring in some areas of the refuge. The NHFG and MDIFW have asked us to open refuge lands to furbearer trapping consistent with their respective state seasons. Those agencies maintain that trapping is a traditional, historic use in the area, was established well before the refuge was created, and was allowed by previous owners. They also promote trapping as a wildlife-dependent activity that is an effective tool for managing furbearer populations.

Off-road Vehicle Use

ORV and ATV use is not allowed on the refuge except by special use permit on a case-by-case basis to allow hunters with disabilities reasonable access to hunt and retrieve their game.

We have been involved in many partnerships since refuge establishment, which would not have been possible without the cooperation of the states of New Hampshire and Maine, timber companies, conservation organizations, private landowners, local elected officials, and town and county community leaders. Those partners continue to be active in land conservation for the common goal of maintaining the aesthetic, cultural, economic, and ecological values of the region for future generations.

Our partnerships continue to expand to include not only groups and individuals interested in land conservation, but also those interested in habitat and species management, recreation and visitor services, and education and public outreach. A list of our current partners follows.

Conservation organizations: Trust for Public Lands, TNC, ASNH, Loon Preservation Committee, New England Forestry Foundation, Mahoosic Land Trust, Society for the Protection of New Hampshire Forests, Androscoggin Watershed Council, Rangeley Lakes Heritage Trust, The Conservation Fund, Trout Unlimited;

Town and County Governments: Towns of Errol, Upton, Magalloway Plantation, and Coos County;

State agencies: NHFG, MDIFW, NHDRED, New Hampshire Office of Energy and Planning;

Private companies: FPLE, Wagner Forest Management; and,

Universities and other educational institutions and organizations: Dartmouth College, University of Vermont, University of Massachusetts, Hurricane Island Outward Bound, The Chewonki Foundation, and the Northwoods Stewardship Center.

Friends Group

The Friends of Umbagog National Wildlife Refuge assist in the development and implementation of interpretive programs and tours on the refuge. Members also participate in the annual Wildlife Festival and Take-Me-Fishing events. They are invaluable in supporting those priority programs and helping us respond to the requests for programs that far exceed our ability to meet them.

Volunteer Programs

Our active volunteer program involves student interns from all over the country, as well as local residents, clubs, and organizations.

Every summer and fall, we host three to four volunteer student interns, who are generally college-aged students or recent graduates. Interns spend 10 to 12 weeks assisting with various refuge projects in return for housing and a small stipend. Their duties include working on maintenance, collecting biological data, monitoring public use, leading nature walks and interpretive programs, helping with the Wildlife Festival and Fishing event, monitoring public use, designing educational displays, greeting the public, and maintaining the refuge GIS system.

Four or five volunteers, generally local or from elsewhere in New Hampshire, assist us each spring in surveying land birds, marsh birds, and shorebirds. Ten to 25 volunteers assist the refuge each year at the Wildlife Festival. Volunteers run information booths and lead birding tours (by canoes, pontoon boats, or walks). They also spend a day helping with various refuge projects. Past projects have included cleaning up the refuge and surveying for waterfowl broods, ospreys, eagles, and other raptors.

Five volunteer local anglers assisted with the first Take Me Fishing event in 2002. They set up displays, demonstrated fly-tying and fly-casting, and guided fishing trips on the lake.

Several organizations bring volunteer youth groups to perform service work on the refuge each summer. Those include Hurricane Outward Bound, The Chewonki Foundation, and the Vermont Leadership Center. Past projects have included clearing trails, building fences, and painting, assisting in biological surveys, and restoring campsites. Group sizes average from 5 to 10 volunteers.

Every year, anywhere from two to five individuals contact us to volunteer their help for one or more days. In the past, those volunteers have assisted with maintenance, biological surveys, public outreach and visitor services, the design of an interpretive trail, clerical work, and research. The duration of the work has varied from just a few hours up to 2 months. We provide housing for volunteers who contribute more than one day and come from locations that are more distant.

Youth Conservation Corps Program

We also host a YCC summer program, typically for 4 to 5 youth between the ages of 14 and 18. An adult coordinator is also hired to supervise them. The YCC program includes an environmental educational component in addition to their paid work assisting with refuge studies, facilities maintenance, and other activities. This is a popular program in the area, as summer outdoor employment for youth is limited.

*Youth Conservation
Corps crew
on the refuge*



Ian Drew/USFWS

Chapter 4



Ed Henry/USFWS

Sunset on Umbagog Lake

Environmental Consequences

Introduction

This chapter describes the environmental consequences we predict from implementing the management alternatives presented in chapter 2. Where detailed information is available, we present a scientific and analytic comparison between alternatives and their anticipated consequences, which we describe as “impacts” or “effects.” In the absence of detailed information, we make comparisons based on our professional judgment and experience. We specifically predict the effects of implementing the management actions and strategies for each of the three alternatives: alternative A (Current Management), which serves as the baseline for comparing alternative B (Focal Species: the Service-preferred alternative), and alternative C (Natural Processes Management).

We focus our discussion on the impacts associated with the goals and significant issues identified in chapter 1 – Purpose of and Need for Action. Direct, indirect, short-term, beneficial and adverse effects likely to occur over the 15-year life span of the plan are discussed. Beyond the 15-year planning horizon, we give a more speculative description of the direct, indirect, and cumulative effects. At the end of this chapter, table 4.14 summarizes the effects predicted for each alternative and allows for a side-by-side comparison. Finally, this chapter identifies the irreversible and irretrievable commitment of resources from our proposed actions, as well as those actions relationship between short-term uses of the environment and long-term productivity, their cumulative effects, and the relationship to environmental justice.

As required by CEQ and Service regulations implementing NEPA, we assessed the importance of the effects of the CCP alternatives based on their context and intensity. The context of the impacts ranges from local and site-specific to regional and broad-scale, for example, direct impacts to soils at a kiosk construction location would be highly localized. Impacts on common loon reproduction would directly affect the common loon population on Umbagog Lake and indirectly affect common loon populations in the larger context of New Hampshire and Maine. Improvements in breeding habitat for Canada warbler would benefit this species of conservation concern in the context of BCR 14 and throughout its range. Although refuge lands comprise a small percentage of these larger ecosystem or regional contexts, all alternatives were developed to contribute towards conservation goals in these larger geographic landscapes. Table 4.1 provides some context for our discussion.

The proposed species and habitat actions are consistent with the states of New Hampshire and Maine comprehensive wildlife conservation strategies, and national and regional conservation plans identified in chapter 1. At varying levels, they would each make positive contributions to these larger landscape-scale conservation endeavors.

We evaluated the intensity of impacts based on the expected degree or percentage of resource change from current conditions, the frequency and duration of the effect, the sensitivity of the resource to such an effect or the natural resiliency of the resource to recover from such an effect, and the potential for implementing effective preventative or mitigation measures to reduce the effect. Duration of effects vary from those that would occur only once for a brief period of time during the 15-year planning horizon, for example, the effects of visitor center construction, to those that would occur every day during a given season of the year, for example, impacts from snowmobiling.

Table 4.1. Impact contexts for Service actions under CCP at Lake Umbagog Refuge

Kiosk Footprint	0.005 acre
Vernal Pool	0.001 to 0.5 acre
Deer wintering areas	9,221 acres (including proposed expansion lands)
Woodcock Focus Areas	6,664 acres (including proposed expansion lands)
Refuge Habitat Management Units	722 to 4,173 acres (1.1 to 6.5 mi ²)
Umbagog Lake	>8,500 acres (13.3 mi ²)
Refuge lands	> 20,500 acres (25.4 mi ²)
Coos County, NH	1.15 million acres (1,801 mi ²)
Oxford County, ME	1.33 million acres (2,078 mi ²)
Upper Androscoggin Watershed	1.47 million acres (2,300 mi ²)
Atlantic Northern Forest – Bird Conservation Region 14	87.3 million acres (137,500 mi ² in U.S. & CAN)
Eastern Spruce-Hardwood Forest (Partners-in-Flight Area 28)	90 million acres (140,685 mi ² in U.S. & CAN)

There are certain types of actions identified in chapter 2 that do not require additional NEPA analysis because they are “categorically excluded” from further analysis or review and, as such, their consequences are not further described in this chapter. The following group of “management activities” are not analyzed because they would qualify for categorical exclusion under applicable regulations if independently proposed, and are minor in effect and common to all alternatives.

- environmental education and interpretative programs (unless major construction is involved, or a significant increase in visitation is expected)
- research, resource inventories, and other resource information collection activities
- operations and maintenance of existing infrastructure and facilities (unless major renovation is involved)
- routine, recurring management activities and improvements
- small construction projects (e.g. fences, berms, small water control structures, interpretative kiosks, development of access for routine management purposes)
- vegetation plantings
- minor changes in amounts or types of public use
- issuance of new or revised management plans when only minor changes are planned
- law enforcement activities



Ian Drew/USFWS

Mixed woods on the refuge

In chapter 2, under the section “Actions Common to All Alternatives; Additional NEPA Analysis” we acknowledge that, in order to implement any additions to the hunt program proposed for consideration under alternatives B and C, and the consideration

of a furbearer management program, we would need to conduct additional environmental and impacts analysis and public involvement to comply with NEPA. While we describe some of the anticipated impacts in this chapter, we would plan to fully evaluate those program additions in a separate NEPA analysis to be initiated after CCP approval.

We have organized this chapter by major resource heading. Under each heading, we discuss the resource context and the types of benefits and adverse impacts of management actions that we evaluated. We then discuss the benefits and adverse effects that would occur regardless of which alternative is selected and finally the benefits and adverse effects of each of the alternatives.

Effects on Socioeconomic Resources

In support of analyzing the socio-economic consequences of the actions proposed in the three draft CCP/EIS alternatives, we enlisted the assistance of economists at the USGS - Fort Collins Science Center. Their full report, a regional economic impact analysis, is included as appendix G. It provides detailed information on the current economic setting, and provides a means of estimating and comparing how current management under alternative A, and proposed management under alternatives B and C, could effect the local and regional socio-economic environment. The economic impacts were estimated using the “Impacts Analysis for Planning” (IMPLAN) regional input-output modeling system developed by the U.S. Forest Service.

For each alternative, regional economic effects from the IMPLAN model are reported for the following categories:

- **Local output** represents the change in local sales or revenue
- **Personal Income** represents the change in employee income in the region that is generated from a change in regional output.
- **Employment** represents the change in number of jobs generated in the region from a change in regional output. IMPLAN estimates for employment include both full time and part time workers, which are measured in total jobs.

This type of analysis provides two critical pieces of information: 1) it illustrates a refuge’s current and potential future economic contribution to the local community; and, 2) it can help in determining whether local economic effects are, or are not, a real concern in choosing among management alternatives. Below we provide a summary of the USGS report’s conclusions by alternative.

Socio-Economic Effects of Alternative A (Current Management)

Refuge Revenue Sharing

Under provisions of the Refuge Revenue Sharing (RRS) Act, local towns receive an annual payment for lands that have been purchased in full fee simple acquisition by the Service. Payments are based on the greater of 75 cents per acre or 0.75% of the market value of lands acquired by the Service. 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. Comparing the last few years, fiscal year (FY05) had the lowest appropriation where actual RRS payments were 41% of authorized levels. We use that as our benchmark for comparing the alternatives’ future contribution since it offers a conservation estimate.

In 2005, payments to local townships were \$5,049 to Magalloway, ME, \$6,018 to Upton, ME, \$603 to Cambridge, NH, \$19,509 to Errol, NH, and \$6,467 to Wentworth Location, NH for a total payment of \$37,646. Accounting for both the direct and secondary effects, RRS payments for alternative A generate total annual economic impacts of \$51,700 in local output, \$30,700 in personal income, and 1 job in Coos and Oxford counties.

Refuge Visitor Expenditures in Local Economy

Table 4.2 summarizes estimated refuge visitation by type of visitor activity for alternative A. The visitation estimates for alternative A assume a ten percent increase over the previous five year average annual refuge visitation estimate of 49,500 to reflect the increasing trend in regional visitation.

To determine the local economic impacts of visitor spending, only spending by persons living outside the local area of Coos and Oxford counties are included in the analysis. The rationale for excluding local visitor spending is two-fold. First, money flowing into Coos and Oxford counties from visitors living outside the local area (hereafter referred to as non-local visitors) is considered new money injected into the local economy. Second, if residents of Coos and Oxford counties visit Lake Umbagog Refuge more or less due to the management changes, they will correspondingly change their spending of their money elsewhere in those counties, resulting in no net change to the local economy. These are standard assumptions made in most regional economic analyses at the local level. Accounting for both the direct and secondary effects, spending by non-local refuge visitors for alternative A generates total annual economic impacts of \$1.05 million in local output, \$365,400 in personal income, and 15.6 jobs.

Table 4.2. Estimated annual refuge visitation by visitor activity for alternative A

Visitor Activity	Total # of visits	Percentage (%) of non-local visits	Total # of non-local visits	Number of hours spent at refuge	Number of non-local visitor days ¹
Consumptive Use					
Fishing	11,000	70%	7,700	8	7,700
Big Game hunting	2,500	67%	1,675	8	1,675
Upland game hunting	3,000	67%	2,010	8	2,010
Waterfowl and migratory bird hunting	150	60%	90	8	90
Non-Consumptive Use					
Wildlife viewing: boating/water use	14,000	60%	8,400	8	8,400
Wildlife viewing: nature trails and other wildlife observation	4,500	85%	3,825	2	956
Other recreation (snowmobiling)	20,000	60%	12,000	1	1,500
Total	55,150		35,700		22,331

¹One visitor day = 8 hours.

Impacts from Refuge Administration

Employees of Lake Umbagog Refuge reside and spend their salaries on daily living expenses in communities near the refuge thereby generating impacts within the local economy. Household consumption expenditures consist of payments by individuals/households to industries for goods and services used for personal consumption. The IMPLAN modeling system contains household consumption spending profiles that account for average household spending patterns by income level. The current approved refuge staff consists of ten permanent and nine seasonal employees for alternative A. Five of the permanent positions are currently vacant but are anticipated to be filled under alternative A.

For alternative A, salary spending by refuge personnel would directly account for \$541,300 in local output (sales or revenue), 3.8 jobs, and \$89,000 in personal income in the local economy. The secondary or multiplier effects would generate an additional \$91,800 in local output, 1.2 jobs, and \$30,300 in personal income.

Accounting for both the direct and secondary effects, salary spending by refuge personnel for alternative A would generate total economic impacts of \$633,100 in local output, 5 jobs and \$119,300 in personal income.

A wide variety of supplies and services are purchased for refuge operations and maintenance activities. Refuge purchases made in Coos and Oxford counties, contribute to the local economic impacts associated with the refuge. For alternative A, work related expenditures would directly account for \$92,900 in local output, 1.1 jobs, and \$32,300 in personal income in the local economy. Accounting for both the direct and secondary effects, work related purchases for alternative A would generate total economic impacts of \$126,500 in local output, 1.5 jobs and \$43,500 in personal income.

Impacts from Habitat Management

No timber harvesting or other commercial or economic management activities would occur under alternative A.

Summary of Economic Impacts for Alternative A

Table 4.3 summarizes the direct and total economic impacts of all refuge management activities for alternative A in Coos and Oxford counties. Under alternative A, refuge management activities directly related to all refuge operations generate an estimated \$1.45 million in local output, 17.7 jobs and \$425,300 in personal income in the local economy. Including direct, indirect, and induced effects, all refuge activities would generate total economic impacts of \$1.86 million in local output, 23.1 jobs and \$558,900 in personal income. In 2000, total personal income was estimated at \$2.16 billion and total employment was estimated at 36,874 jobs for Coos and Oxford counties (U.S. Department of Commerce 2002). Total economic impacts associated with refuge operations under alternative A represent well less than one percent of total income (0.03%) and total employment (0.1%) in the overall Coos County and Oxford County economy. Total economic effects of refuge operations play a much larger role in the smaller communities near the refuge such as Errol, NH and Upton ME where most of the refuge related economic activity occurs as compared to the overall, combined economies of the two counties.

Table 4.3. Economic impacts of all refuge management activities for alternative A (2005, \$,000)

	Local Output	Personal Income	Employment (# jobs)
Refuge Revenue Sharing			
Direct Effects	\$37.6	\$26.1	0.8
Total Effects	\$51.7	\$30.8	1.0
Refuge Administration (staff salary spending and work related purchases)			
Direct Effects	\$634.2	\$121.3	4.9
Total Effects	\$759.7	\$162.8	6.5
Public Use Activities			
Direct Effects	\$776.9	\$277.9	12.0
Total Effects	\$1,049.4	\$365.4	15.6
Habitat Management (timber harvesting)			
Direct Effects	<i>No timber harvesting occurs under Alternative A</i>		
Total Effects			
Aggregate Impacts			
Direct Effects	\$1,448.7	\$425.3	17.7
Total Effects	\$1,860.8	\$558.9	23.1

Socio-Economic Effects of Alternative B (Focal Species Management)

Property Tax Impacts and Refuge Revenue Sharing

The proposed Service acquisition of 32,159 acres in fee simple will have an effect on the amount of local property taxes collected as land is transferred from private taxable ownership to public nontaxable ownership. As we described under alternative A, although lands acquired by means of fee simple acquisition by the Service are removed from the tax rolls, the local taxing entities will receive an annual payment, under provisions of the RRS Act.

Accounting for the current RRS payments of \$37,646 (alternative A) and the \$42,846 increase for new land acquisition, RRS payments would total \$80,492 under alternative B. Accounting for both the direct and secondary effects, RRS payments for alternative B would generate total annual economic impacts of \$110,200 in local output, \$65,800 in personal income, and 22 jobs in Coos and Oxford counties. A portion (\$44,781) of the increase in RRS payments under alternative B offsets the loss in private property tax collections which does not represent a real increase economic activity to the area. Accounting for the loss in property tax collections, RRS payments under alternative B would generate new total economic impacts of \$49,100 in local output, 1.0 job, and \$29,200 in personal income.

Refuge Visitor Expenditures in Local Economy

Changes in refuge management activities can affect recreational opportunities offered and visitation levels. Table 4.4 shows the estimated visitation levels associated with each visitor activity for alternative B. Under alternative B, visitation is anticipated to increase for all activities compared to alternative A. The increases in visitation levels are due to refuge land acquisition, additional public use infrastructure, and regional visitation trends. Specific details for each activity are explained below.

Accounting for both the direct and secondary effects, spending by non-local refuge visitors for alternative B would generate total economic impacts of \$2.31 million in local output, \$794,600 in personal income, and 34.1 jobs. Most of the increase in visitation is based on the number of people that currently recreate on lands that will be acquired by the refuge. Therefore, it is not a real increase in visitation or economic activity to the area. However, the refuge land acquisition maintains recreation access that is not guaranteed under alternative A. Of the increase in visitation under alternative B, 2,985 out of the 3,569 wildlife viewing related visitor days would be an actual increase in visitation and economic activity to the area that would generate total economic impacts of \$150,900 in local output, 2.4 jobs and \$53,000 in personal income.

Table 4.4. Estimated annual refuge visitation by visitor activity for alternative B.

Visitor Activity	Total # of visits ²	Percentage (%) of non-local visits	Total # of non-local visits	Number of hours spent at refuge	Number of non-local visitor days ¹
Consumptive Use					
Fishing	14,000	70%	9,800	8	9,800
Big Game hunting	6,250	67%	4,188	8	4,188
Upland game hunting	7,500	67%	5,025	8	5,025
Waterfowl and migratory bird hunting	200	60%	120	8	120

Visitor Activity	Total # of visits ²	Percentage (%) of non-local visits	Total # of non-local visits	Number of hours spent at refuge	Number of non-local visitor days ¹
Non-Consumptive Use					
Wildlife viewing: boating/water use	18,000	60%	10,800	8	10,800
Wildlife viewing: nature trails and other wildlife observation	10,000	85%	8,500	2	2,125
Other recreation (snowmobiling)	35,000	60%	21,000	4	10,500
Total	90,950		59,433		42,558

¹ One visitor day = 8 hours.

² Most of the increase in visitation is based on the number of people that currently recreate on lands that will be acquired by the refuge. While it is not a real increase in visitation or economic activity to the area, the refuge land acquisition maintains recreation access that is not guaranteed under Alternative A.

Impacts from Refuge Administration

Proposed staff for alternative B includes all approved staff positions under alternative A, plus an additional three permanent and four seasonal positions. For alternative B, salary spending by refuge personnel would directly account for \$777,800 in local output, 5.4 jobs, and \$127,900 in personal income in the local economy. The secondary or multiplier effects would generate an additional \$131,900 in local output, 1.8 jobs, and \$43,500 in personal income. Accounting for both the direct and secondary effects, salary spending by refuge personnel for alternative B would generate total economic impacts of over \$909,700 in local output, 7.2 jobs and \$171,400 in personal income. Due to the increased staffing levels for alternative B, the associated economic effects of staff salary spending would generate \$276,500 more in local output, 2.2 more jobs, and \$52,100 more in personal income than alternative A.

Work related expenditures under alternative B would directly account for \$141,700 in local output, 1.6 jobs, and \$49,300 in personal income in the local economy. Accounting for both the direct and secondary effects, work related purchases for alternative B would generate a total economic impact of \$193,000 in local output, 2.3 jobs and \$66,300 in personal income. Due to the increased non-salary expenditures for alternative B, the associated economic effects of work related purchases would generate \$66,500 more in local output, 0.8 more of a job, and \$22,900 more in personal income than alternative A.

Impacts from Forest Habitat Management

Timber harvesting in support of focal species habitat management is an economic activity proposed under alternative B on refuge lands. Refuge timber harvest quantities under alternative B are based on a 15% management unit harvest in 15 year intervals, which is described in more detail in the draft CCP/EIS appendix K. Average annual sawtimber, pulp, and fuelwood harvest quantities were determined by refuge personnel and based on two major assumptions: 1) harvest numbers were based on current refuge lands at current stocking volumes; and, 2) as land is acquired (over the next 15 year period) those lands would have been harvested by the private owner prior to sale. Stocking volumes on lands proposed for acquisition

are anticipated to be low and would not allow for additional commercial harvest within the 15 year planning horizon of this draft CCP/EIS. All economic gains would be realized by the private owner prior to Service ownership.

Estimated revenues were based on stumpage value estimates for northern New Hampshire (New Hampshire Department of Revenue 2005). The revenue estimates account for the stumpage values of the different species types (by percent of composition) within the refuge harvest. Over the 15 year refuge harvest cycle, an annual average of 135 MBF of softwood sawtimber, 27 MBF of hardwood sawtimber, 125.3 cords of softwood pulp, 371.3 cords of hardwood pulp, and 88.4 cords of fuelwood would be harvested with stumpage valued at \$27,700. Total sawtimber, pulp and fuelwood product resulting from timber activities in Coos and Oxford counties was estimated to be 657,000 CCF in 2002 (US Forest Service Timber Products Output Data 2002). The total annual harvest quantity under alternative B represents 0.1% of this total.

Accounting for both the direct and secondary effects, timber production related to refuge harvests for alternative B would generate a total economic impact of \$24,500 in local output, one-tenth of job and \$4,000 in personal income. Forest-based industries in Coos and Oxford counties generated over \$1.16 billion in local output and 4,148 jobs in 2002. Therefore, timber production related to refuge harvests for alternative B would have a very insignificant role in the Coos and Oxford counties forest related industries, accounting for less than 0.003% of local output and employment.

Summary of Economic Impacts from Alternative B

Table 4.5 summarizes the change in economic impacts of all refuge management activities for alternative B compared to alternative A in Coos and Oxford counties. Increases in economic impacts under alternative B, when compared to alternative A, are as follows: refuge management activities directly related to all refuge operations generate an estimated additional \$1.28 million in local output, 17.3 jobs and \$412,400 in personal income in the local economy. Including direct, indirect, and induced effects, all refuge activities would generate total economic impacts above those of alternative A of \$1.68 million in local output, 22.8 jobs and \$543,100 in personal income. Total economic impacts associated with refuge operations under alternative B represent less than one percent of total income (0.05%) and total employment (0.11%) in the combined economies of the two counties. Total economic effects of refuge operations play a much larger role in the smaller communities near the refuge such as Errol, NH and Upton ME where most of the refuge related economic activity occurs as compared to the overall, combined economies of the two counties.

Table 4.5. Change in economic impacts under Alternative B compared to Alternative A (2005, \$,000).

	Local Output	Personal Income	Employment (# jobs)
Refuge Revenue Sharing			
Direct Effects	+\$42.5	+\$29.8	+1.0
Total Effects	+\$58.5	+\$35.0	+1.2
Refuge Administration (staff salary spending and work related purchases)			
Direct Effects	+\$285.3	+\$55.9	+2.1
Total Effects	+\$343.0	+\$75.0	+3.0
Public Use Activities			
Direct Effects	+\$930.0	+\$323.4	+14.1
Total Effects	+\$1,258.3	+\$429.2	+18.5

	Local Output	Personal Income	Employment (# jobs)
Habitat Management (timber harvesting)			
Direct Effects	+\$18.6	+\$2.4	+0.1
Total Effects	+\$24.5	+\$4.0	+0.1
Aggregate Impacts			
Direct Effects	+\$1,276.3	+\$412.4	+17.3
Total Effects	+\$1,684.3	+\$543.1	+22.8

Socio-Economic Effects of Alternative C (Natural Processes Management)

Property Tax Impacts and Refuge Revenue Sharing

As explained for alternative B, the loss in local property tax revenue was estimated by using the 2005 current value assessments for each land type to be acquired by fee simple acquisition and the 2005 tax rates for each potentially affected community. All 76,304 acres to be acquired under alternative C would be full fee simple acquisition and would result in an annual loss of \$47,204 in property tax collections in Coos and Oxford counties. RRS payments at the current authorized funding level of 41% would result in an annual payment of \$114,435 which would offset the loss in property tax collections and result in an annual net increase of \$20,206. No town would experience an actual net loss in collections. Cambridge, NH does not assess property taxes and would benefit the most from the RRS payments under alternative C.

Accounting for the current RRS payments of \$37,646 (alternative A) and the \$114,435 increase for new land acquisition, RRS payments would total \$152,081 under alternative C. Accounting for both the direct and secondary effects, RRS payments for alternative C would generate total annual economic impacts of \$209,000 in local output, 4.1 jobs, and \$124,300 in personal income in Coos and Oxford counties. A portion (\$94,228) of the increase in RRS payments under alternative C offsets the loss in private property tax collections which does not represent a real increase economic activity to the area. Accounting for the loss in property tax collections, RRS payments under alternative C would generate new total economic impacts of \$79,500 in local output, 1.6 jobs, and \$47,300 in personal income.

Preparing to snowmobile in the Errol area



Marvin Moriarty/USFWS

Refuge Visitor Expenditures in the Local Economy

Table 4.6 shows the estimated visitation levels associated with each visitor activity for alternative C. Under alternative C, visitation is anticipated to increase for all activities as compared to alternative A. The increase in visitation is due to refuge land acquisition, additional public use infrastructure, and regional visitation trends. Specific details for each activity are explained below.

Table 4.6. Estimated annual refuge visitation by visitor activity for alternative C.

Visitor Activity	Total # of visits ²	Percentage (%) of non-local visits	Total # of non-local visits	Number of hours spent at refuge	Number of non-local visitor days ¹
Consumptive Use					
Fishing	14,000	70%	9,800	8	9,800
Big Game hunting	7,500	67%	5,025	8	5,025
Upland game hunting	9,000	67%	6,030	8	6,030
Waterfowl and migratory bird hunting	200	60%	120	8	120

Visitor Activity	Total # of visits ²	Percentage (%) of non-local visits	Total # of non-local visits	Number of hours spent at refuge	Number of non-local visitor days ¹
Non-Consumptive Use					
Wildlife viewing: boating/water use	18,000	60%	10,800	8	10,800
Wildlife viewing: nature trails and other wildlife observation	10,000	85%	8,500	2	2,125
Other recreation (snowmobiling)	35,000	60%	21,000	4	10,500
Total	93,700		61,275		44,400

¹One visitor day = 8 hours.

² Note: Most of the increase in visitation is based on the number of people that currently recreate on lands that will be acquired by the refuge. While it is not a real increase in visitation or economic activity to the area, the refuge land acquisition maintains recreation access that is not guaranteed under Alternative A.

Accounting for both the direct and secondary effects, spending by non-local refuge visitors under alternative C would generate total economic impacts of \$2.39 million in local output, \$821,500 in personal income, and 35.3 jobs. Most of the increase in visitation is based on the number of people that currently recreate on lands that would be acquired by the refuge which is not a real increase in visitation or economic activity to the area. However, the refuge land acquisition maintains recreation access that is not guaranteed under alternative A. Of the increase in visitation under alternatives B and C, 2,985 out of the 3,569 wildlife viewing related visitor days would be an actual increase in visitation and economic activity to the area that would generate total economic impacts of \$150,900 in local output, 2.4 jobs and \$53,000 in personal income.

Impacts from Refuge Administration

Same as alternative B.

Impacts from Forest Habitat Management

As noted under alternative B, timber harvest in support of habitat management is an economic activity that would occur on refuge lands. Refuge timber harvest quantities for alternative C are based on a 4% management unit harvest in 15 year intervals. The management unit that would be harvested under alternative C is equivalent to the management unit that would be harvested under alternative B. Therefore the only change in refuge timber harvesting between alternatives B and C is the quantity harvested (the same composition of tree species would be harvested). Under alternative B, 15% of the management unit would be harvested in 15 year intervals as compared to only 4% under alternative C. Over the 15 year harvest cycle, the refuge harvest would produce approximately 25% of the quantity harvested for alternative B resulting in an annual harvest average of 33.8 MBF of softwood sawtimber, 6.8 MBF of hardwood sawtimber, 31.3 cords of softwood pulp, 92.8 cords of hardwood pulp, and 22.1 cords of fuelwood with stumpage valued \$6,900.

Timber production in Coos and Oxford counties related to refuge harvests would directly account for \$4,700 in local output and \$600 in personal income in the local economy. The level of refuge timber production for alternative C is not large enough to generate any employment impacts. Accounting for both the direct and secondary effects, timber production related to refuge harvests for alternative

C would generate a total economic impact of \$6,100 in local output and \$1,000 in personal income.

Summary of Economic Impacts for Alternative C

Table 4.7 summarizes the change in economic impacts of all refuge management activities for alternative C compared to alternative A in Coos and Oxford counties. Increases in economic impacts under alternative C, when compared to alternative A, are as follows: refuge management activities directly related to all refuge operations generate an estimated additional \$1.39 million in local output, 19.6 jobs and \$480,500 in personal income in the local economy. Including direct, indirect, and induced effects, all refuge activities would generate total economic impacts above those of alternative A of \$1.84 million in local output, 25.8 jobs and \$625,600 in personal income. Total economic impacts associated with refuge operations under alternative B represent less than one percent of total income (0.05%) and total employment (0.11%) in the combined economies of the two counties. Total economic effects of refuge operations play a much larger role in the smaller communities near the refuge such as Errol, NH and Upton ME where most of the refuge related economic activity occurs as compared to the overall, combined economies of the two counties.

Table 4.7. Change in economic impact under alternative C compared to alternative A (2005, \$,000).

	Local Output	Personal Income	Employment (# jobs)
Refuge Revenue Sharing			
Direct Effects	+\$114.5	+\$79.5	+2.5
Total Effects	+\$157.3	+\$93.5	+3.1
Refuge Administration (staff salary spending and work related purchases)			
Direct Effects	+\$285.3	+\$55.9	+2.1
Total Effects	+\$343.0	+\$75.0	+3.0
Public Use Activities			
Direct Effects	+\$987.3	+\$344.6	15.0
Total Effects	+\$1,336.8	+\$456.1	+19.7
Habitat Management (timber harvesting)			
Direct Effects	\$4.7	\$0.6	0
Total Effects	\$6.1	\$1.0	0
Aggregate Impacts			
Direct Effects	+\$1,391.7	+\$485.5	+19.6
Total Effects	+\$1,843.2	+\$625.6	+25.8

Effects on Air Quality

Chapter 3 - Affected Environment presents the status of air quality in the surrounding refuge landscape. Air quality is good, with no current criteria pollutant exceedances, but of recent concern are ground level ozone and particulate matter that in 2004 exceeded safe health levels.

We evaluated the management actions proposed in each alternative for their potential to help improve air quality, locally, in the region, and globally. The benefits we considered included:

- Potential to adopt energy efficient practices to reduce the refuge's contribution to emissions
- Potential of refuge land conservation to limit the growth of development thereby limiting emission sources and reducing losses of forest vegetation
- Potential of refuge forest management activities to contribute to carbon sequestration and reduce greenhouse gases

The potential adverse effects of the management alternatives that were evaluated included increases in:

- particulates from using burning as a management tool
- vehicle and equipment emissions
- air emissions from new or upgraded building facilities.

Air Quality Impacts That Would Not Vary by Alternative

Overall air quality in the refuge landscape is currently good, with the exception of moderate levels of ozone and particulates that have exceeded safe health levels in the recent past and that contribute to transient visibility problems. Air quality monitoring records for Coos County, NH and Oxford County, ME (EPA 2005) indicate that ozone and PM2.5 have recently exceeded levels considered safe for sensitive subgroups. Air quality index measures show that in 2004, O3 exceeded safe levels on 3 days and PM2.5 exceeded safe levels on 2 days in Coos County. Oxford County had a single day in 2004 with unhealthy PM2.5 levels. Monitoring in 2005 through September indicates O3 and PM2.5 levels in the moderate range just below unhealthy levels.

Regional air quality should not be adversely affected by refuge management activities regardless of which management alternative is selected. None of the alternatives would violate EPA standards; all three would be in compliance with the Clean Air Act.

There are no major stationary or mobile sources of air pollutants at the refuge or in the local vicinity and none would be created under any of the refuge management alternatives. On the contrary, the Service limits human uses of the refuge to compatible wildlife-oriented consumptive and non-consumptive uses and thus curtails anthropogenic sources of emissions by maintaining wetlands and all but a few acres of floodplain and uplands in natural vegetative cover. So the analysis of air quality impacts considered only how the Service's actions at the refuge might affect criteria air pollutants, visibility, and global warming to a minimal degree, focusing on the potential for localized air quality impacts or improvement.

Visibility concerns due to emission-caused haze, at the nearest Class I airshed, the Great Gulf Wilderness Area, would not be affected by any of the proposed management alternatives.

In his review studies on the ecology of fire, D'Avanzo (2004) describes the findings of a number of scientists concerning fire's role in the northern parts of the Northeast:

- According to Niering (1992) mature stands in many areas originated after extensive fires that were fueled by logging debris in the late 19th century. This led to fire-protection policies and the decline of many fire-dependent ecosystems, for example jack pine (*Pinus banksiana*).
- Bormann and Likens (1979) show that human-induced fires are much more common than fires caused by lightning in northern forests. In addition, fires in Vermont and New Hampshire (Green and White Mountains) are quite rare compared to those in national forests in Pennsylvania, Wisconsin, Minnesota, and Michigan. Northern New England forests have been called "asbestos forests" because fires are so relatively uncommon.
- Foster et al. (1997) argue that hurricanes and other wind events are much more important vectors of disturbance here. Factors limiting fire in northern New England include: precipitation throughout the year, resistance of dominant trees to fire, limited litter accumulation, and many sites (e.g. valleys) protected from high winds.

There would be some minor improvements by way of reduced local emission sources and thus benefits to air quality from actions common to all the alternatives. Removing dwellings, such as cabins or other developed sites or structures, on property acquired from willing sellers and restoring developed areas that are no longer needed for refuge administration or programs to natural conditions would eliminate these locations as potential air emission sources.

Reducing road use would reduce on-refuge vehicular emissions. Although we would keep main access roads open to provide motorized and non-motorized access for approved activities, we would retire and restore unnecessary forest interior and secondary roads to promote watershed and resource conservation. All ATV trails and all unauthorized snowmobile trails would be restored to natural vegetation to eliminate their use.

None of the alternatives include an expansion of the existing snowmobile trail system. The increases in snowmobiling attributed to the refuge are due to each alternative's respective refuge expansion proposals, including land with established regional snowmobile trails. In other words, the current capacity on those lands would not change from current levels. Studies in Yellowstone National Park by Bishop et al (2001) found that snowmobiling accounted for 27% of the park's annual emissions of carbon monoxide, and up to 77% of annual hydrocarbons. No studies have been conducted in the Umbagog area, so the percent contribution by snowmobiling to those local emissions levels is not known. However, current levels do not cause the area to exceed federal or state air quality standards. See the compatibility determination for snowmobiling in Appendix C, "Appropriateness and Compatibility Determinations," for additional information.

Similar to snowmobiling, we are not increasing the current capacity for motorized boating on refuge lands. The predicted increases in motorized boating on the refuge are due to each alternative's respective expansion proposal. Motor boats contribute carbon monoxide and hydrocarbons to the air, but the extent of their contribution is not known for the Umbagog area. As with snowmobiling, current levels do not cause the area to exceed federal or state air quality standards. An outreach program is planned under all alternatives to promote the use of 4-stroke engines to mitigate air quality impacts.

Table 4.8 describes the number of visitors anticipated annually under each alternative.

Table 4.8. Annual refuge visits by alternative

Activity	Alternative ¹		
	A	B	C
Consumptive Use			
Fishing	11,000	14,000	14,000
Hunting: Big Game	2,500	6,250	7,500
Hunting: Migratory Birds	150	200	200
Hunting: Upland Game	3,000	7,500	9,000
Non-Consumptive Uses			
Boating/Water Use	14,000	18,000	18,000
Nature trails/other wildlife observation/office visits	4,500	10,000	10,000
Other recreation (snowmobile)	20,000	35,000	35,000
Total annual refuge visits	55,150	90,950	93,700

¹ Note: Most of the increase in visitation under Alternatives B and C is based on the number of people that currently recreate on lands that will be acquired by the refuge. While it is not a real increase in visitation or economic activity to the area, the refuge land acquisition maintains recreation access that is not guaranteed under Alternative A.

To limit smoke and other particulate sources under all alternatives, we would conduct no burning on the refuge, except for burning of demolished cabins.

Wildfire is not a substantive concern on the refuge because of the fire characteristics of the Northern Forest. Termed the “asbestos forest” by some scientists (text box next page) the Northern Forest has a history of very few fires and those of only limited extent. Most fires that do occur are human-caused both historically and at present. Nevertheless, we would seek to minimize the possibility of serious fires and their associated health and safety concerns. We would conduct a wildland urban interface hazard assessment along common boundaries of adjacent private landowners to insure forest management practices are not creating excessive fuel loading that would lead to severe fires.

Refuge Fire Management Plan:

Although the Refuge is not within a Federal Class I Air shed under the Clean Air Act Amendments of 1977, visibility and clean air are valued natural resources and their protection would be given full consideration in fire management planning and operations. The Refuge will comply with all applicable federal, state, and local air pollution control requirements, as specified within Section 118 of the Clean Air Act, as amended (42 USO 7418). Further guidance is found within the Service’s Fire Management Handbook.

An issue with wildland fire is public and fire fighter safety and health. The Refuge is to take aggressive action to manage smoke to prevent reduced visibility hazards, public safety, fire fighter exposure, and overall air quality (reduce particulate emissions). By minimizing the acreage burned, notifying the public, and restricting access these issues can be mitigated.

Construction and operation of a new visitor contact station and headquarters building at the Potter Farm location would be done under alternatives B and C and cause some local air quality impacts. The size of the facility would vary by alternative as discussed below.

We would introduce energy efficiency measures in our operations that would also reduce emissions. All motorized equipment would be upgraded to 4-stroke equipment whenever a current piece of equipment is retired. We would improve insulation in buildings, use radiant heat where feasible, and fluorescent lights where ever possible.

Air Quality Effects of Alternative A (Current Management)

Air Quality Benefits

Proposed refuge management activities would neither substantively benefit nor adversely affect currently good local and regional air quality, with no violations of Federal or State Clean Air Act standards, no impacts to nearby Class I areas, and no cumulative effects on regional ozone or particulate matter pollutant levels.

There would be minor air quality benefits from the air pollutant filtering effects of 15,450 current and up to 5,985 newly acquired acres of upland, floodplain, lake shore, riparian and wetlands vegetation and from adopting energy efficient practices. There would be a negligible reduction in atmospheric carbon due to the sequestering effects of 10,845 current and up to 4,838 newly acquired forested acres. Benefits would be limited to land purchases within the current refuge acquisition boundary in contrast to alternatives B and C that substantially expand the conserved lands base.

Forest management under alternative A would be limited to passive management of existing forest cover. No other forest management activities would be conducted. This would further limit the potential for the beneficial effects of carbon sequestration compared to alternatives B and C.

Adverse Air Quality Impacts

Alternative A would include few ground disturbing activities and introduce few additional emission sources.

Air Quality Effects of Alternative B (Focal Species Management)

An increase of about 5,000 annual refuge visits by motor vehicle, and little to no predicted increase in current snowmobile and motor boat use on refuge lands, would cause a minor increase in air emissions in the long term and contribute minimally to potential cumulative effects.

Air Quality Benefits
The effects of alternative B would be similar to alternative A. There would be no substantive change in air quality; no violation of air quality standards, no impacts to Class I areas, and no cumulative effects on ozone and particulate matter. Locally there would be more minor benefits than alternative A but also more potential adverse effects.

Air quality benefits would increase from maintaining up to 76,939 acres (existing and expanded refuge lands) of natural vegetation to filter air and from more energy efficient refuge operations. Acquiring up to 43,928 forested acres on expansion lands would stem nearby development growth and reduce potential air emissions from homes, businesses, camps, vehicles, off-road vehicles and equipment.

We would institute longer rotations in forest management on these lands than have been used by commercial timber managers so that carbon sequestration benefits would increase. Longer forest rotations would improve the health, diversity, and resilience of the forest to disturbance, disease and insect outbreaks, thus maintaining an important carbon “sink.” Similar, though more limited benefits would also accrue from acquisition of forested lands within the current acquisition boundary.

Adverse Air Quality Impacts

The new Potter Farm visitor facility would be a standard design small office building. Construction of the visitor facility and construction, renovation, or demolition activities associated with other refuge improvements (text box) would cause short-term, localized effects from construction vehicle and equipment exhausts. Operation of the facility would slightly increase stationary source emissions at the site.

Projected annual refuge use levels of 90,950 visits would increase vehicle emissions on and near the refuge in the longer term. The contribution to cumulative local and regional air quality effects would likely be compensated for to a large degree by precluding development in the expansion area.

Restoration or New Construction Activities Under Alternatives B&C

BUILDINGS/STRUCTURES – Changes proposed under Alts B/C

- 2 buildings would remain intact to serve their current function
- Carmen House (quarters)
- Stranger House (quarters)
- 2 buildings would be converted or expanded
- Office – converted to a research facility
- Shop – add a 30 x 100 storage building
- 1 building would be constructed – Potter Farm – would be converted to offices under all three alternatives
- Alt B small office standard design
- Alt C medium office standard design
- 1 building would be demolished
- Cabin at Office – demolish

CABINS

- 13 cabins would be demolished and disposed

RECREATION/INFORMATION FACILITIES with Kiosks

- Magalloway River Canoe trail/launch (w/kiosk)
- Magalloway River Trail extension – 1/4 mile through woods, stone dust trail
- Trail at Potter Farm – 1.8 miles long, 3 feet wide, dirt/wood chip trail (see Oak Point report)
- Trail in expansion – approximately 1 mile long on old logging road
- 2 pullouts - 1/2 acre gravel with wooden guard rails
- Overlook at 26 NH/ME line – 1 acre parking lot 24X24 deck

Air emissions from snowmobiles and motor boats would not significantly increase even though the projected estimate of those activities increases. The predicted increase in visitors engaged in those activities is due to Service acquisition of lands in private ownership currently used by snowmobilers and boaters, rather than any true increase in numbers or capacity for those activities in the Umbagog area.

Air Quality Effects of Alternative C (Natural Processes Management)

Air Quality Benefits

Under alternative C we would expand the refuge land base outside the current acquisition boundary. The expansion area would include 69,702 acres of upland forested lands that would be managed in 25,000-acre or larger contiguous, unfragmented blocks, to create a mosaic of conifer and hardwood stands. Management actions would be designed to simulate a mix of stand age and structure that would occur under natural environmental influences. Similar to alternative B, this expanded land acquisition would stem nearby increases in development of second homes and seasonal use homes, thereby substantially reducing the long term potential for air emissions from homes, businesses, camps, vehicles and equipment.

We would utilize accepted forest management practices on these lands with longer rotation ages than commercial timber operations use, which would result in increased carbon sequestration. The predominance of more mature stands would improve the health, diversity, and resilience of the forest to disturbance, disease and insect outbreaks, thus maintaining an important carbon “sink.” Similar, though more limited benefits would also accrue from acquisition of forested lands within the current acquisition boundary.

Adverse Air Quality Impacts

The new Potter Farm visitor facility would be a standard design medium office building. Construction of the visitor facility and construction, renovation, or demolition activities associated with other refuge improvements (see text box above) would cause short-term, localized effects from construction vehicle and equipment exhausts. Operation of the facility would slightly increase stationary source emissions at the site.

We would upgrade our refuge maintenance operations to include energy efficient vehicles and equipment.

Projected annual refuge use levels of 93,700 visits would increase vehicle emissions on and near the refuge in the longer term. The contribution to cumulative local and regional air quality effects would likely be compensated for to a large degree by precluding development in the expansion area. Similar to alternative B, although the refuge land base supporting snowmobiling and motor boating would increase, snowmobiling and boater numbers would simply be transferred to our counts and air emissions would not significantly increase over current levels.

Effects on Soils

Soils are the structural matrix and nutrient source for plant productivity at the refuge and must be protected to sustain the variety of wetland, riparian, and upland habitats that would meet our habitat and species management goals. Overall, the soils of the refuge are productive and in good condition, with no substantive erosion, compaction, or contamination problems. In certain areas such as cliffs, soils are absent or patchy, thin, and susceptible to disturbance so we would manage these areas to limit any human disturbance.

We evaluated and compared the management actions proposed for each of the refuge CCP alternatives on the basis of their potential to benefit or adversely affect upland soils and soils of the refuge’s floodplains, lake shore, and riparian

areas. Impacts of the alternatives to wetland soils are discussed in the wetlands section.

We compared the benefits of the alternatives from actions that would protect soils from erosion, compaction, or contamination or that would restore eroded, compacted, or contaminated soils, including the:

- Extent to which refuge land acquisition and conservation under the alternative would limit the growth of nearby development or recreational use thereby reducing loss of forest vegetation and human disturbance and their potential soil impacts
- Extent to which the alternative would replace private forest management on acquired expansion lands with Service management that would improve soil protection
- Potential for camp site acquisition and closure and restoration of access roads and trails to provide opportunities to restore soils
- The potential adverse soil effects of the refuge management alternatives that were evaluated included impacts from:
 - construction of buildings, parking facilities, access roads, and interpretive trails
 - forest management activities, including tree-cutting, and use of roads and skid trails
 - site clearing for focal species management
 - hiking, camping, or other refuge visitor activities
 - wildland fire suppression policies and methods

Soil Impacts That Would Not Vary by Alternative

Regardless of which alternative is selected, we would continue to use best management practices in all management activities that might affect refuge soils to ensure that we maintain refuge soil productivity. Forest management activities would be strictly constrained by resource sensitivity which limits management on 4,478 acres of industry inoperable lands and 2,663 acres of high resource sensitivity areas to individual tree treatments for the benefit of wildlife.

We would restore developed sites with buildings or other infrastructure that have been acquired or that are no longer needed for refuge purposes to natural topography and hydrologic conditions and return to native vegetation as quickly as feasible. In general, existing main access roads would remain open to provide motorized and non-motorized access for approved activities. Other designated motorized access may be developed in the expansion area once a minimum manageable unit is acquired.

Because wildfires can lead to substantive erosion and sedimentation when followed by precipitation, we would take steps to insure that our forest management practices are not creating major fuel loads that would lead to soil-damaging fires. These high temperature and sometimes extensive fires are unlikely to occur at the refuge because of the fire-resistant nature of the Northern Forest (see Air Quality section). Nevertheless, any areas that are burned would be stabilized with erosion control measures and re-vegetated to minimize the potential for damaging erosion.

Under all alternatives, 12 existing remote lake campsites on refuge lands would be maintained. No increased capacity is planned. These sites have been established for years. Regularly used campsites result in soil compaction and reduction in soil moisture. Camping may reduce or remove the organic litter and soil layer, and run-off, and soil erosion may increase. Those changes affect soil invertebrates and microbial processes, and inhibit plant growth. Campsites accessed from the water may also undergo shoreline erosion from the effects of repeated boat landings compacting and removing vegetation. Camp fires create additional impacts. Camp fires destroy organic matter in the soil chemistry to a point that could effectively “sterilize” the soil, making re-vegetation difficult.

Studies indicate that camping impacts may be locally quite severe, but are usually restricted to a relatively small area, i.e. the campsite itself. Significant impacts on vegetation and soil generally occur quickly, even with light use. Much of the impact occurs when the campsite is first opened and during the first year of use. See the compatibility determination for camping in appendix C, “Appropriateness and Compatibility Determinations,” for additional details on those studies. Under all alternatives we plan an outreach program to promote “Leave No Trace” principles.

Off-road vehicles, such as motorbikes and ATVs, are not allowed on the refuge, but violations do occur occasionally. These vehicles can cause serious soil disturbance, compaction, and erosion, especially when they are not on hardened roads. Deteriorating forest roads can also be a locus for such soil impacts. To minimize these impacts, we would inventory and assess all access roads within the refuge within 5 years of CCP completion, and on any newly acquired lands, and implement procedures to retire and restore unnecessary forest interior and secondary roads to promote watershed and resource conservation. We would also restore any off-road vehicle or unauthorized snowmobile trails to eliminate their use. Increased law enforcement would also help reduce those violations contributing to soil impacts.

All designated snowmobile trails on the refuge would be through trails only; we would not provide parking, warming huts, or other infrastructure on refuge lands. No new snowmobile trails are planned under any alternative. Published studies have resulted in differing conclusions as to whether snowmobiling necessarily causes soil compaction. The only common determination is that snowmobile trails on steep, south facing slopes (e.g. > 30 degrees) have a higher likelihood of impact. Damage primarily resulted from decreased snow depths, due to greater solar radiation on south slopes, together with increased pressure of snowmobile treads on steeper slopes. This situation occurs rarely, if at all, on refuge trails. However, we plan to evaluate all trails each 5 years to ensure no site-specific impacts are occurring. Some of these trails may be re-routed or closed, if it is determined that they have a significant negative impact on soils, wildlife or habitat.

Regardless of alternative, site conditions including soil condition, elevation, slope, aspect, and hydrology would be the ultimate determinant of the habitat management potential for any particular site on the refuge. No site would be managed in a manner inconsistent with its recognized potential.

Soil Impacts of Alternative A (Current Management)

Soil Benefits

Alternative A is the least desirable alternative in terms of potential benefits from acquisition and conservation of additional lands and the potential for site restoration. We would be limited to purchase of 5,830 acres of forested and recently harvested upland, lakeshore, and floodplain lands within the current

refuge acquisition boundary in contrast to alternatives B and C that would allow us to substantially expand the conserved land base (see text box). There would be no opportunity to protect or restore roads, trails, or sites outside the current refuge boundary so soil impacts from management or development of those lands would continue and likely would increase over the long term.

Forested and Recently Harvested Uplands, Lakeshore, and Floodplain Lands Protected by CCP Alternatives

Alternative A – 19,105 acres within current refuge acquisition boundary

Alternative B – 63,169 acres in fee lands and easements including expansion area

Alternative C – 88,947 acres in fee lands including expansion area

Our forest management under alternative A would be limited to a custodial role in conserving existing forest cover. Other than fire protection, we would not actively manage the refuge forested uplands.

Adverse Soil Impacts

Alternative A would include few ground disturbing activities that might adversely affect refuge soils. We would not conduct forest management activities, virtually eliminating any minimal potential for localized soil damage from tree-cutting, skid roads, or trails. . This should eliminate any potential for significant cumulative effects. Visitation under alternative A would not appreciably change over current levels and is expected to be lower than under either of the other alternatives. As such, visitor activities that might impact soils, such as hiking off designated trails, camping, snowmobiling, and boat launching would pose the lowest concern.

Soil Impacts of Alternative B (Focal Species Management)

Soil Benefits

Alternative B would provide increased benefits over alternative A and also increased localized adverse effects to refuge soils. Expanding the refuge land base under alternative B by nearly 48,000 acres would eliminate the potential for large-scale development on these lands and reduce the long term potential for the resulting soil impacts.

It is unlikely that any significant forest management operations would occur on expansion lands within the first 15 years or longer after the CCP is implemented, except for pre-commercial thinning or similar non-commercial operations. However, restoration of roads and trails and fire suppression practices on the expansion lands would help reduce soil erosion from such disturbed sites. When the expansion area forests have reached manageable age classes, we would use improved forest management practices in terms of measures to protect the soil. Longer forest rotations would improve the health, diversity, and resilience of the forest to disturbance, disease and insect outbreaks and thereby help maintain protective vegetative cover. New roads or trails needed for forest management would be limited to those necessary to access the stands, would be used less often because of the longer rotations, and would be restored to vegetation after use.

Wetlands soils impacts.—Under alternative B we may conduct a hydro-geologic study of groundwater and nutrient flow that are maintaining peatlands and we would address issues or threats as necessary.

Adverse Soil Impacts

Impacts from construction of buildings, kiosks, boat launch, parking facilities, roads and trails.—Under the expanded construction program noted in the

section on Air Quality, there would be localized soil compaction and loss of soil productivity where soils are removed or surfaced for new structures, kiosks, boat launch, parking facilities, roads, and trails and in immediately adjacent areas where vehicles and heavy equipment are used for site access and preparation work. These impacts would constitute an unavoidable adverse impact of these refuge infrastructure improvements but would comprise, in total, no more than 50 acres of the nearly 48,000 acres of alternative B refuge expansion lands. Offsetting these soil impacts would be reclamation of natural soil productivity on restored cabin sites, campsites, trails, and roads.

Boardwalks would be constructed over saturated areas to protect sensitive wetland vegetation. No construction other than placement of boardwalk pilings would be done in wetlands so there should be negligible localized effects to wetland soils.

Impacts from increased visitation. — As we discuss under “Soil impacts that would not vary by alternative” above, the projected increases in annual refuge use levels for those activities likely to impact soils is a primarily a result of increased land acquisition. The capacity for snowmobiling and remote lake camping on refuge lands, for example, would not increase as we do not plan to expand the existing snowmobile trail system or number of campsites. Any contribution to cumulative local and regional soil quality and productivity effects would likely be compensated for to a large degree by precluding development in the expansion area.

Compaction and erosion from forest management activities.—There would be short-term, localized soils impacts from forest management practices including stand cutting, and clearing for access roads and skid trails. We would minimize these impacts by adhering strictly to best management practices for our forest management operations.

Table 4.9. Manageable forest habitat on the Lake Umbagog Refuge in next 15 years under the CCP

Forest Type	Acres
Hardwood	804
Softwood	1,032
Mixed Woods	2,205
TOTAL	4,041

In the next 15 years, we would limit forest management to approximately 4,000 acres (see table 4.9) of current refuge fee-owned lands in a mature age class and stand condition, which occur in the Low or Moderate Resource Sensitivity Zones. We would manage forest lands in the Low Resource Sensitivity Zone within the current refuge acquisition boundary as well as those in the expansion area according to best management practices recommended for New Hampshire and Maine and to meet or exceed New Hampshire and Maine forest certification standards.

We would manage forests in the Moderate Sensitivity Zone only to the extent necessary to achieve specific wildlife or plant community objectives. We would severely limit forest management within High Resource Sensitivity Zone to single tree techniques such as single tree felling or girdling or small group

selection to benefit wildlife. **Damage from fire.**—Soil damage from fires or from erosion on fire-damaged sites is unlikely to occur on the refuge. Nevertheless, all wildland fires would be suppressed with fire fighter and public safety as the highest priority. Although wildland fires rarely occur in the Lake Umbagog lake area, we would protect against wildland fire whenever it threatens human life, property, and natural or cultural resources. Fires would be suppressed in a prompt, safe, aggressive, and cost-effective manner to minimize adverse impacts to resources and acreage.

Focal Bird Species of Refuge Wetlands and Open Water and Submerged Aquatic Vegetation Habitats

- Common Loon
- American black duck
- Ring-necked duck
- Wood duck
- Common goldeneye
- Black-backed woodpecker
- Rusty blackbird

Soil Impacts of Alternative C (Natural Processes Management)

Soil Benefits

From a watershed perspective, alternative C would be the most beneficial in terms of the total land area conserved and resulting reduced potential for soils impacts. We would expand the refuge land base under alternative C by more than 74,000 acres, eliminating to a greater extent than alternative B the potential for development of second homes and seasonal use homes or off-road vehicle use on these lands. This should substantially reduce the long term potential for soil impacts from construction and from off-road vehicles.

Once these expansion land forests have recovered from their last cut and reached manageable status, we would manage forests on expansion lands in contiguous 25,000 acre blocks to create a mix of age and structure to simulate what would occur under natural environmental conditions without human intervention. Longer forest rotations, which would improve the health, diversity, and resilience of the forest to disturbance, disease and insect outbreaks, would help maintain protective vegetative cover. Existing unnecessary roads and trails would be restored. New roads or trails needed for forest management would be limited to those necessary to access the stands, would be used less often because of the longer rotations, and would be restored to vegetation after use.

Adverse Soil Impacts

Impacts from construction of buildings, parking facilities roads and trails.— Impacts here would be the same as those discussed under alternative B.

Impacts from increased visitation.— Impacts here would be the same as those discussed under alternative B.

Impacts from forest management activities.—There would be short-term, localized soils impacts from forest management practices including stand cutting, and clearing for access roads and skid trails. As in alternative B, we would minimize these impacts by adhering strictly to best management practices for forest management operations on approximately 4,000 acres of current refuge upland forest in the Low and Moderate Resource Sensitivity Zones. We would severely limit forest management within the High Resource Sensitivity Zone to single tree techniques such as single tree felling or girdling or small group selection to benefit wildlife.

Impacts from fire.—Soil damage from fires or erosion on fire-damaged sites is unlikely to occur on the refuge. Although wildland fires rarely occur in the Lake Umbagog refuge area, under alternative C we would allow naturally ignited fires to burn until a human resource is threatened. We would protect against wildland fire only when it threatens human life or property. We would conduct no salvage

Effects on Hydrology and Water Quality

harvest after fire or windthrow event and would not allow collection or removal of dead and down wood except in WUI areas.

Management actions proposed for the refuge's CCP alternatives were evaluated and compared based on their potential to help maintain and improve the hydrology and water quality of Umbagog Lake, and the wetlands, rivers, ponds, and vernal pools in the Upper Androscoggin River watershed. We evaluated the benefits of actions that would protect or restore the hydrology or maintain or improve water quality:

- Land acquisition and conservation that would provide watershed benefits by limiting land clearing and changes in local hydrology
- Camp site restoration that would reduce erosion and restore site hydrology
- Improvements in local hydrology through road reconstruction or removal and culvert removal
- Work in partnership with FERC licensee to manage lake water levels at all seasons to benefit wetlands and focal species
- Improved water quality monitoring for early problem identification
- Improved cooperation of other landowners in watershed to influence water quality

We evaluated and compared the impacts of refuge management actions with the potential to cause adverse effects to hydrology and water quality including:

- Creation of wetland openings (e.g. in cattails) to benefit waterfowl
- Changes in recreational boating activities that might lead to lake and river contamination with petroleum products

Hydrology and Water Quality Impacts That Would Not Vary by Alternative



USFWS

Conducting water studies on the refuge

Hydrology and Water Quality Benefits

Decision making based on comprehensive scientific data.—Regardless of which alternative we select, we would take a number of steps to insure that we have sufficient scientific data to support management decisions regarding refuge hydrology and water quality. We would conduct a systems analysis to determine the lake bathymetry and annual hydrology. We may also conduct a sediment analysis, identify wetland functions and measures of integrity, and evaluate water quality and the effect on Federal trust species. We would use this information to evaluate wetland habitat availability and quality from different water level regimes on Federal trust resources. Finally, we would work with State agencies and other conservation partners to identify sources of point and non-point sediment and nutrient loading (e.g. septic systems, erosion, etc) impacting refuge wetlands, and associated lakes and rivers, and address these sources where possible.

Benefit to the FINNL wetland.—The Floating Island National Natural Landmark would benefit by more ecologically based management. We would propose to the Park Service an expanded boundary that is more ecologically based, using recent vegetation surveys (see map 2-1).

Adverse Hydrology and Water Quality Impacts

In managing the refuge, we would closely monitor and mitigate all of our routine activities that have some potential to result in chemical contamination of water

directly through leakage or spills or indirectly through soil runoff. These include use of motorized watercraft, control of weeds and insects around structures, use of chemicals for de-icing roads and walkways, and use of soaps and detergents for cleaning vehicles and equipment. Personnel would take the following precautions to minimize the potential for the chemicals and petroleum products becoming a water quality problem:

- Pouring or mixing of chemicals or petroleum products would be conducted no closer than 25 feet from surface water and over a non-porous surface material
- All staff would be trained in spill prevention and spill response

Invasive plant control with herbicides.—Regardless of the alternative selected, the herbicide active ingredient glyphosate, formulated as Rodeo[®], would be used as one method to prevent establishment and spread of invasive wetland plants, in particular, purple loosestrife, Japanese knotweed, and *Phragmites*. The Regional Contaminants Specialist, who is responsible for upholding Federal standards for water quality and soil protection, has reviewed our proposals and approves our chemical herbicide use.

There would be a potential for herbicide concentrations in lakes and ponds to build up to chronic levels over time. The potential depends on the balance of pesticide input and removal from the lake or pond system. Herbicide inputs may occur either through direct application, water inflow, or through resuspension and diffusion from the sediment layer. Herbicide removal from the system may occur through outflow, degradation, volatilization, and settling or diffusion into the underlying sediment (Neitsch et al. 2001).

The rate of herbicide degradation is an important consideration for assessing the effects of a given herbicide on ponds and lakes. Glyphosate degrades in water with a reported half-life in water that ranges from 3.5 to 70 days depending on the rate of transfer to the sediment layer and testing source (SERA 1996). Based on the relatively short half-life, the large water volume of the lakes, rivers, and wetlands, and the limited acreage likely to require treatment (currently less than 1 acre) it is not expected that any discernable effects would occur to these water resources as a result of herbicide treatments.

Impacts from increased visitation.—All alternatives predict some increase in annual visitor numbers; however, the increase varies due to each alternative's respective refuge expansion proposal. Alternative A predicts the lowest annual increase, since no expansion is proposed, while alternative C predicts the highest increase due to its larger refuge expansion proposal. Camping, boating, and snowmobiling are three visitor activities that have some potential to impact water quality, even at current use levels. We do not plan to increase capacity for these activities on existing refuge lands, or on lands to be acquired, regardless of alternative; rather, we plan to maintain existing use levels.

Camping can compromise water quality through improperly disposed human waste at campsites by introducing pathogens. Human and pet waste, food disposal and dishwashing may increase aquatic nutrient loads. That may result in limited, localized increases in algal growth, facilitating oxygen depletion and altering the composition of aquatic vegetation and invertebrate communities. Runoff from eroded campsites can increase turbidity and sedimentation, which may affect fish and invertebrates. Pit toilets located near water in shallow, permeable soils can sometimes introduce coliform bacteria into the water. However, camping rarely affects water quality to the point it is a public health

concern (Cole, 1981), and we do not predict the camping we propose would pose a risk to water quality and public health under any alternative.

Boating can impact water quality from improperly cleaned motor boats, which may introduce invasive aquatic species from other water bodies. Soap from improper dishwashing, trash and fish-cleaning waste may each pollute water.

Snowmobiling is documented to contribute petroleum hydrocarbons after ice-out in small shallow water bodies exposed to snowmobile exhaust. The concentration of hydrocarbons in snow is likely to be particularly high on trails where regular grooming constantly packs exposed snow. Spring snowmelt may release those hydrocarbons into streams or other bodies of water. To what extent the water bodies on the refuge are at risk of hydrocarbon pollution is unclear given current levels of snowmobile use, recent improvements in snowmobile technologies, and the large volumes of water in these local systems. The compatibility determination for snowmobiling in appendix C, "Appropriateness and Compatibility Determinations," provides additional references on snowmobiling impacts.

Hydrology and Water Quality Impacts of Alternative A

Benefits

We would expect some increase in hydrology and water quality benefits from acquisition and conservation of more than 7,400 additional acres of upland forest, lakeshore, wetlands and other lands within the acquisition boundary under alternative A because we would prohibit potentially damaging development and otherwise incompatible uses.

We would not make improvements in local hydrology through road reconstruction or removal or culvert removal. However, we would realize water quality benefits from improved monitoring and cooperation of watershed landowners. Loons would continue as indicator of effectiveness of water level management on nesting wildlife.

On a site basis, camp restoration would reduce erosion and restore site hydrology. Stringent precautions in conducting refuge management activities would prevent chemical contamination of water directly through leaks or spills or indirectly through soil runoff.

Adverse Impacts

Under alternative A, we would not create wetland openings to manage waterfowl, eliminating their potential short-term impacts.

Fishing and hunting activities in the Upper Androscoggin River watershed are not expected to increase under alternative A, but non-consumptive uses associated with wildlife viewing, such as hiking, wildlife photography, canoeing and kayaking would likely increase based on trends in non-consumptive use in the Region. So there may be an increase in the potential for changes in recreational boating activities that might lead to lake and river contamination with petroleum products. Public outreach on that and other issues such as invasive aquatic weeds, invasive fish, and lead contamination would help mitigate that risk.

Hydrology and Water Quality Impacts of Alternative B

Benefits

By expanding the refuge by up to 47,807 acres in land acquisition and easements under alternative B we would provide substantial additional watershed benefits by limiting land clearing and changes in local hydrology that might otherwise affect those areas from development.

We would increase camp site restoration that would reduce erosion and restore site hydrology and we would improve local hydrology through road reconstruction

or removal. Under alternative B we would also restore the hydrology of areas such as the Day Flats area by plugging ditches and re-contouring the disturbed areas.

Water quality benefits would improve from a strengthened partnership with FPLE, the FERC licensee in determining lake water levels at all seasons, upgraded monitoring, and greater efforts in seeking cooperation of watershed landowners. We would work with the States of New Hampshire and Maine to establish an Umbagog Lake Working Group to develop regulations and best management practices for activities on the lake and rivers, that would help maintain good water quality, such as a boater ethics program that would include proper waste disposal protocol, elimination of lead fishing tackle, and use of wake zones and appropriate locations for access.

Adverse Impacts

Fishing and hunting activities in the Upper Androscoggin River watershed are not expected to increase under alternative B, but non-consumptive uses associated with wildlife viewing, such as hiking, wildlife photography, canoeing and kayaking would likely increase based on trends in non-consumptive use in the Region and the improved visitor facilities proposed under this alternative. Impacts predicted for camping, boating, and snowmobiling are noted above under “Hydrology and Water Quality Impacts that would not vary by Alternative.”

Benefits

Similar to alternative B, by expanding the refuge by up to 74,414 acres in land acquisition under alternative C we would provide substantial additional watershed benefits by limiting land clearing and changes in local hydrology that might otherwise affect those areas from development.

We would increase camp site restoration, reduce erosion and restore site hydrology and we would improve local hydrology through road reconstruction or removal and culvert removal. We would also restore the hydrology of the Day Flats area by plugging ditches and re-contouring the disturbed areas.

We would promote a more natural hydrologic regime, would monitor to determine if this causes adverse water quality effects, and would alter management accordingly.

We would work with the States of New Hampshire and Maine to establish an Umbagog Working Group to develop voluntary best management practices for activities on the lake and rivers, that would help maintain good water quality, such as boater ethics program that would include proper waste disposal protocol, elimination of lead fishing tackle, and use of wake zones and appropriate locations for access.

Adverse Impacts

Under alternative C, we would increase staffing and engage in a higher level of routine refuge management activities that may result in a somewhat higher potential for incidence of chemical contamination of water directly through leakage or spills or indirectly through soil runoff than alternative A. We would follow the same measures outline under alternative A to minimize these effects.

We would not create wetland openings to manage for waterfowl thereby avoiding any adverse impact to water quality during the installation phase.

Under alternative C non-consumptive visitor uses associated with wildlife viewing, such as hiking, wildlife photography, canoeing and kayaking would likely increase based on trends in non-consumptive use in the Region in general, and

Hydrology and Water Quality Impacts of Alternative C

Effects on Open Water and Submerged Aquatic Vegetation and Wetland Habitats and Species

the improved visitor facilities proposed under this alternative. Impacts predicted for camping, boating, and snowmobiling are noted above under “Hydrology and Water Quality Impacts that would not vary by Alternative.”

Wetlands management and conservation is our highest priority for the refuge, consistent with the original refuge establishment purpose, and our first and foremost CCP goal. We evaluated the management actions proposed for each of the refuge CCP alternatives for their potential to benefit or adversely affect open water and submerged aquatic vegetation, and wetland habitats—including fen and flooded meadow, boreal fen and bog, northern white cedar forest, and scrub-shrub wetland—and associated focal species.

Benefits

We evaluated the benefits of our actions that would conserve or restore the open water and submerged aquatic vegetation and wetlands habitats or conserve and enhance breeding or migrating focal species, including:

- Acquisition and conservation of additional wetlands
- Conversion of certain areas to more productive or unique wetlands
- Management to prevent the growth of invasive species
- Manipulation of Umbagog Lake water levels to maintain or expand wetlands and to seasonally benefit focal species
- Control of predators that affect nesting or migratory species

Adverse Impacts

We evaluated the potential for the actions proposed under the Lake Umbagog refuge management alternatives to cause adverse effects to open water and submerged aquatic vegetation and wetlands habitats, including:

- actions causing soil, hydrology, and water quality impacts that might adversely affect open water biota and wetlands maintenance and productivity
- actions such as vegetation management and promotion or creation of ponds, that might adversely affect open water biota and wetlands maintenance and productivity
- activities of refuge visitors and lake users that might directly impact wetlands habitats or disturb nesting or migratory species

Open Water and Submerged Aquatic Vegetation and Wetland Habitat and Species Impacts That Would Not Vary by Alternative

Wetlands Conservation.—Regardless of which CCP alternative we select, we would continue to conserve the refuge wetlands as the highest priority for refuge management. Because the extent of the unique wetlands complex at the refuge is largely a function of the impounding of Umbagog Lake, we expect that Umbagog Lake water levels would continue to fluctuate, but only within the current bounds of 1,247 ft above mean sea level (MSL) high and 1,238 ft MSL low, regardless of any future changes in management arrangements concerning management of Errol Dam. We also expect that the dam system upriver from the refuge would continue to function within the current system bounds.

We expect that the forested Upper Androscoggin River watershed would remain largely forested and that only excessively prolonged periods of heavy rainfall or prolonged extensive drought, neither of which has been known to occur in this region, would alter the hydrologic regime.

Other than very gradual losses of acreage in particular wetland types resulting from natural succession, we anticipate that any adverse impacts to the refuge wetlands complex would likely be a result of changes in local hydrology or water quality originating within the Upper Androscoggin River watershed or from direct human disturbance or the influx of invasive species. Regardless of which CCP alternative we select, we would develop a HMP and IMP for wetland habitats, and would mitigate any potential for major unplanned changes in vegetation by continuously monitoring our vegetation types and updating our GIS database at least every 5 years.

Water Level Effects on Loon and Other Species.—Under all alternatives we will continue to cooperate with the FERC licensee and other regulatory agencies under the existing license for Errol Dam, to develop a yearly water level management plan “to benefit nesting wildlife.” We will continue to promote stable water levels during the nesting season to the extent possible under the current agreement. We will also collect detailed information on the impacts of fluctuating water levels, which may lead us to request a modification of the license agreement. We will also continue to recommend that water levels be managed at other critical times of the year (e.g. during fall migration) to benefit wildlife.

Rare Communities.—Regardless of alternative, we would take all measures necessary to conserve the rare wetland communities on the refuge. We would survey the FINNL and other unique or rare plant communities as a priority and in cooperation with the NPS, would expand the boundary of the FINNL to one that is more ecologically based using the 2002-2003 vegetation surveys (see map 2-1). Within 2 years of CCP completion, we would conduct all administrative procedures to expand the boundary. Also, within 3 years of CCP completion, we would convene a workshop with wetlands ecologists to determine what information should be collected and what monitoring should occur to document any potential loss or degradation of the area. We would also establish a baseline from which to compare subsequent information.

- | |
|---|
| <p>Rare & Uncommon Plants in Refuge Fens</p> <ul style="list-style-type: none"> • Narrow-leaved cotton grass • Heart-leaved twayblade • Creeping sedge • Meager sedge • Livid sedge • Thin-flowered sedge • Moor rush • Dragon’s mouth • Pursh’s goldenrod • Cotton bulrush • Orchid’s rose pogonia • Grass pink |
|---|

Purple loosestrife



Invasive Plants.—Invasive plants can cause major damage to native plant assemblages and the wildlife they support if invasive populations are allowed to become established and spread. We would take steps to insure that invasive species do not become established to degrade the wetlands by conducting a systematic survey for invasive species and removing them where they occur. Key among these invasive plants are purple loosestrife, Japanese knotweed, and *Phragmites*. We would take proper care of all refuge equipment to avoid introduction or transport of invasive plants, implement outreach and education programs, and actively support State initiatives and continue to work with States to prevent introduction of invasive species to all water bodies on the refuge.

Umbagog Lake “Working Group.”—As described in chapter 2, we propose creating an Umbagog Lake Working Group under all alternatives that would coordinate voluntary efforts to reduce resource threats and resolve user conflicts on the lake. Priority projects for the working group would include working with the States and others to help:

- reduce wildlife exposure to lead
- reduce boating conflicts and user and landowner impacts at access sites and on the lake

- establish refuge and lake user “carrying capacities” and “thresholds of acceptable change” to minimize user conflicts and impacts on wildlife and habitats;
- reduce boat wake impacts on the Magalloway and Androscoggin rivers
- determine if changes to current area closure protection measures are warranted
- identify and address point and non-point sediment and nutrient loading sources where possible

Impacts from furbearer management.—Under alternatives B and C, furbearer management program may include trapping as an administrative management tool. The furbearer management program would not be designed to eliminate targeted furbearer populations, but rather, remove individuals in those areas where they are negatively impacting biological resources, facilities, or creating a human health and safety concern. Trapping these species would occur only after full consideration of mitigating impacts with less than lethal techniques is determined to be cost prohibitive or impractical.

After final approval of the CCP, a furbearer management plan will be prepared as a step-down plan from this CCP. The furbearer management plan will be a separate plan and will be subject to its own NEPA review process. The purpose of the furbearer management plan would be to consider opening the refuge to public trapping under state regulation to maintain furbearer populations at levels compatible with the habitat and with refuge objectives, minimize furbearer damage to facilities and wildlife habitat, minimize competition with, or interaction among, wildlife populations and species that conflict with refuge objectives, and minimize threats of disease to wildlife and humans. This plan is scheduled to be prepared within 3 years of final approval of this CCP. In the interim, the refuge will undertake winter track surveys aimed at documenting mid-sized carnivore densities on refuge lands.

It is currently anticipated that furbearer management could result in both direct and indirect effects on open water and submerged aquatic vegetation and wetlands habitats and species. Indirect impacts could result from the activity of placing traps as it could displace migratory birds during pair bonding/nesting season, or could destroy nests by trampling. Direct impacts would include the harvest of targeted species, and the potential to harvest non-targeted species. Some of those species could be predators on migratory birds or nests, or could be species that induce beneficial habitat changes (e.g. beavers). A full consideration of potential impacts will be included in the separate NEPA analysis for furbearer management.

Because of the temporal separation of trapping activities and breeding wildlife using the refuge, indirect impacts on those resources by trappers would be negligible. Trapping in early March - June may disturb individual early nesting waterfowl on occasion, and cause their temporary displacement from specific, limited areas. Those impacts are occasional, temporary, and isolated to small geographic areas. Bald eagles initiate nesting activities on the refuge in February, but no evidence suggest trapping has affected bald eagle nesting success.

Trapping nest predators such as raccoons, fox, skunk, and mink could have positive impacts on nesting birds, although this benefit could be only temporary and depends on timing, and extent of animals removed. Trapping of beaver and muskrat can be both positive and negative habitat influences. Muskrats dig bank dens into embankments, causing considerable damage and adding costs to the operations of the refuge. Beaver will sometimes plug water control structures,

causing damage, limiting access, and compromising the capability of refuge staff to manage habitat. On the other hand, muskrat and beaver can both enhance aquatic and wetlands habitats by creating openings and ponding water. Many species in this forested region favor beaver ponds and wetlands. Beaver are a keystone species for cycling small wetlands systems from pond to meadow to scrub-shrub to forest, and back to pond. Administrative trapping would only after full consideration of less than lethal options have proven unsuccessful or are impractical for the specific circumstances.

Impacts from increased visitation.—All alternatives predict some increase in annual visitor numbers; however, the increase varies due to each alternative's respective refuge expansion proposal. Alternative A predicts the lowest annual increase, since no expansion is proposed, while alternative C predicts the highest increase due to its larger refuge expansion proposal. We do not plan to increase capacity for these activities on existing refuge lands, or on lands to be acquired, regardless of alternative; rather, we plan to maintain existing use levels.

Direct impacts on wildlife can be expected wherever humans have access to an area. In general, human presence disturbs most wildlife, which typically results in a temporary displacement without long-term effects on individuals or populations. Some species will avoid areas frequented by people, such as developed trails and buildings, while other species seem unaffected or even drawn to a human presence. When visitors approach too closely to nests, they may cause the adult bird to flush exposing the eggs to weather events or predators. Overall, direct effects should be insignificant from non-consumptive visitor activities because use of refuge lands is fairly dispersed, and large areas are not accessible.

Hunting and fishing are two priority, wildlife-dependent consumptive activities with additional direct effects on open water wildlife and habitats. Hunting of waterfowl has been ongoing on refuge lands for decades, including prior to refuge establishment. The refuge's hunt program follows federal and state regulations for annual harvest levels and seasons by species. These regulations are set within each state based on what harvest levels can be sustained for a species without adversely affecting its overall Atlantic Coast flyway population. As such, hunting results in individual losses, but the projected cumulative harvest would not jeopardize the viability of any harvested species' population. Some disturbance to non-target wildlife species may occur; however, those impacts should be minimal because hunting pressure is moderate and occurs outside the breeding season. Since the refuge has been open to hunting since 2000 and hunting occurred in the Umbagog area for many years prior to the creation of the refuge, no additional impacts are anticipated. Some wildlife disturbance of non-target species and impacts to vegetation may occur. However, these impacts should be minimal since hunting pressure is moderate, occurs outside the breeding season, and Refuge-specific regulations prohibit the use of ATVs and permanent tree stands, which are most likely to significantly damage vegetation. Our April 2007 amended EA for the refuge's current hunt program (alternative 2 in that EA), which we incorporate by reference herein, provides additional impacts analysis (USFWS, 2007).

The refuge's fishing program follows both states of New Hampshire and Maine regulations, including harvest limits for certain species. These limits are set to ensure that harvest levels do not cumulatively impact native fish resources to the point they are no longer self-sustainable. Other potential impacts of fishing on open water and submerged aquatic vegetation and wetlands wildlife and habitats are detailed in the compatibility determination for public fishing found in appendix C, "Appropriateness and Compatibility Determinations." A summary follows:

- **Accidental or deliberate introductions of non-native fish by anglers.** We plan to continue to work with both states in implementing a public education and outreach program; increased law enforcement is also planned under all alternatives.
- **Accidental introduction of invasive plants, pathogens, or exotic invertebrates attached to fishing boats.** Similar to non-native fish, we will continue to work with both states in implementing a public education and outreach program under all alternatives.
- **Negative effects on loons, eagles, osprey, waterfowl, and other wildlife from lost fishing gear;** namely, the concern with these species ingesting lead sinkers, hooks, lures, and litter, or becoming entangled in fishing line or hooks. Similar to non-native fish, we will continue to work with both states in implementing a public education and outreach program under all alternatives.
- **Disturbance to wildlife; namely to breeding and brood-rearing loons, waterfowl, bald eagles, osprey, and wading birds.** Similar to other visitors, anglers can approach too closely to nests, and may cause the adult birds to flush exposing the eggs to weather events or predators. Under all alternatives, in cooperation with both states, we will continue to close areas seasonally around active nesting sites to minimize human disturbance.
- **Reduction or alteration of prey base important to fish-eating wildlife.** The extent to which this has occurred over the years, and the impact its had on those wildlife, is unknown.
- **Negative impacts on water quality.** These were described in the section titled “Effects on Hydrology and Water Quality” above.
- **Negative impacts on sensitive wetlands from boat access sites and associated foot traffic.** Direct impacts on vegetation can result as boats physically traverse through wetlands vegetation. Other ground disturbing impacts can occur in wetlands from anglers getting their boats in water, or from shoreline fishing. Portions of, or whole plants, can be torn, sometimes by the roots. Refuge boat access sites and trails will be located away from sensitive wetlands, peat lands, and rare plants under all alternatives. Habitat features important for trout, such as overhanging banks, will also be protected from disturbance

In summary, our observations and knowledge of the area provide no evidence that cumulatively, the visitor activities we propose to continue to allow will have an unacceptable effect on wildlife resources or their habitats. Prior landowners have allowed the public to engage in these activities for many years without discernable negative effects. We do not expect a substantial increase in the cumulative effects of visitor use over the 15 year timeframe of this plan. Refuge staff will monitor and evaluate the effects of visitor use, in collaboration with state agencies and partners, to discern and respond to unacceptable impacts on wildlife or habitats

Open Water and Submerged Aquatic Vegetation, and Wetland Habitat and Species Impacts of Alternative A

We would continue to conserve the refuge’s current 3,233 acres of wetlands and 5,033 acres of open water and submerged aquatic vegetation habitat (see table 4.10) under alternative A. Acquisition and conservation of additional wetlands under alternative A would be limited to 706 acres that would be acquired from willing sellers within the current refuge boundary. This increase would be minor compared with adding as much as 4,380 wetland acres and 801 open water and submerged aquatic vegetation acres under alternative B or 5,178 wetland acres and 901 open water and submerged aquatic vegetation acres under alternative C. The additional acreage to be acquired in the respective expansion areas would more than double the refuge’s wetlands base.

Table 4.10. Wetland acquisition by alternative (acres)

Wetland Type	current refuge acres	A		B			C		
		still to be acquired	total in acquisition boundary	Fee Acres	Easement Acres	Fee + Easement	Alt B Totals	Fee Only	Alt C Totals
Fen and Flooded Meadow	487	79	566	103	20	123	687	209	775
Boreal Fen and Bog	1,235	167	1,402	2,277	407	2,684	4,086	3,222	4,624
Northern White Cedar	829	202	1,031	0+	0+	0+	1,031	0+	1,031
Scrub-Shrub Wetlands	682	258	940	790	77	867	1,807	1,041	1,981
Total All Wetland Types	3,233	706	3,939	3,170	504	3,674	7,613	4,472	8,411
Open Water & Submerged Aquatic Vegetation	5,033	801	5,834	46	23	69	5,906	100	5,934

Of the three refuge management alternatives, we would be most constrained under alternative A in terms of how we would improve conservation of wetlands and open water and submerged aquatic vegetation habitats and enhance management of focal species. Our management efforts would be limited to habitat inventory, mapping, and monitoring; bird surveys and surveys of other vertebrates, invertebrates, and plants; support of research on water level effects and loon populations, protection of nesting loons, and limited acquisition of additional wetlands and open water and submerged aquatic vegetation habitat. We would implement no active habitat management such as waterfowl food plantings to improve wetlands and manage habitat productivity for breeding or migratory waterfowl.

Water level fluctuations, water quality problems and human disturbance of wildlife would continue to pose some risk of adversely affecting wetland habitat; breeding, brood rearing, and migrating waterfowl; marsh birds, shorebirds, and wading birds; and other wildlife species of concern at the refuge under alternative A.

We would monitor habitat conditions and continue to work closely with FPLE, the FERC licensee, to ensure that water levels do not affect any wetland habitat type.

Water quality may become an increasingly important issue at the refuge as lands adjacent to the refuge are developed and the user population increases over the years, although the refuge should experience the lowest increase in users under alternative A.

Over the long term, the risk of erosion and water quality problems that might affect these habitats would be highest under this alternative because watershed land conservation would be limited to acquisition within the current refuge boundary.

Fen and Flooded Meadow

Acquisition of up to 79 additional acres and conservation of a resulting total 566 acres of fen and flooded meadow habitat under alternative A would provide minimally increased benefits to breeding and migrating waterfowl and other species using this habitat type. We would monitor wetland conditions but we would not actively manage the habitat for waterfowl or other species.

We would plan to identify impacts to fen and flooded meadow habitat from changes or fluctuations in water levels as the water levels and their effects are monitored and evaluated.

Visitors fishing or boating in or near fen and flooded meadow habitat may disturb nesting or foraging birds, except where we implement areas closures around bald eagle and loon nests. Because of staffing and management constraints, alternative A would offer little opportunity to further limit visitor impacts.

Boreal Fen and Bog

We would continue to conserve the refuge's 1,235 acres of boreal fen and bog habitat under alternative A and would seek to acquire 167 additional acres of the habitat. Purchase of these additional acres would minimally increase conservation of the refuge peatland complex.

None of our passive management actions under alternative A would adversely affect boreal fen and bog habitats. The refuge peatland habitats generally are not used by visitors so disturbance of wildlife or damage to rare plants would be unlikely to occur. Of course care would be taken in our own projects and in monitoring by researchers to avoid any effects to these habitats.

Northern White Cedar

We may acquire as much as 202 acres of northern white cedar habitat under alternative A. Purchase of these additional acres, which includes the largest Northern white cedar swamp in New Hampshire, would substantially benefit conservation of this type in the region as well as benefiting focal species such as the black-backed woodpecker. However, no active management techniques would be employed.

None of our passive management actions under alternative A would adversely affect northern white cedar habitat. Northern white cedar habitats generally are not used by visitors so disturbance of wildlife or direct damage to the habitat would be extremely unlikely to occur. Care would be taken in our own projects and in monitoring of researchers to avoid any effects to these habitats.

Scrub-Shrub Wetland

We may acquire as much as 258 acres of scrub-shrub wetland habitat under alternative A. Purchase of these additional acres would increase conservation of this habitat as well benefits to woodcock because they would constitute an increase of 37 percent in Service ownership.

No active management techniques would be employed and none of our passive management actions under alternative A would adversely affect scrub-shrub habitat.

Open Water and Submerged Aquatic Vegetation

We would acquire 801 acres of open water and submerged aquatic vegetation habitat thereby conserving 5,834 acres of open water and submerged aquatic vegetation habitat under alternative A. No active management techniques would be employed.

As noted, water quality effects on aquatic species may become an increasingly important issue at the refuge as lands adjacent to the refuge are developed. Over the long term, the risk of erosion and water quality problems that might affect these habitats would be highest under this alternative because watershed land conservation would be limited to land acquisition within the current refuge boundary.

Refuge visitors who boat and fish may cause localized, transient impacts by disturbing the bottom substrate in shallow areas or causing minor spills or leaks of petroleum products. Brochures and signage would notify these users of proper precautions. We would work with the State of New Hampshire to evaluate the no-wake exemption on Magalloway and Androscoggin rivers which allows high speed boat operation within 150 feet of shoreline. These impacts would be more limited when compared to alternatives B and C, because the estimated refuge user population increases over the years would be lowest under alternative A.

Common Loon

We would continue to protect loons as we have in the past under alternative A. We would continue to support research on the apparent decline in Umbagog Lake loons, to advise the FERC licensee on water levels to benefit loons, and to protect active loon nests in spring and summer from predators and human disturbance using outreach and visitor contact, floating rafts, buoy lines, restricted access, and other tools as warranted.

No additional active management techniques would be employed to increase loon productivity and none of our passive management actions under alternative A would adversely affect loons.

Open Water and Submerged Aquatic Vegetation and Wetland Habitat and Species Impacts of Alternative B

We propose to substantially expand conservation of the refuge wetlands and markedly upgrade how we manage for waterfowl and other focal species under alternative B. We would continue to conserve the refuge's current 3,150 acres of wetlands and 5,033 acres of open water and submerged aquatic vegetation habitat (see table 4.10) under alternative B. In addition to acquiring the remaining 706 wetland acres and 801 open water and submerged aquatic vegetation acres within the current refuge boundary, we would seek to acquire 3,674 wetland acres and 69 acres of open water and submerged aquatic vegetation habitat in the alternative B expansion area (see map 2-6). The additional acreage to be acquired would more than double the refuge's conserved wetland and open water and submerged aquatic vegetation habitat acreage.

Among the alternatives, we would be best able to achieve our wetlands conservation and focal species management goals under alternative B. Our management efforts would be expanded well beyond our current passive management to include specific habitat manipulation and species conservation measures including providing waterfowl food plantings, and management of habitat productivity for breeding and migratory waterfowl.

We would take additional steps to ensure that water level fluctuations and water quality problems are addressed, and to further limit human disturbance and thereby reduce the risk of adverse effects to wetland habitats and focal species. We would monitor habitat condition and continue to work closely with the FERC licensee to ensure that water levels do not affect any wetland habitat type. Further, under alternative B we propose several future studies, and inventory and monitoring projects that would assist in evaluating the impacts from water level fluctuations.

Observation platform on the Magalloway River



Paul Casey/USFWS

Through acquisition of lands adjacent to the refuge we would expand conservation of the watershed and reduce the adverse effects of development and population increases over the years.

There would be no impacts from construction and operation of the Potter Farm visitor facility because the proposed location is not immediately adjacent to wetlands habitat. However, construction of the interpretive loop trail near the new headquarters, under this alternative poses some risk of affecting wetlands. A conceptual design and tentative location for a trail (see map 2-8) are identified in the Roadway/Trail Evaluations and Headquarters Assessments (Oak Point Associates 2004). The trail would be approximately 2 miles long, designed to allow travel by people with disabilities, and route visitors to wetland and meadow habitat adjacent to the Lake and then north through forested areas before looping back to the headquarters. The eastern portion of the trail would parallel a large wetland. No construction would be done that would directly affect the wetland other than setting of pilings for boardwalks, which would be constructed over saturated areas to protect sensitive vegetation.

Fen and Flooded Meadow

Under alternative B, we would improve our management of fen and flooded meadow habitat by acquiring and conserving as much as 123 additional acres of the habitat and actively managing it for breeding and migrating waterfowl, marshbirds, shorebirds, and wading birds. Fee purchase and easements on these additional acres would increase this habitat by 41 percent.

We would take specific steps to upgrade fen and flooded meadow habitat management for breeding, brood rearing, and migrating waterfowl; marsh birds, shorebirds, and wading birds; and other wildlife species of concern at the refuge under alternative B. An improved partnership with the FERC licensee to address water level control, expanded bird and aquatic invertebrate surveys, and promotion of wild rice and other food plants would substantially upgrade our ability to support breeding and migratory birds.

We plan to identify impacts to fen and flooded meadow habitat from changes or fluctuations in water levels as the water levels and their effects are monitored and evaluated so that we can assure that any effects of fluctuating levels would be minor and short-term

Refuge visitors fishing or boating in or near fen and flooded meadow habitat may disturb nesting or foraging birds. These effects would likely increase with the increased visitation expected under this alternative. We plan to increase staffing and enhance management under alternative B to ensure this type of disturbance would occur infrequently, impacts would continue to be minor and not adversely affect waterfowl productivity.

Boreal Fen and Bog

Conservation and management of boreal fen and bog habitats would greatly improve under alternative B. We would acquire as much as 2,684 additional acres under this alternative more than tripling the refuge's conserved boreal fen and bog acreage. Purchase of these additional acres would greatly increase conservation of the refuge peatland complex. The Floating Island National Natural Landmark (FINNL) would expand from 860 to 2,181 acres. Monitoring and research efforts would identify threats to this habitat.

Northern White Cedar

We may acquire an additional 202 acres of northern white cedar habitat within the acquisition boundary and in the expansion area under alternative B. Purchase of the 202 additional acres in the current acquisition boundary, which includes

the largest northern white cedar swamp in New Hampshire, would substantially benefit conservation of this type in the region as well as benefiting focal species such as the black-backed woodpecker. The acreage in the expansion area cannot be estimated at this time from available mapped data however, we expect it to be no more than 50 acres. Purchase of these small scattered stands would provide some minimal additional benefit to black-backed woodpecker because they would constitute an increase of less than 5 percent in Service ownership.

There would be no adverse effects from limited habitat management actions under this alternative. Although not likely to be a priority in 15 year life of CCP, there is a potential for restoring about 150 acres of northern white cedar over that time.

Scrub-Shrub Wetland

Acquiring as much as 867 acres to conserve a total 1,807 acres of scrub-shrub habitat would double the refuge's conserved acreage and substantially increase benefits to scrub-shrub wetland habitat, Canada warbler and woodcock, and scrub-shrub wetland dependant species under alternative B.

Manual or portable power tools would be used in vegetation management to manipulate or maintain habitat such as alder. Cutting would be done to minimize disturbance to nesting or foraging wildlife.

Open Water and Submerged Aquatic Vegetation

Benefits would be greater under alternative B with addition of up to 870 open water and submerged aquatic vegetation acres and an expanded program of management activities to conserve and enhance the biota of open water and submerged aquatic vegetation habitats.

With added watershed land conservation of more than 47,000 acres under this alternative, risks to aquatic species from water quality problems would diminish in Umbagog Lake and in the river tributaries. Some of this benefit may be offset by increased visitation.

Refuge visitors who boat and fish may disturb the bottom substrate in shallow areas or cause minor spills or leaks of petroleum products. Outreach including brochures and signage will notify these users of proper precautions.

Common Loon

While we would continue to protect loons as we have in the past under alternative B in cooperation with the LPC and FERC licensee, we would take a number of additional steps including monitoring angler use and fishing pressure in relation to loon territories, validating loon nesting and territorial carrying capacities, and further determine whether 14 nesting pairs on Umbagog Lake and 4 nesting pairs in the expansion area remain appropriate targets for these areas, evaluating interactions of loons with waterfowl during the breeding season; and specifically evaluate how these wildlife interact at high loon densities. The major proposed expansion in watershed land base would increase indirect benefits to loons by protecting water quality and their aquatic prey base.

We would evaluate the need for predator control around loon sites and where necessary would use lethal and non-lethal predator control measures targeted at individual animals. Continuous monitoring of methods would ensure control would not adversely affect any sensitive predator species populations.

The near doubling of refuge visitation under alternative B would likely increase pressure to view loons and increase the potential for nesting loon disturbance. We would upgrade signage and informative materials to educate visitors to this

Open Water and Submerged Aquatic Vegetation and Wetland Habitat and Species Impacts of Alternative C

problem, expend greater staff effort in monitoring visitor presence near loon nest sites, and continue to exclude visitors from these areas as necessary.

We would substantially expand conservation of the refuge's wetlands under alternative C but we would not manage the refuge wetlands for production of waterfowl or other focal species but rather would manage them to promote a diverse and sustainable wetlands complex with a natural regime of disturbance and recovery and a natural sustainable complement of native wildlife species.

We would continue to conserve the refuge's current 3,233 acres of wetlands and 5,033 acres of open water and submerged aquatic vegetation habitat (see table 4.10) under alternative C. We would seek to acquire the remaining 706 wetland acres and 801 open water and submerged aquatic vegetation acres within the current refuge boundary as well as 4,472 wetland acres and 100 acres of open water and submerged aquatic vegetation habitat in the alternative C expansion area (see map 2-11). Similar to alternative B, the additional acreage to be acquired would more than double the refuge's conserved wetland and open water and submerged aquatic vegetation habitat acreage.

Compared to the other alternatives, we would achieve a greater degree of wetlands conservation under alternative C in terms of acreage under Service management but we would not likely achieve the highest level of productivity or sustainability in terms of the range of focal wildlife species that we would manage for under alternative B. Our management efforts would be expanded beyond our current custodial management to include specific habitat manipulation measures to simulate as closely as possible the biotic community conditions that would otherwise exist under natural disturbance patterns in the Northern Forest in the absence of 200 years of human resource use and industrial, commercial, agricultural, residential, and recreational development.

We would address water quality problems to eliminate to the degree possible the effects of human pollution. Through acquisition of lands adjacent to the refuge we would expand conservation of the watershed and reduce the adverse effects of development. We would work towards a water level agreement that simulates as near as possible, the natural hydrologic regime of the Upper Androscoggin River watershed. We would limit human access to simulate a back country wilderness-type experience with no facilities development and no motorized access.

We would not take any specific steps to enhance habitat for breeding, brood rearing, and migrating waterfowl; marsh birds, shorebirds, and wading birds; and other wildlife species of concern at the refuge under alternative C. However, we would continue to protect common loons in cooperation with the FERC licensee and the Loon Preservation Committee. We would monitor habitat condition and continue to work closely with the FERC licensee to ensure that water levels do not affect any wetland habitat type. Limiting human access to simulate a back country wilderness-type experience with no facilities development and no motorized access would benefit wildlife by reducing disturbance and localized habitat losses.

We would continue to promote stable water levels during the nesting season to the extent possible under the current agreement, using loons as the indicator species to evaluate the effectiveness of water level management on nesting wildlife. We would continue to recommend that water levels be managed at other critical times of the year (e.g. during fall migration) to benefit wildlife.

Construction of the loop trail near the new Potter Farm facility would have the same impacts and mitigation as described for alternative B.

Fen and Flooded Meadow

The benefits to fen and flooded meadow habitat would be minimally higher with 209 acres of habitat acquired and conserved under alternative C. There would be no refuge focal species management so benefits to refuge focal species would be indirect from the increase in habitat conservation.

Water level fluctuations, water quality problems and human disturbance would continue to pose some risk of adversely affecting fen and flooded meadow habitat, waterfowl, and other wildlife at the refuge under alternative C.

We would monitor habitat condition and continue to work closely with the FERC licensee to ensure that water levels do not affect this habitat. Water quality may become an increasingly important issue at the refuge as lands adjacent to the refuge are developed and the user population increases over the years.

There would be no impacts from construction and operation of the Potter Farm facility because the location is not adjacent to this habitat. Impacts should be minimal from Lake users fishing or boating who may disturb nesting birds, but this would occur infrequently and not likely adversely affect waterfowl productivity.

Boreal Fen and Bog

The benefits of conservation and management of boreal fen and bog habitats would be similar to alternative B with up to 3,222 fee acquired acres. This alternative too would greatly increase conserve the refuge's peatland complex and substantially benefit peatland dependent species.

Peat coring of the FINNL and other peatlands on Lake Umbagog Refuge under this alternative would not adversely affect these wetlands.

Northern White Cedar

We may acquire as much as 202 acres of northern white cedar habitat under alternative C. As in alternative B, purchase of these additional acres would minimally benefit black-backed woodpecker.

Scrub-Shrub Wetland

We may acquire as much as 1,299 acres of scrub-shrub wetland habitat under alternative C. Purchase of these additional acres would benefit woodcock, Canada warbler and other species.

Open Water and Submerged Aquatic Vegetation

We would acquire 801 within the boundary and 100 additional open water and submerged aquatic vegetation acres under alternative C. We expect that acquisition and conservation of an additional major portion of the Upper Androscoggin River watershed under alternative C would benefit aquatic biota, including SAV and fish, by reducing the potential for development and off-refuge recreational use that may adversely affect refuge water quality.

Common Loon

We would continue to protect loons as we have in the past under alternative C. We would continue to support research on the decline in Umbagog Lake loons, to advise the FERC licensee on water levels to benefit loons, and to protect active loon nests in spring and summer from predators and human disturbance using outreach and visitor contact, buoy lines, restricted access, and other tools as warranted.

No additional active management techniques would be employed to increase loon productivity under alternative C. We do not expect that any of our management

Effects on Floodplain, Lake Shore, and Riparian Habitats and Species

actions, including forest management actions, would adversely affect loons. We expect that acquisition and conservation of an additional major portion of the Upper Androscoggin River watershed under alternative C would indirectly benefit loons by reducing the potential for development that may adversely affect refuge water quality.

Floodplain, lake shore, and riparian habitats serve as protective buffers and wildlife travel corridors between the refuge wetlands and the watershed upland areas, as important forest components of the refuge, and as valued productive breeding habitat for focal vertebrate species, including cavity nesting waterfowl, bald eagle, osprey, and regional priority bird species including the northern parula and rusty blackbird. A major priority of the refuge is to sustain high quality woodcock habitat in the areas identified as woodcock focus areas.

Management actions proposed for each of the refuge CCP alternatives were evaluated for their potential to help conserve and expand floodplain, lakeshore, and riparian habitats and to maintain and improve the productivity of focal wildlife species. The evaluated benefits include:

- Potential for acquisition of floodplain, lake shore, and riparian areas that would expand conservation of these habitats
- Potential for habitats to benefit locally with restoration of camp sites
- Potential for protection of vernal pools through improved inventory and management measures that would enhance these uniquely important productive habitats
- Potential to implement specific management measures to protect and enhance eagle and osprey nest sites would benefit these focal raptors
- Potential for improved woodcock management

The adverse effects of the Lake Umbagog refuge management alternatives that were evaluated include:

- The potential for increased refuge visitation to adversely affect these habitats
- The potential for human disturbance of bald eagle and osprey nest sites

The potential for alterations in hydrology or other land management actions to adversely affect vernal pools

Floodplain, Lake Shore, and Riparian Habitat Impacts That Would Not Vary by Alternative

Resource Conservation. — Regardless of which CCP alternative we select, we would develop a HMP and IMP for floodplain, lakeshore, and riparian habitats, we would mitigate any potential for major unplanned changes in floodplain, lakeshore, and riparian habitat vegetation by continuously monitoring our vegetation types and updating our GIS database at least every 5 years.

We would conserve and maintain natural vernal pools, and other small-scale unique or rare communities on existing refuge lands and within the expansion areas. We would implement a comprehensive program (text box) to conserve vernal pools that would include inventory, monitoring, research, ranking, and management protocols to minimize any impacts to these uniquely important habitats.

We would continue to protect bald eagles and ospreys from human disturbance during the nesting season, evaluating closure areas on a case-by-case basis. Legal hunting is not considered a threat to these species because no hunting is occurring during spring and summer when these birds are nesting. Also, no mortality of these birds has been attributed to accidental shooting in the Umbagog Lake Area. We have also submitted this document for an intra-agency Section 7 consultation on ESA compliance.

Vernal Pool Conservation

- complete inventory of vernal pools in 5 years
- develop and implement management standards and guidelines to conserve vernal pool habitat in 7 years
- rank vernal pools as to their conservation concern and need for management based on size, location, threats, productivity, seasonality, species diversity, and other parameters
- promote vernal pool conservation in Refuge outreach programs
- survey to identify all potentially affected vernal pools before any active forest management occurs
- follow best management practices to protect all vernal pools

Facilities Upgrade and Protection.— The majority of our current refuge facilities are located in the riparian zone of the Magalloway River. A number of new facilities and visitor amenities are proposed for the lakeshore areas at the refuge.

All snowmobile trails on the refuge would be through trails only; we would not provide parking, warming huts, or other infrastructure on refuge lands. No expansion of the existing trail system would occur without specific site evaluation.

Site, Road, and Trail Restoration

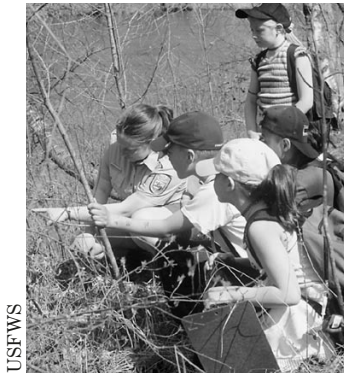
We would restore developed areas that are no longer needed for refuge administration or programs to natural conditions. As we acquire lands, we would remove cabins or other developed sites or structures if they are surplus to refuge needs, re-grade to natural topography and hydrology and re-vegetate to establish desirable conditions.

We would inventory and assess all access roads within the refuge, and on any newly acquired lands, and implement procedures to retire and restore unnecessary forest interior and secondary roads to promote watershed and resource conservation. All ATV trails on Service fee lands and all unauthorized snowmobile trails would be restored to eliminate their use. Existing main access roads would remain open to provide motorized and non-motorized access for approved activities.

Facility Maintenance

Under Alternative A, the existing headquarters building on the Magalloway River would be maintained. In alternatives B and C it would be converted to a research or auxiliary field office. In addition, all alternatives would remove the adjacent small cabin.

All of the alternatives include the periodic maintenance and renovation of existing facilities to ensure the safety and accessibility for staff and visitors. Our current facilities are described in chapter 3. They include administrative facilities such as refuge quarters at two former residences and the maintenance shop off Mountain Pond road. Visitor facilities to be maintained under all alternatives include: the Magalloway River trail and new extension, sign, and viewing platform; and, 2 roofed, wooden information kiosks. A Magalloway River Canoe Trail and launch site would be implemented in 2006 and would also require periodic maintenance.



USFWS

Youth program on the refuge

Fire Protection

We would conduct a wildland-urban interface hazard assessment along common boundaries of adjacent private landowners within 2 years of CCP approval and every 10 years thereafter, to ensure forest management practices are not creating excessive fuel loading. Details will be incorporated in the refuge FMP.

Impacts from increased visitation.—The impacts are the same as those described for wetlands habitats in the discussion under “Open Water and Submerged Aquatic Vegetation and Wetland Habitat and Species Impacts that would not vary by Alternative.” In addition to those, these habitat types could be impacted by hunting for additional species and from the camping program. Hunting in these habitat types on refuge lands extends to migratory game birds and upland game hunting. White-tailed deer, moose, snowshoe hare, ruffed grouse and woodcock are the principal species hunted. As described in the discussion on waterfowl hunting, this use has been established in the area on refuge lands for decades. All hunting seasons and limits adhere to respective federal and state regulations. Those regulations are set within each state based on what harvest levels can be sustained for a species without jeopardizing state populations, or in the case of woodcock, the Atlantic flyway population. As such, hunting results in individual losses, but the projected cumulative harvest would not jeopardize the viability of any harvested species’ population. Some disturbance to non-target wildlife species may occur; however, those impacts should be minimal because hunting pressure is moderate and occurs outside the breeding season. Our 2007 amended EA for the refuge’s current hunt program (alternative 2 in that EA), which we incorporate by reference herein, provides additional impacts analysis (USFWS, 2007).

Anticipated impacts of hunting as listed in the public hunting compatibility determination follow:

Since the refuge has been open to hunting since 2000 and hunting occurred in the Umbagog area for many years prior to the creation of the refuge, no additional impacts are anticipated. Some wildlife disturbance of non-target species and impacts to vegetation may occur. However, these impacts should be minimal since hunting pressure is moderate, occurs outside the breeding season, and Refuge-specific regulations prohibit the use of ATVs and permanent tree stands, which are most likely to significantly damage vegetation. Hunting also helps to keep populations of browsing species such as deer and moose within the carrying capacity of the habitat, thus reducing excessive damage to vegetation caused by over-browsing, and maintaining understory habitat for other species.

Currently, all areas of the Refuge are open to hunters and other members of the public during hunting season. Although conflicts between user groups can occur, this does not appear to be a significant issue at present use levels. In the future, the Refuge may need to manage public use to minimize conflicts and insure public safety, should significant conflicts become evident. This may include public outreach and using zoning to separate user groups.

Similar to other visitor activities, human disturbance on wildlife can result from camping. Larger groups, and those campers with pets, are more likely to disturb wildlife. Generally, these disturbances result in a temporary displacement without long-term effects on individuals or populations. Some species may avoid areas frequented by people, such as campsites, while other species seem unaffected or even drawn to the human presence. Humans may intentionally supply foods to wildlife, or unintentionally supply foods through littering, accidental spillage, or improper food storage. Human foods are generally unhealthy for wildlife, and may also promote scavenging behavior, which could increase wildlife vulnerability to predators. Rodent populations often increase

at campsites in response to the increased availability of human food, and may negatively affect nesting songbirds since they also predate on eggs. Bears and other scavengers may also be attracted to improperly stored food, and may damage property or threaten visitor safety. We have recorded one instance of a bear looking for food damaging a kayak at an Umbagog Lake campsite.

Campers can directly and indirectly effect vegetation in these habitat types as well. Impacts can be locally severe, even with low to moderate use. There is typically a loss of ground vegetation cover, reduced vegetation height and vigor, loss of rare or fragile species, and changes in plant community and composition. Vegetation may be removed or trampled, especially shrubs and trees that could be used for firewood. Axes and fire scars can damage trees, and branches may be broken, bark removed or damaged, or nails placed in trees. Tree regeneration is typically lost and the disturbed site will often convert to trampling-resistant grasses and forbs. Some rocky and gravelly lakeshore areas are more resistant to disturbance, including many along Umbagog Lake.

When people come from out of the area, they can be vectors for seeds and propagules of invasive plants. Once established, invasive plants can outcompete native vegetation, thereby altering habitats and indirectly affecting wildlife. The threat of invasive plants is an issue we are vigilant about; annual monitoring, immediate treatment, and a public outreach and education program would occur under all alternatives.

No expansion of camping sites is planned under any alternative, and all camping allowed is permitted only at designated sites. We intend to continue to evaluate campsites annually. Regarding human disturbance, we would continue to minimize this impact by seasonally closing campsites that are located close to active loon territories or nesting bald eagles. Visitors are now required to bring their own firewood to reduce impacts to vegetation. Overall, under current and planned management, and based on our observations at campsites, we predict the effects from camping would not be significant under any alternative.

Impacts to Floodplain, Lake Shore, and Riparian Habitats and Species from Alternative A

We would continue to conserve the refuge’s current 1,372 acres of floodplain, lakeshore, and riparian habitat (see table 4.11) under alternative A. An additional 153 acres of wooded floodplain and 288 acres of lakeshore pine-hemlock habitat under alternative A—a 32 percent increase—would be acquired from willing sellers within the current refuge boundary. This minor increase would be lower but of the same order of magnitude as the acquisition increases proposed under the refuge expansion alternatives B and C.

Table 4.11. Floodplain, lakeshore, and riparian habitat acquisition proposed by alternative

		A		B				C	
Habitat Type	current refuge acres	still to be acquired	total in acquisition boundary	Fee Acres	Easement Acres	Fee + Easement	Alt B Totals	Fee Only	Alt C Totals
Wooded Floodplain	1140	153	1,293	123	13	136	1429	140	1433
Lakeshore Pine-Hemlock	232	288	520	0+	0+	0+	520+	0+	520+
Total Both Types	1372	441	1813	123+	13+	136+	1949+	140+	1953+

Adding up to 441 acres of these habitats would increase conservation of floodplain, lakeshore, and riparian acres to over 1,800 acres but we would be more constrained under alternative A than under the other alternatives in terms of how much we could improve conservation of floodplain, lakeshore, and riparian habitats and enhance management of focal species. Our management efforts would be limited to habitat inventory, mapping, and monitoring; bird surveys and surveys of other vertebrates, invertebrates, and plants; support of related research, protection of nesting eagles and ospreys, and limited acquisition of additional habitat. We would implement no active habitat management such as early successional management.

The Magalloway River trail project would cause short term construction impacts and long-term loss of a minor amount of habitat. Construction of the Potter Farm headquarters and visitor contact facility would cause minor localized impacts along the lakeshore. There would be no other construction projects that would affect these habitats.

Of the twelve campsites that the refuge intends to keep open, 5 are located in lakeshore pine-hemlock habitat, 5 are in mixed conifer-hardwoods, and 2 are in balsam fir-floodplain forest, all accessible only by boat. Remote camping would continue to have localized, long term impacts to lakeshore and floodplain habitats as described above. Illegal camping at non-designated sites also occurs regularly along the Magalloway River, Harper's Meadow, in the Leonard Pond area, and elsewhere. Monitoring and outreach would help mitigate these latter impacts.

Wooded Floodplain

We would acquire up to 153 additional acres of wooded floodplain habitat under alternative A within the current refuge boundary. This increase from the current 1,140 acres in Service ownership would minimally increase benefits to cavity nesting waterfowl, northern parula, and rusty blackbird because of the habitat conservation afforded although no active management techniques would be employed.

Lakeshore Pine-Hemlock

We would acquire as much as 288 additional acres of lakeshore pine-hemlock habitat under alternative A. This added habitat would more than double refuge acreage from the current 232 acres and, thereby, would increase protection benefits to jack pine, bald eagle, osprey, and other raptors at the refuge. There would be no adverse impacts from this land acquisition although there may be localized, short term impacts to soils from camp or other site restoration activities on any of these newly acquired lands.

Bald Eagle and Osprey

Bald eagle and osprey would benefit from conservation of the lakeshore pine-hemlock habitat described above under alternative A. Our biological program would continue its present priorities such as: cooperating with partners in the monitoring of loon, bald eagle, and osprey populations on the lake; protecting loon, bald eagle, and osprey active nest sites from human disturbance on refuge lands.

Potential adverse impacts to eagles and ospreys under alternative A would include a somewhat greater risk of human disturbance of nesting eagles and ospreys and a higher probability of loss or lack of recruitment of nesting trees than are likely to occur under alternatives B and C because we would not be able to invest as much time and the level of resources required for protection and we would not implement super-canopy tree recruitment measures. The eagle and

Impacts to Floodplain, Lake Shore, and Riparian Habitats and Species from Alternative B

osprey aquatic food base would more likely be adversely affected under alternative A than B or C because watershed conservation would be limited to current lands and lands within the acquisition boundary.

We propose a modest increase in acquisition and conservation of floodplain, lakeshore, and riparian habitat under alternative B as well as a substantial upgrade in our management actions to conserve and improve this habitat for focal species.

We would continue to conserve the refuge’s current 1,372 acres of floodplain, lakeshore, and riparian habitat (see table 4.11) under alternative B while seeking to acquire 289 acres of wooded floodplain and 288 acres of lakeshore pine-hemlock habitat—a combined 577 acre increase—from willing sellers within the current refuge boundary and in the expansion area. This increase would be of the same order of magnitude as those proposed under alternatives A and C.

We plan a greater amount of restoration for the alternative B expansion area to benefit primarily riparian habitat. The localized short term impacts and long term benefits of restoration projects would be similar to alternative A. The impacts of construction projects also would be similar to alternative A.

A greater increase in refuge visitation would cause minimally higher risk than alternative A of localized habitat impacts from recreational activities.

Management of remote camping would be upgraded under alternative B to minimize the impacts to floodplain and lakeshore habitats described above. Mitigation would include:

- Establishing a program of increased outreach on-site, and increased enforcement of rules and regulations to minimize illegal camping
- Possibly designating some sites as “one night only” for paddlers moving through the area
- Providing campers with an orientation and overview of rules and regulations and Leave No Trace program
- Restoring sites or seasonally closing sites as needed to conserve resources
- Removing camping at North 1 and North 2 sites along Route 16
- Improving campsites to address safety and long term sustainability without habitat degradation

There would be increased benefits to vernal pools on more than 47,000 acres of expansion lands where vernal pools would be inventoried and protected under alternative B.

Bald Eagle & Osprey Protection Under Alternative A

- Protect and maintain super-canopy nesting trees on current and future refuge lands.
- Inventory active and historic nesting sites each year
- Continue bald eagle and osprey surveys in conjunction with the States of Maine and New Hampshire, and conservation partners
- Maintain and/or install as warranted, predator guards on all active nesting trees.
- Continue to implement area closures around bald eagle nest trees; place visible floating buoys and signs to alert all boaters to closure area.
- Continue to work cooperatively with State agencies and NGO’s on bald eagle and osprey management.

Wooded Floodplain

We would acquire or manage under easement as much as 289 additional acres of wooded floodplain habitat under alternative B both within the current refuge boundary and in the expansion area. This increase in acreage from the current 1,140 acres in Service ownership would increase benefits to cavity nesting waterfowl, northern parula, and rusty blackbird because of the increased land conservation and the active management techniques that would be employed.

Mapping and monitoring of the Magalloway River floodplain would be conducted. We would restore the hydrology of the Day Flats area by plugging ditches and re-contouring the disturbed areas. This action may cause immediate short-term erosion and sedimentation while the project is underway to restore this partially developed site to a wooded wetland. We would employ best management practices to mitigate these effects.

Lakeshore Pine-Hemlock

The additional acreage of lakeshore pine-hemlock we would acquire under alternative B would be the same 288 as noted above for alternative A. This increase in acreage, from the current 232 acres, would provide some minimal benefit to jack pine, bald eagle, osprey, and other raptors because there would be less than 1 square-mile of this type under Service protection.

Bald Eagle and Osprey

There would be increased bald eagle and osprey benefits from conservation of the lakeshore pine-hemlock habitat and active management to eliminate human disturbance and protect and recruit nesting trees.

We would upgrade our management activities under alternative B to protect bald eagles and osprey (text box) by implementing more stringent measures to protect nesting trees and instituting measures to ensure nesting trees are available within 1 mile of foraging habitat.

The risk of human disturbance would increase slightly from increased visitation which would be mitigated by our upgrade in management.

Water quality would be improved or maintained through monitoring. The eagle and osprey aquatic food base would be better protected by expanded watershed and open water and submerged aquatic vegetation habitat conservation.

New Headquarters and Visitor Contact Facility

We propose to construct a new refuge headquarters and visitor contact facility at the Potter Farm tract on the south shore of Umbagog Lake. The Potter Farm site is common to Alternatives B and C, but the size of the facility differs depending

Expanded Bald Eagle & Osprey Protection under Alternative B

All alternative A measures **plus**:

- Protect and maintain super-canopy trees within 1 mile of high quality foraging habitat to support nesting and perching by bald eagles and osprey.
- Protect individual nest trees with at least a 300-foot no-touch buffer area.
- Ensure recruitment of new nest trees; identify stands with potential.
- Manipulate pines in high quality raptor habitat areas to promote new nesting sites
- Control human access with potential to disturb nest sites.
- Protect historic nest sites, nest trees, and trees with partially constructed nests
- Work with States to support efforts to eliminate practices that contribute lead and other contaminants to the lake.
- Ensure recruitment of new nest trees; identify stands with this potential.

on the alternative. Alternative B proposes a small office, as defined by the new Service facility standards, while alternative C proposes a medium office facility.

The Potter Farm site is an abandoned farm site with a house and barn immediately surrounded by fields and adjacent to wooded areas and the Lake. The site does not currently support important lakeshore vegetation such as mature white pine stands, so construction of the new headquarters and visitor contact facility would not directly adversely impact vegetation although construction would preclude restoration of the Potter Farm site to lakeshore forest in the future.

Visitor access to the new facility would be provided by new surfacing of the section of Mountain Pond Road from U.S. Highway 26 to Potter Farm Road and new surfacing of Potter Farm Road. Surfacing would be upgraded from the current single lane gravel surfacing to a 24-foot 2-lane paved surface which would require construction of a full depth gravel section for the entire width of the roadway and reconstruction of all roadside swales and culverts. Surfacing impacts would be localized with effects to the road shoulder areas and the environment immediately downgradient of the swales and culverts. Best management practices for road construction would be employed in upgrading the road, including review of culvert designs and use of silt fences and debris catchments to minimize the potential for erosion and sedimentation impacts to the Thurston Cove and Big Island portions of the Lake. Best Management Practices (BMPs) and ancillary precautions would be defined in an *Erosion and Sedimentation Control Plan* to be approved by the Service before the reconstruction contract is approved.

Visitor Infrastructure

In conjunction with the proposal to develop a new administrative and visitor contact facility, alternatives B and C propose to construct an interpretive trail at the Potter Farm site. A conceptual design and tentative location for a trail were identified by Oak Point Associates in their report. The trail was approximately 2 miles long, and would be designed to allow travel by people with disabilities.

Alternatives B and C also propose additional visitor facilities along major travel routes, including 2 roadside pullouts, and an overlook platform on Route 26. Each of these sites would have an information kiosk, and provide parking for several vehicles. Both alternatives propose a ¼ mile loop extension to the Magalloway River accessible to people with disabilities (ADA compliant).

Impacts to Floodplain, Lake Shore, and Riparian Habitats and Species from Alternative C

Similar to alternative B, we propose a minor increase in acquisition and conservation of floodplain, lakeshore, and riparian habitat under alternative C although we would not implement specific management actions for focal species. Rather we would manage this habitat to reflect what would occur under natural environmental influences. We would continue to conserve the refuge's current 1,372 acres of floodplain, lakeshore, and riparian habitat (see table 4.11) under alternative C and seek to acquire 293 acres of wooded floodplain and 288 acres of lakeshore pine-hemlock habitat—a 581 acre increase—from willing sellers within the current refuge boundary and in the expansion area. This increase would be of the same order of magnitude as those proposed under alternatives B and C.

The localized short term impacts and long term benefits of restoration projects would be similar to alternative B.

The greater increase in visitation under this alternative as compared to alternative B would cause a minimally higher risk of localized habitat impacts from recreational activities.

Remote camping would continue to have localized, long term impacts to lakeshore and floodplain habitats. Like alternative B, remote camping on the existing designated sites would continue to be allowed, but we would increase monitoring of individual sites, and rehabilitate, or close permanently or seasonally those in need of restoration. Increased efforts would be made to address these problems under this alternative. Our emphasis on a wilderness-type camping experience would further reduce impacts compared to alternatives A and B.

There would be increased benefits to vernal pools on more than 74,414 acres of expansion lands because those vernal pools would be inventoried and protected under alternative C.

Wooded Floodplain

We would acquire in fee as much as 293 additional acres of wooded floodplain habitat under alternative C within the current refuge boundary and in the expansion area. Similar to alternative B, this increase in acreage from the current 1,140 acres in Service ownership would increase benefits to cavity nesting waterfowl, northern parula, and rusty blackbird because of the increased land conservation and any active management techniques that would be employed in the near term to promote establishment of a sustainable floodplain community.

We would restore the hydrology of the Day Flats area by plugging ditches and re-contouring the disturbed areas. This action may cause immediate short-term erosion and sedimentation while the project is underway to restore this partially developed site to a wooded wetland. We would employ best management practices to mitigate these effects.

Lakeshore Pine-Hemlock

Alternative C would have the same habitat conservation and site restoration benefits, and short-term impacts, as alternative B. Additional acreage to be identified in the expansion area would minimally increase benefits to jack pine, bald eagle, osprey, other raptors by providing additional nesting and roosting habitat. We would acquire the same 288 acres of lakeshore pine-hemlock under alternative C as noted earlier under alternatives A and B. This increase in acreage from the current 232 acres would provide minimal benefit to jack pine, bald eagle, osprey, and other raptors because there would be less than 1 square-mile of this type under Service conservation.

Bald Eagle and Osprey

Under alternative C we would institute the same measures proposed under alternative B to enhance bald eagle and osprey protection and recruitment so the same benefits and impacts would result.

There would be an increased risk of human disturbance from increased refuge visitation under alternative C that would be mitigated by our proposed upgrade in management.

Water quality would be improved or maintained through increased monitoring efforts and the eagle and osprey aquatic food base thereby better protected by expanded watershed and open water and submerged aquatic vegetation conservation.

New Headquarters and Visitor Contact Facility

Same impacts as described above for Alternative B under this subject heading.

Visitor Infrastructure

Same impacts as described above for Alternative B under this subject heading.

Effects on Upland Forest Matrix Habitats and Species

The upland forest matrix in and near the refuge is vital to conserving the refuge watershed while providing habitat and movement corridors for wildlife of the Northern Forest and ensuring long-term recreational opportunities for refuge visitors. Conserving the Lake Umbagog refuge forest matrix to sustain and enhance these values would continue to be a major refuge goal.

Management actions proposed for each of the refuge CCP alternatives were evaluated and compared on the basis of their potential to benefit or adversely affect upland forest habitats and focal species.

We compared the benefits of the alternatives from actions that would conserve or restore upland forests and improve conditions for focal species, including the extent to which we would:

- acquire and conserve upland forest lands
- restore camp sites to promote forest growth
- engage in forest management practices on former privately managed lands that would increase rotations and lead to more mature forest
- improve forest conservation and management to alter forest composition so that it best supports focal bird species
- improve forest conservation and management to create habitat and travel corridors to benefit mammalian focal species

The potential adverse effects of the refuge management alternatives that were evaluated included impacts from:

- Forest management activities that include tree cutting and construction and use of skid trails and haul roads

Increased recreational use of current and newly acquired upland forests that could lead to habitat impacts or disturbance of wildlife

Impacts to Upland Forest Matrix Habitats and Focal Species That Would Not Vary by Alternative

Forest Management.—Regardless of the alternative selected, we would use at a minimum all BMPs recommended by the States of New Hampshire and Maine (see appendix K) to conduct forest management activities in the refuge uplands. These BMPs would protect sensitive habitat components such as vernal pools and focal species nesting sites.

Impacts from increased visitation.—Potential impacts to upland forests and focal species from our priority, wildlife-dependent public use programs and camping, is the same as described under “Floodplain, Lakeshore, and Riparian Habitat Impacts that would not vary by Alternative.”

In addition, there are potential impacts from snowmobiling which would continue at current use levels under all alternatives. Appendix C includes a compatibility determination for snowmobiling which summarizes a literature review of potential impacts. None of those studies were conducted locally, however, and direct extrapolations to the refuge are difficult. In general, the greatest potential impact is with resident winter mammals and raptors, such as the bald eagle. Some of the wildlife and habitat impacts described in the compatibility determination are:

- increased energy expenditure by wildlife in response to the disturbance; increased heart rate, activity, or actual flight could each result in an energetic cost, which is exacerbated in severe winters or in individual animals in poor health or condition
- displacement to suboptimal habitat or areas where forage and cover are a lower quality
- alteration of behavior where disturbed animals may change their foraging times to periods when energy losses or exposure to predators is higher
- changes in community composition and inter-species interactions
- improved predator access to prey wintering areas (a benefit for predators, but a negative impact on prey)
- direct mortality from snowmobile-wildlife collisions.
- Two potential positive impacts noted are:
 - reduced energy expenditure by wildlife where snow compaction and trail creation reduces energy expenditure in otherwise deep snow
 - improved access to resources whereby compacted trails expand access to foraging areas

Winter on the refuge



Snowmobile trails on the refuge are located almost entirely on existing hardened roads built to support commercial logging operations. Impacts from snowmobiling on these surfaces relating to soil and vegetation have been effectively mitigated by the use of these roads as the location for the trails. Water courses are crossed with bridges and culverts designed to support trucks and other heavy equipment, therefore additional impacts from snowmobiling is unlikely. Snowmobile trails throughout the area have been established for many years and pre-date refuge ownership. Wildlife impacts are considered minimal since potentially affected wildlife are generally accustomed to this use. Increases in emission regulations by the EPA along with the increase in the number of 4-stroke and new cleaner 2-stroke engines in modern snowmobiles has and will continue to reduce potential impacts to the environment. An increased law enforcement presence from a Refuge Law Enforcement Officer and the Zone Officer will ensure compliance with snowmobile restrictions. Monitoring will identify any actions needed to respond to new information and correct problems that may arise in the future.

Based on available information and at current and anticipated levels and patterns of use, and given our monitoring, outreach and enforcement programs, we predict the effects of snowmobiling on designated refuge trails, considered separately or cumulatively, would not constitute significant short-term or long-term impacts on upland habitats. However, we plan to evaluate all trails on a 5 year basis to ensure no site-specific impacts develop. Some of these trails may be re-routed, if it is determined that they have a significant negative impact on wildlife or habitat.

With regards to hunting, our April 2007 amended EA for the refuge's current hunt program (alternative 2 in that EA), which we incorporate by reference herein, provides an impact analysis on upland forest wildlife species affected by our program. Our proposal under alternative B and C to consider adding a new turkey hunt on refuge lands in both states, and a new bobcat hunt on refuge lands in Maine, consistent with respective states' regulations, would be fully analyzed in a separate environmental analysis. We would plan to initiate that analysis

within two years of CCP approval and would include opportunities for public involvement.

Impacts to Upland Forest Matrix Habitats and Focal Species from Alternative A

Under alternative A, we would continue to conserve the refuge's current 10,845 acres of upland spruce-fir, mixed, and northern hardwood forest (see table 4.12). We would also seek to acquire and conserve an additional 4,838 acres of upland forest—a 37 percent increase in acreage—from willing sellers within the current refuge boundary. This increase would be of much more limited benefit to upland habitats and focal species when compared with adding as much as 43,928 upland forest acres under alternative B or 69,702 acres under alternative C. The additional acreage to be acquired in their respective expansion areas would more than double the refuge's conserved upland forest habitat.

Table 4.12. Upland mixed forest matrix habitat acquisition proposed by alternative

		A		B				C	
Habitat Type	current refuge acres	still to be acquired	Refuge Total	Fee Acres	Easement Acres	Fee + Easement	Refuge Total	Fee Only	Refuge Total
Spruce-fir	2,346	956	3,302	14,476	11,085	25,561	28,863	11,468	14,770
Mixed Forest	3,859	2,454	6,313	5,521	5,731	10,952	17,265	27,918	34,231
Northern hardwoods	4,640	1,428	6,068	3,804	3,611	7,415	13,483	30,316	36,384
Forest Matrix	10,845	4,838	15,683	23,501	20,427	43,928	59,611	69,702	85,385

We would not engage in forest management practices on former privately managed lands that would increase rotations and lead to more mature forest under alternative A. We would not actively manage the forest to improve forest structure or alter forest composition so that it best supports focal bird species. Our management role would be passive so we would not engage in harvesting. However, we expect that natural succession and disturbance would eventually lead to mature forests with a larger softwood component. Forest succession alone would be the only means by which habitat to benefit mammalian focal species would be created.

Because we would not actively manage the forests under alternative A, there would be no impacts from tree cutting or construction and use of skid trails and haul roads.

Acquisition of 4,838 upland forest matrix acres and increased visitation under alternative A would minimally increase off-trail disturbance of upland forests with habitat impacts or disturbance of wildlife.

Because natural succession would be the only mechanism through which the upland areas would recover from ice storms, wind throw or other natural disturbances, and there would be a far more limited acreage in refuge uplands (approximately 15,000 acres) under alternative A, any significant disturbance event could have serious implications so far as the potential for the natural disturbance to diminish the habitat value of those portions of the refuge for long periods

Snowmobiling would continue to be allowed with use confined to the two state-designated trails. Appendix C includes a compatibility determination for snowmobiling which describes potential impacts from this activity. However, allowing snowmobiling only on established trails means any important habitat and wildlife impacts have already occurred. Some level of winter wildlife disturbance effects would continue.

Spruce-fir Habitat Type

Under alternative A, acquiring up to 956 acres to total 3,302 refuge acres of spruce-fir conserved would benefit refuge focal species. However, we would not implement any measures to directly enhance mature spruce-fir habitats to benefit blackburnian or black-throated green warblers. We would continue to work with partners to conserve deer winter yards which would maintain some localized mature spruce fir stands preferred by these species. Through natural succession spruce-fir is expected to become a larger component of the upland forests, so this would also tend to benefit the warblers. Deer would benefit from winter yard conservation on current and newly acquired lands.

Under alternative A, there would be no active forest management so there would be no management-related adverse impacts.

Mixed Woods Habitat Type

Under alternative A, acquiring up to 2,454 acres to achieve a total of 6,313 refuge acres of mixed woods conserved would benefit refuge focal species. As noted for spruce-fir we would not implement any measures to directly enhance mixed forest to promote the spruce or fir habitat components to benefit Canada, black-throated green, and blackburnian warblers.

Through natural succession spruce and fir are expected to become a larger component of the upland forests, so this would tend to benefit the warblers. There would be no benefits to woodcock because no active woodcock management would occur. In general, maturing forest with few large disturbed sites would not support woodcock. However, because there would be no active forest management there would be no management related adverse impacts.

Northern Hardwoods Habitat Type

Acquiring up to 1,428 acres to total 6,068 refuge acres of Northern hardwoods conserved would benefit refuge focal species. But we would not actively manage northern hardwood stands to promote dense understory to benefit black-throated blue warblers, or intolerant hardwoods to benefit woodcock production, Canada warbler or other early successional species. We would be limited to relying on whatever natural disturbances occur to promote early successional growth. No active management, however, means there would be no management related adverse impacts.

- Forest management on the refuge will generally follow recommendations in the following publications:
- Forestry habitat management guidelines for vernal pool wildlife in Maine (Calhoun and deMaynadier 2003).
 - Buffers for wetlands and surface waters: a guidebook for New Hampshire municipalities (Chase et al. 1997).
 - Best management practices for erosion control on timber harvesting operations in New Hampshire (Cullen 2000).
 - Biodiversity in the forests of Maine: guidelines for land management (Flatebo et al. 1999).
 - Good forestry in the granite state: recommended voluntary forest management practices for New Hampshire (NHFSSWT 1997).
 - Management guide for deer wintering areas in Vermont (Reay et al. 1990).
 - Guide to New Hampshire timber harvesting laws (Smith and Whitney 2001).

American woodcock



USFWS

Impacts to Upland Forest Matrix Habitats and Focal Species from Alternative B

We propose to greatly expand conservation of upland habitats at the refuge and to institute a wide range of significant upgrades in our management of upland focal species under alternative B. We would continue to conserve the refuge's current 10,845 acres of upland forest (see table 4.12) under alternative B and propose acquiring the remaining 4,838 acres within the current refuge boundary and 43,928 additional forested acres in the alternative B expansion area (see map 2-7). In all we plan to conserve 59,611 acres of upland forest matrix.

We would not implement forest habitat management on expansion lands within 15 years of CCP approval except for pre-commercial thinnings or other pre-commercial operations, until the forest has recovered from recent harvesting. Silvicultural practices on about 4,000 acres within the refuge acquisition boundary may cause some of the adverse effect described below, but implementation of best forest management practices would minimize effects. We would avoid impacts to all sensitive environments on the refuge by adhering to strict operability standards that prohibit or severely restrict forest management on protected resources and in buffer areas.

There would be the same type of wildlife disturbance impacts from snowmobiling as discussed above, but there would be more trails monitored because of refuge expansion. Precluding installation of additional infrastructure to support snowmobiling would limit such impacts by limiting time spent on the refuge. We would relocate trail portions where needed to meet habitat goals and would close and restore unauthorized trails.

Spruce-fir Habitat Type

Acquiring up to 25,561 acres to total 28,863 refuge acres of spruce-fir conserved would increase benefits to refuge focal species. We would implement specific measures to enhance spruce-fir habitats on current and expansion area lands under alternative B to benefit blackburnian and black-throated green warblers, and to promote growth of travel corridors for lynx and other larger mammals. Forest management measures are detailed in the habitat management plan that includes using silvicultural methods on spruce-fir management units such as thinnings, small patch cuttings, and overstory removal to enhance regeneration of spruce. Rotations used to favor spruce would be 100 to 120 years; for fir 80 years.

All of these silvicultural techniques pose some risk of causing adverse impacts on, adjacent to, and downgradient of the site as well as on access roads and skid trails. Forest practices could damage the litter layer, coarse woody debris, snags, or cavity trees important for wildlife. They may alter the moisture regimes in soil and on the forest floor in ways that affect plants and animals such as forest floor amphibians and small mammals. Other potential effects include soil disturbance, compaction, and erosion on site and on access roads and skid trails, elimination or displacement of individual animals inhabiting the treated site, loss of nesting, roosting, or raptor perching trees, and increased risk of colonization by invasive plants. Residual stand damage may result in the introduction of insects or disease into an otherwise healthy stand. Harvesting may also leave the remaining trees more susceptible to wind throw. Best forest management practices (see text box) would be followed to ensure that any effects on managed land would be minimized.

We would avoid direct impacts to all sensitive environments on the refuge by adhering to BMPs and restricting management in high sensitivity zones and industry inoperable areas.

We would continue to work with partners to conserve deer wintering areas which would maintain some localized mature spruce fir stands preferred by these species.

Mixed Woods Habitat Type

Acquiring up to 10,952 acres to total 17,265 refuge acres of mixed woods conserved would substantially increase benefits to refuge focal species. Similar to our proposal for spruce-fir habitat, we would implement measures under alternative B to enhance mixed woods habitat, focusing principally on the spruce and fir components of these habitats and on patches of early successional habitat. Management would be conducted on current refuge lands and fee acquired expansion lands to benefit blackburnian and Canada warblers and woodcock in woodcock focus areas. We would use the same techniques and rotations described above for spruce and fir. We would create and maintain openings and promote early successional hardwoods for woodcock in woodcock focus areas. These measures are detailed in the habitat management plan.

The potential for adverse impacts would be similar to what we described for spruce-fir above, with a slightly greater degree of risk of soil erosion from openings maintained for woodcock. Potential impacts of human disturbance caused by refuge visitors would be limited by the relative remoteness of the woodcock management sites.

Northern Hardwoods Habitat Type

Acquiring up to 7,415 acres to total 13,483 refuge acres of Northern hardwood forest conserved would benefit refuge focal species. Their benefits would increase through active management to promote dense understory to benefit black-throated blue warblers, and intolerant hardwoods to benefit woodcock production, Canada warbler or other early successional species.

There would be adverse impacts from silvicultural operations, including those noted above under spruce-fir. These impacts would generally be short-term, localized at managed sites, and mitigated by best forest management practices.

Similar to alternative B, we propose a major expansion in the total acreage of upland forest matrix we would conserve at the refuge under alternative C. However, our management objectives under alternative C are designed to attain certain forest characteristics rather than to directly optimize focal species conservation and productivity.

Under alternative C we would not employ specific forest management measures targeted at focal species but rather manage the forest in large, contiguous blocks greater than 25,000 acres to provide a mosaic of composition and maturity that would be characteristic of these forests under natural patterns of disturbance and succession. We expect that, in general, focal species would ultimately benefit as these natural characteristics are attained, but we would not alter our management approach even if it is determined that certain focal species do not benefit.

To manage the forest at such a landscape scale requires us to acquire a greater expansion area than proposed under alternative B. While we would continue to conserve the refuge's current 10,845 acres of upland forest and acquire 4,838 acres within the current refuge boundary, we would seek an additional 69,702 forested acres in the alternative C expansion area (see map 2-11). In all we would conserve 85,385 acres of upland forest.

Impacts of Forest Roads on Birds

"We studied the effect of maintained and unmaintained forest roads on (1) forest bird nest survival, (2) reproductive parameters of ovenbirds (Seiurus aurocapillus) potentially associated with food abundance, and (3) habitat and microclimate at six sites on the White Mountain National Forest, New Hampshire, during two breeding seasons. We conclude that small, unsurfaced forest roads at low road density do not result in decreases in forest passerine bird productivity in extensively forested areas in New England." (King and DeGraaf 2002)

Impacts to Upland Forest Matrix Habitats and Focal Species from Alternative C

The silvicultural practices employed under alternative C and their potential impacts, best management practices, and operability restrictions to conserve sensitive environments would be the same as alternative B. The cumulative direct forest management effects would be similar to but more limited than alternative B because of smaller cuts (4%) to management units.

Snowmobiling impacts would be limited to current trails where any substantive habitat and wildlife impacts have generally already occurred. Winter wildlife disturbance effects would continue



Bob Harris/USFWS

Moose are common in the spruce-fir forest

Spruce-fir Habitat Type

The spruce-fir habitat benefits would be similar to alternative B, with major expansion of 11,468 acres to total 14,770 of spruce-fir forest conserved under alternative C. However, there would be no refuge focal species management measures. Forest management effects would be similar to but more limited than alternative B because of the smaller cuts (4%) to each management unit. There would be lower cumulative effects over the type within the Umbagog Lake watershed. Deer would benefit from conserving mature and maturing stands on expansion lands.

The techniques we would use to manage spruce-fir under alternative C to achieve a pattern characteristic of the diversity of the spruce-fir type under natural disturbance patterns would include small group selection and individual tree removal with longer entry intervals to promote older aged stands of 150 years or greater. These forest management methods would likely have effects similar to those described previously for alternative B with more limited direct effects to management sites and lower cumulative effects over the type within the Upper Androscoggin River watershed.

The exception to this would occur where an insect outbreak affects a major portion of the forest, up to 2,500 acres, or we determine that cutting a large area is necessary to simulate the effects of an insect outbreak or major blowdown event. Should such a requirement be identified in the future, we would conduct a full NEPA analysis of the forest management project.

Mixed Woods Habitat Type

There would be benefits similar to alternative B, with a major expansion of 27,918 acres to total 34,231 of mixed woods conserved under alternative C. However, we would implement no refuge focal species management measures. We would use small group selection, on up to 1/2-acre sites, to increase the softwood component of the mixed woods stands. This forest landscape mosaic would benefit Canada warblers where there is sufficient dense understory and blackburnian warblers where there are sufficient mature conifers. Impacts on these sites would be more limited than those described for alternative B on similar sites because the cuts would be smaller and entry to stands would be less frequent. In the long term, we would not likely be able to achieve as high a population density of either bird species on refuge lands because we would not be cutting back mature stands as frequently or over as large a portion of this type and therefore not creating as much optimal habitat as we would under alternative B.

We would not specify woodcock management focus areas under alternative C and would not promote woodcock as a major focal species. We would manage for natural clearings and early successional components in mixed stands that would be part of the mosaic of stand composition sought under this alternative. These clearings would benefit woodcock only if singing grounds and large openings for night roosting are sufficient in number and proximity to the woodcock's other necessary habitat components to adequately support the species.

Northern Hardwoods Habitat Type

There would be benefits similar to alternative B with major expansion of 30,316 acres to total 36,384 of Northern hardwood forest conserved under alternative C but no refuge focal species management measures. We would use small group and single tree selection cuts of ¼ acre or less to create all-aged stands in this type with a median canopy tree age of 150 years. These openings would be employed to simulate tree fall gaps. Impacts on these sites would be more limited than those described for alternative B on similar sites because the cuts would be smaller and entry to stands would be less frequent. In the long term, we would not likely be able to achieve as high a population density of either bird species on refuge lands because we would not be cutting back mature stands as frequently or over as large a portion of this type and therefore not creating as much optimal habitat as we would under alternative B.

As noted above, these clearings would benefit woodcock only if singing grounds and large openings for night roosting are sufficient in number and proximity to the woodcock’s other necessary habitat components to adequately support the species.

Effects on Public Use and Access

Since refuge lands are held in the public trust by the Service, access is generally allowed for compatible, priority wildlife-dependent public uses unless Federal trust resource would be impacted, or the activity would detract from achieving refuge purposes or the Refuge System mission, or because administrative resources are not available to ensure a safe, quality experience. Lake Umbagog Refuge is currently open to the following priority wildlife-dependent public uses: hunting, wildlife observation and photography, environmental education and interpretation. Under all alternatives we would officially open the refuge to fishing, which according to Service policy, is another priority, wildlife-dependent public use. Other popular activities allowed on the refuge include, but are not limited to: remote lake camping in designated sites, snowmobiling in designated areas dogsledding, and motorized and non-motorized boating. We will also officially open the refuge to the following activities by incorporating the following compatibility determinations in this Environmental Impact Statement: “Recreational Gathering of Blueberries, Blackberries, Strawberries, Rapsberires, Mushrooms, Fiddleheads and Antlersheds,” “Horseback Riding,” and “Bicycling.”

Some regionally popular activities are not allowed on the refuge as described in chapter 2-alternatives. These include: ATV or other motorized ORV use; personal watercraft; personal motorized equipment such as segways; competitions or organized group events (e.g. fishing derbies, dog trials, or mountain bike or cross-country ski or boat races); geocaching, and camping outside of designated sites.

Table 4.8 provides a summary of projected annual visitation by the major activities allowed for each alternative. We evaluated the benefits of the following management actions with the potential to affect the level of opportunity or visitor experience for those major activities listed:

- Service fee simple land acquisition provides permanent access for approved activities
- Improvements and/or new construction of visitor infrastructure, and the increased distribution of refuge information, will improve visitor experiences
- Increased partnerships with local, regional, and state recreational interests will encourage a diversity of sustainable opportunities
- Increased outreach and Service visibility to promote resource stewardship and outdoor ethics



Ian Drew/USFWS

Fishing on Magalloway River

We evaluated and compared the following impacts that refuge management actions could have on the level of opportunity and visitor experiences:

- Refuge acquisition may result in the elimination of non-wildlife dependent, non-priority activities that are presently allowed by the current owner
- Refuge activities may attract an unanticipated increase in visitation, resulting in increased conflicts or negative encounters among users

Confusion could result over ownership boundaries and which laws, rules, and regulations apply

Public Use and Access Impacts That Would Not Vary by Alternative

The Magalloway River Trail, its new extension, and the new Potter Farm area trails would be maintained and/or developed in Alternatives B and C. This infrastructure would be built to comply with the American with Disabilities Act standards, affording the only opportunity we are aware of in the area for an accessible outdoor experience off of a major road. All alternatives would also continue to allow snowmobile use on designated routes and allow remote lake camping in designated sites. These are some of the most popular activities occurring on the refuge. The opportunity provided for these two activities on the refuge is important because eliminating them would have regional implications. For example, the refuge snowmobile trails are important links in a regional interstate network of trails and disrupting that use would diminish a very important social and economic activity for the area. Remote lake camping in the area is very limited and offers a very unique opportunity for a visitor to immerse themselves in nature. It should be noted, however, that none of the alternatives propose to expand these activities on current refuge lands. Nevertheless, we predict we would be able to meet demand for these activities, within the current capacity of the refuge to maintain them and still meet refuge goals and objectives, over the next 15 years.

Our April 2007 amended EA for the refuge's current hunt program (alternative 2 in that EA), which we incorporate by reference herein, provides additional impacts analysis (USFWS, 2007).

As lands are acquired for the refuge, we would plan to continue to allow the six priority, wildlife-dependent activities, except under extenuating circumstances unforeseen at this time. However, there may be activities allowed by the current owner that we would not allow to continue once acquired for the refuge. The list of popular activities not allowed on refuge lands was noted above. We are not sure how much these activities are occurring on lands proposed for acquisition, but suspect activities such as ATV use, dirt biking, and off-road mountain biking occur. Some people engaged in these activities would shift their use to other ownerships, including the White Mountain National Forest and town lands. Other people, including some that may be local residents in Errol, NH or Upton, ME, may use these lands exclusively, and be forced to quit the activity.

Public Use and Access Impacts of Alternative A

Alternative A would result in Service acquisition of 7,482 acres from willing sellers to add to the approved boundary, increasing opportunities for priority public uses commensurately. A 10% increase over current visitation, resulting in an expected 55,150 annual visitors over the next 15 years, is predicted based on regional tourism trends, increased Service land acquisition, and planned visitor services activities. We do not anticipate that this increase would adversely affect resources or the use or enjoyment by visitors because the increases projected for the refuge would be well-distributed. The only potential for increased adverse effects, or increased conflict, between or among users may occur with visitors engaged in boating. While we rarely hear complaints from visitors, those that we do hear are typically about incidents between non-motorized and motorized boaters. Or, we have heard from adjacent private landowners who complain about trash and human waste being left on their lands from lake and river boater

trespass. Alternative A does not propose to regulate these activities, but we would continue to respond to complaints on a case-by-case basis.

There is an increasing local demand for interpretive and educational programs as evidenced by the numerous requests we receive. Our current staffing level and management priorities limit our ability to respond to all requests. Two interpretive programs a year, and participation in two local community events, is our current limit. Under alternative A, we would continue not to be able to meet demand for these activities.

Our current hunting program and infrastructure would be maintained, including the six waterfowl hunting blinds. According to state wildlife biologists responsible for the Umbagog area, hunting pressure is considered light for northern New Hampshire and western Maine. We believe we are accommodating all hunters who want to use the area. Hunting appears to be well-distributed and we rarely hear complaints about its administration. Neither our observations of hunters, nor feedback from them, or comments from other refuge visitors, has demonstrated to us that we need to place any additional restrictions on hunting.

We predict that fishing opportunities would not appreciably increase, despite our formally opening up the refuge to fishing, since fishing currently occurs. Similar to hunting, our observations indicate that fishing is well-distributed, and self-regulated, and we rarely hear complaints.

Public Use and Access Impacts of Alternative B

Alternative B would result in Service acquisition of 26,840 acres in fee simple from willing sellers to add to the approved boundary, increasing permanent opportunities for priority public uses commensurately. In particular, those engaged in hunting, wildlife observation and nature photography would benefit from the expansion. An increase over current visitation, resulting in an expected 90,950 annual visitors over the next 15 years, is predicted based on regional tourism trends, increased Service land acquisition, and planned visitor services activities. Most of the increase in visitation under Alternatives B and C is based on the number of people that currently recreate on lands that will be acquired by the refuge. While it is not a real increase in visitation or economic activity to the area, the refuge land acquisition maintains recreation access that is not guaranteed under Alternative A.

The Magalloway River Trail



Ian Drew/USFWS

With the proposed expanded land base, and proposed new trail and wildlife viewing infrastructure, most of the upland activities would continue to be well-distributed and the variety of interpretive and wildlife observation opportunities, in particular, would increase. We would not appreciably expand our environmental education program, and similar to alternative A, would not likely meet demand until we develop partnerships as planned to facilitate the design and implementation of educational programs on refuge lands. Under alternative B, we would also continue to develop a Friends Group, provide volunteer opportunities, and maintain the Youth Conservation Corps; all of which are programs that will increase Service presence and community outreach.

What we predict to increase is conflicts among boaters, as described under alternative A. To combat this concern, alternative B proposes to work within the structure of the Umbagog Working Group to develop strategies to address these conflicts, including the development of thresholds of acceptable change, capacity limits, or controlled access, which would be implemented among the resource agencies with jurisdiction on the lake. Alternative B would also implement: improved outreach programs, increased Service to visitor contacts, improved informational and educational materials, and develop a promotional campaign to improve boater ethics, as strategies to minimize these conflicts.

Under alternative B, the two refuge river campsites would be eliminated and restored to native vegetation. While these sites have been popular, and are occupied most weekends during July and August, their condition is deteriorating, and creating soil and water impacts. These sites will be closed and not be replaced, which we expect will be a concern to some visitors. The hunt program under alternative B would evaluate the potential of additional hunting opportunities by considering two new seasons, one for turkey hunting on refuge lands in both states, and a bobcat season on refuge lands in Maine, both consistent with respective states' regulations. We plan to analyze the impacts of those additional seasons on hunters and other refuge visitors in a separate environmental analysis. We would initiate that analysis within two years of CCP approval and would include opportunities for public involvement. Fishing impacts are similar to alternative A.

Public Use and Access Impacts of Alternative C

Alternative C would result in Service acquisition of 74,414 acres in fee simple from willing sellers to add to the approved boundary, increasing permanent opportunities for priority public uses commensurately. As with alternative B, those engaged in hunting, wildlife observation and nature photography would particularly benefit from the expansion. An increase over current visitation, resulting in an expected 93,700 annual visitors over the next 15 years, is predicted based on regional tourism trends, increased Service land acquisition, and planned visitor services activities. With the proposed expanded land base, most of the upland activities would continue to be well-distributed.

Most of the increase in visitation under Alternatives B and C is based on the number of people that currently recreate on lands that will be acquired by the refuge. While it is not a real increase in visitation or economic activity to the area, the refuge land acquisition maintains recreation access that is not guaranteed under Alternative A.

Less planned infrastructure for interpretation would be developed under alternative C, otherwise most of the impacts described for alternative B actions apply to alternative C. The only other difference is that in an effort to create a more dispersed, back-country, low density hunting and fishing experience on refuge lands, we may implement a permit program to better disperse users and manage densities. A permit system will not be favored by some people who are opposed to any controls on, or manipulations of, their activity on public lands.

Effects on Cultural Resources

As we described in Chapter 3 – Affected Environment there are several sites on the National Historic Register documented on or near refuge lands. We protect them, and would continue to do so, under state and federal historic preservation act requirements. Our actions with the potential to impact cultural resources are routinely reviewed and assessed under provisions of Section 106 of the National Historic Preservation Act. To date, projects requiring such reviews include an evaluation of whether certain cabins and the Potter Farm complex of buildings qualified as historic structures.

It is possible that unrecorded historic sites occur on lands proposed for acquisition under any alternative. Thus, the potential for permanent protection of presently unknown sites increases with the amount of refuge lands proposed for acquisition.

We expect none of the alternatives to have significant adverse impacts on cultural resources in New Hampshire or Maine. Beneficial impacts would occur at various levels, depending on the alternative, because of proposed environmental education and interpretation programs, and increased field surveys to identify and protect any discovered sites. In alternatives B and C we would identify high probability sites to survey more intensely. Furthermore, we would evaluate the potential to impact archeological and historical resources prior to any

ground disturbing actions, and would consult with respective SHPOs. We would especially be thorough in areas along streams and lakes where there is a higher probability of locating a site. This document has been submitted to both states of Maine and New Hampshire SHPOs for their review and concurrence. The Tribal Historic Preservation Officers from the federally-recognized tribes in Maine have also received this document for review.

Cumulative Impacts

According to the Council on Environmental Quality NEPA implementing regulations at 40 CFR 1508.7, “Cumulative impact” is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

This cumulative impacts assessment includes other agencies’ or organizations’ actions if they are inter-related and influence the same environment. Thus, this analysis considers the interaction of activities at the refuge with other actions occurring over a larger spatial and temporal frame of reference.

Air Quality

None of the alternatives are expected to have significant cumulative adverse impacts on air quality locally or regionally in New Hampshire or Maine. Some short-term, local deterioration in air quality would be expected from air emissions of motor vehicles, motorboats, and snowmobiles used by refuge visitors and staff. Visitors would access the refuge primarily by automobile and snowmobile, with approximately 65 percent of the more than 90,000 annual visits expected to originate outside the Coos County – Oxford County area. However, the refuge is not expected to be a New England recreation destination. Most visitors would already be in the area or would be passing through the area on vacation and would seek out the refuge for a day trip. All snowmobile trails on the refuge would be through trails only; we would not provide parking, warming huts, or other infrastructure on refuge lands. Therefore, the presence of the refuge alone would only account for a small percentage of vehicle emissions generated in this area.

We predict no cumulative impacts to Class 1 air sheds from our actions; the closest Class 1 area being the Great Gulf Wilderness Area, approximately 45 miles to the southwest near Gorham, New Hampshire. The air quality and visibility problems that occur there are caused by ozone and particulate emissions from major sources to the west and south. Actions at the refuge would not contribute to that problem.

With our partners, we would continue to contribute to improving air quality through cooperative land conservation and management of natural vegetation and wetlands. Protecting land from development, which is happening at an increasing rate in New Hampshire and Maine, and maintaining it in natural upland vegetation or wetlands, assures these areas would continue to filter out many air pollutants harmful to humans and the environment.

Soils

The greatest past, present, and foreseeable future adverse impacts on the Umbagog Lake and Upper Androscoggin River watershed soils are from timber management and development. We would improve watershed soil conditions and minimize site-level soil impacts through acquisition of commercially managed timber lands and other upland sites; vegetative restoration of developed sites, roads, and trails; employment of best management practices on building, road, and trail construction sites, cooperative land conservation of important habitat; and technical information exchange with landowners throughout these watersheds.

We would accomplish this to some degree under alternative A. Under alternatives B and C we propose a major increase in Service land acquisition and a wide range of restoration and mitigation practices to improve soil conditions on all refuge lands in the watershed.

Hydrology and Water Quality

There would be cumulative benefits to hydrology and water quality from restoration of camp sites, other disturbed sites, and unused roads and trails on acquired lands. There would also be cumulative benefits from more intensive measures to restore natural hydrology through such measures as culvert removal under alternative C.

There would be no significant adverse cumulative impacts to hydrology or water quality under any of the alternatives. BMPs and erosion and sediment control measures would be used on building, road, trail, and other recreation infrastructure construction sites to ensure impacts are minimized. These projects are few in number and located widely dispersed throughout the refuge so their local effects would not be additive.

Biological Resources-Conserved Habitats and Focal Species

All alternatives would maintain or improve biological resources on the refuge, in the Upper Androscoggin watershed, and within the Northern Forest ecosystem. The combination of our management actions with other organizations' actions could result in significant, beneficial cumulative effects by: (1) increasing conservation and management for Federal and State-listed threatened and endangered species; (2) improving uplands and wetlands habitats that are regionally declining; and (3) preventing spread or reducing invasive plants and animals.

There would be no significant cumulative adverse effects to biological resources under any of the alternatives because the changes in habitat components that we would manage for directly or expect to realize through natural succession would on balance be beneficial. Biological resources that we would manage to prevent their introduction, limit, or eliminate, such as invasive plants or bass, are not natural components of the Lake Umbagog refuge ecosystem. Losses of those biotic components where they occur would not be considered adverse.

Cultural Resources

We expect none of the alternatives to have significant adverse cumulative impact on cultural resources in New Hampshire or Maine. Beneficial impacts would occur at various levels, depending on the alternative, because of proposed environmental education and interpretation programs, increased land protection, and increased field surveys to identify and protect any discovered sites. In alternatives B and C we would identify high probability sites to survey more intensely.

This section evaluates the relationship between local, short-term uses of the human environment and maintaining long-term productivity of the environment. By long-term we mean that the impact would extend beyond the 15-year planning horizon of this draft CCP/EIS.

Cumulative Impacts of Global Climate Change

Department of the Interior Secretarial Order 3226 states that "there is a consensus in the international community that global climate change is occurring and that it should be addressed in governmental decision making...This Order ensures that climate change impacts are taken into account in connection with Departmental planning and decision making". Additionally, it calls for the incorporation of climate change considerations into long-term planning documents such as the CCP.

The Wildlife Society (TWS) published an informative technical review report in 2004 titled "Global Climate Change and Wildlife in North America" (Inkley

et al 2004). It interprets results and details from such publications as the Intergovernmental Panel on Climate Change (IPCC) reports (1996-2002) and describes the potential impacts and implications on wildlife and habitats. It mentions that projecting the impacts of climate change is hugely complex because not only is it important to predict changing precipitation and temperature patterns, but more importantly, to predict their rate of change, as well as the exacerbated effects of other stressors on the ecosystems. Those stressors include loss of wildlife habitat to urban sprawl and other developed land uses, pollution, ozone depletion, exotic species, disease, and other factors. Projections over the next 100 years indicate such major impacts as extensive warming in most areas, changing patterns of precipitation, and significant acceleration of sea level rise. According to the TWS report, "...other likely components of on-going climate change include changes in season lengths, decreasing range of nighttime versus daytime temperatures, declining snowpack, and increasing frequency and intensity of severe weather events" (Inkley et al. 2004). The TWS report details known, and possible influences on, habitat and wildlife including changes in primary productivity, changes in plant chemical and nutrient composition, changes in seasonality, sea level rise, snow, permafrost, and sea ice decline, increased invasive species, pests and pathogens, and impacts on major vertebrate groups.

A second publication we consulted was The Union of Concerned Scientists report titled "Confronting Climate Change in the U.S. Northeast: Science, Impacts, and Solutions (July 2007)" which can be accessed online at www.northeastclimateimpacts.org. This report, and its state summaries for Maine and New Hampshire, reiterates much of the TWS report although within a regional context. Climate-related changes predicted include more frequent days with temperature above 90° F, a longer growing season, less winter precipitation as snow, and more as rain, reduced snowpack and density, earlier breakup of winter ice on lakes and rivers, earlier spring snowmelt resulting in earlier peak river flows, and rising sea temperatures and sea levels (NECIA 2007).

The effects of climate change on populations and range distributions of wildlife are expected to be species specific and highly variable, with some effects considered negative and others considered positive. Generally, the prediction in North America is that the ranges of habitats and wildlife will generally move upwards in elevation and northward as temperature rises. Species with small and/or isolated populations and low genetic variability will be least likely to withstand impacts of climate change. Species with broader habitat ranges, wider niches, and greater genetic diversity should fare better or may even benefit. This will vary depending on specific local conditions, changing precipitation patterns, and the particular response of individual species to the different components of climate change (Inkley et al 2004).

The NH WAP discusses species-specific examples such as impacts to American marten and lynx because of changing snow depths, impacts on alpine butterflies and herbaceous communities due to changes in seasonal timing, and impacts to native fish from projected increased temperatures in rivers and streams (NH WAP 2005). It also discusses the potential for cold-adapted forest trees, such as spruce, fir, aspen, and sugar maple, to retreat northward, dramatically altering the composition of the Northern Forest, and its wildlife-dependent species (NH WAP 2005). The TWS report, however, emphasizes that developing precise predictions for local areas is not possible due to the scale and accuracy of current climate models, which is further confounded by the lack of information concerning species-level responses and to ecosystem changes, their interactions with other species, and the impacts from other stressors in the environment. In other words, only imprecise generalizations can be made about the implications of our refuge management on regional climate change.

Our evaluation of proposed actions in this Final CCP/EIS concludes that only two activities may contribute negligibly, but incrementally, to stressors affecting regional climate change: our prescribed burning program and our use of vehicles, boats, and equipment to administer the refuge. We discuss the direct and indirect impacts of those activities elsewhere in chapter 4. We also discuss measures to minimize the impacts of both. For example, with regards to prescribed burning, we would follow detailed burn plans operating only under conditions that minimize air quality concerns. In addition, many climate change experts advocate prescribed burning to manage the risk of catastrophic fires (Inkley et al. 2004). With regards to our equipment and facilities, we are trying to reduce our carbon footprint wherever possible by using alternative energy sources and energy saving appliances, driving hybrid vehicles, and using recycled or recyclable materials, along with reduced travel and other conservation measures.

In our professional judgment, the vast majority of management actions we propose would not exacerbate climate change in the region or project area, and in fact, some might incrementally prevent or slow down local impacts. We discuss our actions relative to the 18 recommendations the TWS report gives to assist land and resource managers in meeting the challenges of climate change when working to conserve wildlife resources (Inkley et al. 2004). Their position is that if land and resource managers collectively implement these recommendations, then cumulatively there would be a positive impact of addressing climate change.

Recommendation #1: Recognize global climate change as a factor in wildlife conservation. This recommendation relates to land managers and planners becoming better informed about the consequences of climate change and the variability in the resources they work with.

The Service is taking a major role among federal agencies in distributing and interpreting information on climate change. There is a dedicated webpage to this issue at <http://www.fws.gov/home/climatechange/>. The Service's Northeast Region co-hosted a workshop in June 2008 titled "Climate Change in the Northeast: Preparing for the Future." The goal of the workshop was "to develop a common understanding of natural and cultural resource issues and to explore management approaches related to climate change in the Northeast." Its primary target audience was land managers. Experts in climate change gave presentations and facilitated discussion. The stated outcomes were to have participants more fully understand the present and anticipated impacts from climate change on forested, ocean and coastal ecosystems, and be able to identify effective management approaches that include collaboration with other local, state and federal agencies. All of the Northeast Region's Refuge Supervisors and planners attended, as did over 20 refuge field staff. Our staff continues to stay informed about climate change through reading peer-reviewed publications and agency reports, and attending workshops and training.

Recommendation #2: Manage for diverse conditions. This recommendation relates to developing sound wildlife management strategies under current conditions, anticipating unusual and variable weather conditions, such as warming, droughts and flooding.

Our proposed habitat management actions described in chapter 2 are intended to promote healthy, functioning native forests, riparian areas, and wetlands as a priority. We have identified monitoring elements, which will be fully developed in the IMP step-down plan, to evaluate whether we are meeting our objectives and/or to assess changing conditions. We will implement an adaptive management approach as new information becomes available.

Recommendation #3: Do not rely solely on historical weather and species data for future projections without taking into account climate change. This recommendation relates to the point that historical climate, habitat and wildlife conditions are less reliable predictors as climate changes. For example, there may be a need to adjust breeding bird survey dates if migratory birds are returning earlier to breed than occurred historically. A 3-week difference in timing has already been documented by some bird researchers.

We are aware of these implications and plan to build these considerations into our IMP so that we can make adjustments accordingly. Our results and reports, and those of other researchers on the refuge, will be shared within the conservation community.

Recommendation #4: Expect surprises, including extreme events. This recommendation relates to remaining flexible in management capability and administrative processes to deal with ecological “surprises” such as floods or pest outbreaks.

Refuge managers have flexibility within their operations funds to deal with emergencies. Other Regional operations funds would also be re-directed as needed to deal with an emergency.

Recommendation #5: Reduce nonclimate stressors on the ecosystem. This recommendation relates to reducing human factors that adversely affect resiliency of habitats and species.

Similar to our response to #2 above, the objectives of our habitat management program are to protect the biological integrity, diversity and health of refuge lands. Objectives to enhance riparian habitat for watershed protection, and establish healthy, diverse native forests in large tracts will help reduce nonclimate stressors and offset the local impacts of climate change. Also, see our response to #15 below.

Recommendation #6: Maintain healthy, connected, genetically diverse populations. This recommendation relates to the fact that small isolated populations are more prone to extirpations than larger, healthy, more widespread populations. Large tracts of protected land facilitate more robust species populations and can offer better habitat quality in core areas.

Our goal to acquire in fee or easement up to 47,000 acres for the refuge from willing sellers will help establish protected core areas or conservation corridors between other protected lands. We strive to acquire large contiguous tracts because their conservation value is greater. We will also continue to work with our many conservation partners at the state and regional level to support and complement restoration and protection efforts. Also, see our response to #14 below.

Recommendation #7: Translocate individuals. This recommendation suggests that it may sometimes be necessary to physically move wildlife from one area to another to maintain species viability. However, it is cautioned that this tool has potential consequences and should only be used in severely limited circumstances as a conservation strategy.

We have no plans to translocate animals within the 15 year time frame of this CCP; however, should this be a recommendation by other state or federal agency experts as critical to conserving a native species, we will evaluate it.

Recommendation #8: Protect coastal wetlands and accommodate sea level rise. This recommendation relates to actions that could ameliorate wetland loss and

sea level rise, such as purchasing wetlands easements, establishing riparian and coastal buffers, restoring natural hydrology, and refraining from developments or impacts in sensitive wetlands and coastal areas.

While the refuge is not near the coast, wetlands protection is one of our highest priorities. Our responses to recommendation #2 and #6 above identifies our objectives to establish fully functioning riparian areas, protect wetlands, maintain healthy native habitats, and acquire additional land in fee or easement that has high wildlife and habitat values. The heart of this refuge is Umbagog Lake, and many of our conservation actions ultimately contribute to its protection.

Recommendation #9: Reduce the risk of catastrophic fire. This recommendation acknowledges that fire can be a natural part of the ecosystem, but that climate change could lead to more frequent fires and/or a greater likelihood of a catastrophic fire.

Our plans to conduct prescribed burns to maintain healthy forests and reduce fuel loading, if needed in the urban-wildland interface, would reduce the overall risk of a catastrophic fire.

Recommendation #10: Reduce likelihood of catastrophic events affecting populations. This recommendation states that increased intensity of severe weather can put wildlife at risk. While the severe weather cannot be controlled, it may be possible to minimize the effects by supporting multiple, widely spaced populations to offset losses.

Our responses to recommendation #2, #6, and #15 describes the actions we are taking to minimize this risk.

Recommendation #11: Prevent and control invasive species. This recommendation emphasizes the increased opportunities for invasive species to spread because of their adaptability to disturbance. Invasive species control will be essential, including extensive monitoring and control to preclude larger impacts.

Invasive species control is a major initiative within the Service. The Northeast Region, in particular, has taken a very active stand. In chapter 2, we describe our plans on the refuge to control invasive plants. We also describe monitoring and inventorying strategies to protect against infestations. Introducing aquatic invasive plants are a big concern on Umbagog lake. We will support efforts by NHFG and MDIFW to monitor for these species. Working with these partners, enhances the long-term effectiveness of our refuge program.

Recommendation #12: Adjust yield and harvest models. This recommendation suggests that managers may have to adapt yield and harvest regulations in response to climate variability and change to reduce the impact on species and habitats.

Any forest harvest we conduct would follow silvicultural prescriptions intended to promote structural and species diversity and improve the health and integrity of the forests within site capability. We would adhere to both states' best management practices. Our monitoring program will include assessing stand condition and response to management, and detecting focal species response to alert us to any significant changes.

Regarding animal harvest through hunting programs, the refuge does not set harvest regulations. For resident wildlife, regulations are established at the state

level. For migratory game birds, the harvest framework is established at the Flyway level, and further refined at the state level.

Recommendation #13: Account for known climatic conditions. This recommendation states we should monitor key resources through predictable short-term periodic weather phenomenon, such as El Nino, to aid us in future management efforts.

We plan to develop a monitoring program that will help us evaluate our assumptions and success in achieving objectives, as well as help us make future management decisions. Any restoration activities or management actions will be carefully planned and its effectiveness monitored and documented so we can use this information in future management decisions.

Recommendation #14: Conduct medium- and long-range planning. This recommendation states that plans longer than 10 years should take into account potential climate change and variability as part of the planning process.

This 15-year CCP addresses climate change because it emphasizes restoring and maintaining healthy, contiguous, native habitat areas, reducing anthropogenic stressors on refuge lands, working with private landowners to improve the health and integrity of their lands, and pursuing larger conservation connections and corridors with partners to enhance protected core areas. Our monitoring program and adaptive management strategies will also facilitate our ability to respond to climate change.

Recommendation #15: Select and manage conservation areas appropriately. This recommendation states that establishing refuges, parks and reserves is a critical conservation strategy to try to minimize the decline of wildlife and habitats in North America. Decisions on locating future conservation areas should take into account potential climate change and variability. For example, it is suggested that decisions on new acquisition consider the anticipated northward migrations of many species, or the northern portion of species ranges. Managers of existing conservation lands should consider climate change in future planning.

Protecting up to 47,000 additional contiguous acres for the refuge will help provide important corridor connections, maintain natural ecosystem processes and functions, provide for more stable, resilient habitats, provide refugia for isolated or specialized species, protect hydrologic function and habitats for fish and other aquatic species, and reduce anthropogenic stressors on the landscape. In addition, our habitat management objectives on refuge lands are intended to maintain and restore healthy, productive and diverse forests, protect floodplain and riparian areas, and protect wetlands and open water habitats. Our efforts, coupled with those of many other land protection partners, will enhance these benefits in the region.

Recommendation #16: Ensure ecosystem processes. This recommendation suggests that managers may need to enhance or replace diminished or lost ecosystem processes. Manually dispersing seed, reintroducing pollinators, treating invasive plants and pests, are examples used.

While we plan to take an aggressive approach to treating invasive plants, we do not believe at this time there is any need to enhance or replace ecosystem processes. Further, none of our proposed management actions will diminish natural ecosystems processes underway. Should our monitoring results reveal that we should take a more active role in enhancing or replacing those processes, we will reevaluate and/or refine our management objectives and strategies.

Recommendation #17: Look for new opportunities. This recommendation states that managers must be continually alert to anticipate and take advantage of new

opportunities that arise. Creating wildlife conservation areas out of abandoned or unusable agricultural land, and taking advantage of industry interest in investing in carbon sequestration or restoration programs, are two examples cited.

Refuge staff have many conservation partners in the area which, in turn, are networked throughout the larger region. We hear about many opportunities for land protection or habitat restoration through that broad-based network. Our Northeast Region has field offices and a regional office that integrates the other Service program areas, including those that work with private entities. We have developed outreach materials, and make ourselves available to interested organizations and groups, to provide more detailed information on the Service and Refuge System missions, refuge goals and objectives, and partnership opportunities.

Recommendation #18: Employ monitoring and adaptive management. This recommendation states that we should monitor climate and its effects on wildlife and their habitats and use this information to adjust management techniques and strategies. Given the uncertainty with climate change and its impacts on the environment, relying on traditional methods of management may become less effective.

We agree that an effective and well-planned monitoring program, coupled with an adaptive management approach, is essential to dealing with the future uncertainty of climate change. We have built both actions into our CCP. We will develop a detailed step-down IMP designed to test our assumptions and management effectiveness in light of on-going changes. With that information in hand, we will either adapt our management techniques, or re-evaluate or refine our objectives as needed.

**Relationship
between Short-term
Uses of the Human
Environment and
Enhancement of Long-
term Productivity**

All of the alternatives strive to maintain or enhance the long-term productivity and sustainability of natural resources on the refuge. The alternatives strive to conserve our Federal trust species and the habitats they depend on, as evidenced by the seasonal public use restrictions during focal bird species nesting seasons. Outreach and environmental education are a priority in each alternative to encourage visitors to be better stewards of our environment.

The dedication of certain areas for the new refuge headquarters and for roads, trails, visitor facilities on the refuge represents a loss of long-term productivity on localized areas, but is not considered significant given the comparative refuge land base.

In summary, we predict that all alternatives would contribute positively to maintaining or enhancing the long-term productivity of the environment.

**Unavoidable Adverse
Effects**

Unavoidable adverse effects are the effects of those actions that could cause significant harm to the human environment and that cannot be avoided, even with mitigation measures. There would be some minor, localized unavoidable adverse effects under all the alternatives. For example, there would be localized adverse effects of building the new refuge headquarters and upgrading the access road. There would be property tax losses to towns and increased visitation that could have unavoidable effects. However, none of these effects rises to the level of significance. All would be mitigated, so there would in fact be no significant unavoidable adverse impacts under any of the alternatives.

**Potential Irreversible
and Irretrievable
Commitments of
Resources**

Irreversible commitments of resources are those which cannot be reversed, except perhaps in the extreme long term or under unpredictable circumstances. An example of an irreversible commitment is an action which contributes to a species' extinction. Once extinct, it can never be replaced.

In comparison, irretrievable commitments of resources are those which can be reversed, given sufficient time and resources, but represent a loss in production or use for a period of time. An example of an irretrievable commitment is the maintenance of clearings and early successional forest for woodcock management. If for some reason woodcock management were no longer an objective, these would gradually revert to mature forest, or the process could be expedited with plantings.

Only a few actions proposed in the alternatives would result in an irreversible commitment of resources. One is construction of the proposed new Potter Farm visitor facility and access road. Alternatives B and C propose that we continue to pursue this action.

Another irreversible commitment of resources impacting local communities is Service land acquisition. Alternative A limits acquisition to the current refuge acquisition boundary. Alternatives B and C propose refuge expansion at increasing levels, respectively. Once these lands become part of the refuge, it is unlikely they would ever revert back to private ownership.

The commitment of resources to maintain the wetlands is small compared to the benefits derived from the increased biodiversity. These wetlands provide nesting, foraging, and migrating habitat for many migratory bird species of conservation concern. They also benefit refuge visitors by providing wildlife observation.

Environmental Justice

Executive Order 12898 “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations” (February 11, 1994), requires that Federal Agencies consider as part of their action, any disproportionately high and adverse human health or environmental effects to minority and low income populations. Agencies are required to ensure that these potential effects are identified and addressed.

Existing Socio-Economic Conditions

The EPA defines environmental justice as; “the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.” In this context, fair treatment means that no group of people should bear a disproportionate share of negative environmental consequences resulting from the action.

Consideration of the potential consequences of the proposed action for environmental justice requires three main components:

- A demographic assessment of the affected communities to determine whether minority or low income populations are present;
- An integrated assessment of all potential impacts identified to determine if any results in a disproportionately high and adverse impact to these groups; and
- Involvement of the affected communities in the decision-making process and in the development and implementation of any mitigation strategies.

Minority populations are not likely to be affected at the refuge. The minority populations of Oxford County, Maine and Coos County, New Hampshire constitute a substantially smaller proportion of the total population, 1.7% and 1.9% respectively, than that for the states of Maine and New Hampshire, 3.1% and 4.0% respectively, and for the Nation as a whole, 24.6%. Minority populations represent a slightly smaller proportion of the communities surrounding the refuge, 0.6% in New Hampshire and 1.2% in Maine.

Socio-economically disadvantaged populations are present and may be affected by actions taken at the refuge. The percent or individuals who are

socioeconomically disadvantage (living in poverty) in Maine is 10.9% and in New Hampshire, 6.5%. Socioeconomically disadvantaged individuals—living at or below the poverty line—constitute 11.8% of the Oxford County, Maine population, and 10.0% of the Coos County, New Hampshire population. The communities comprised of residents surrounding the refuge (see figure 4.1) differ slightly from their respective Counties. The Maine census block group has a slightly smaller proportion of people living below the poverty line than that for Oxford Counties, at 10.3% while the census tract (2 block groups) in Coos County New Hampshire have a slightly higher percentage living below the poverty line at 7.5%. See table 4.13 below for poverty comparisons with state and national figures.

An aerial view of Harper's Meadow and the diversity of habitats in the area



Ian Drew/USFWS

Figure 4.1. U.S. Census blocks surrounding the refuge

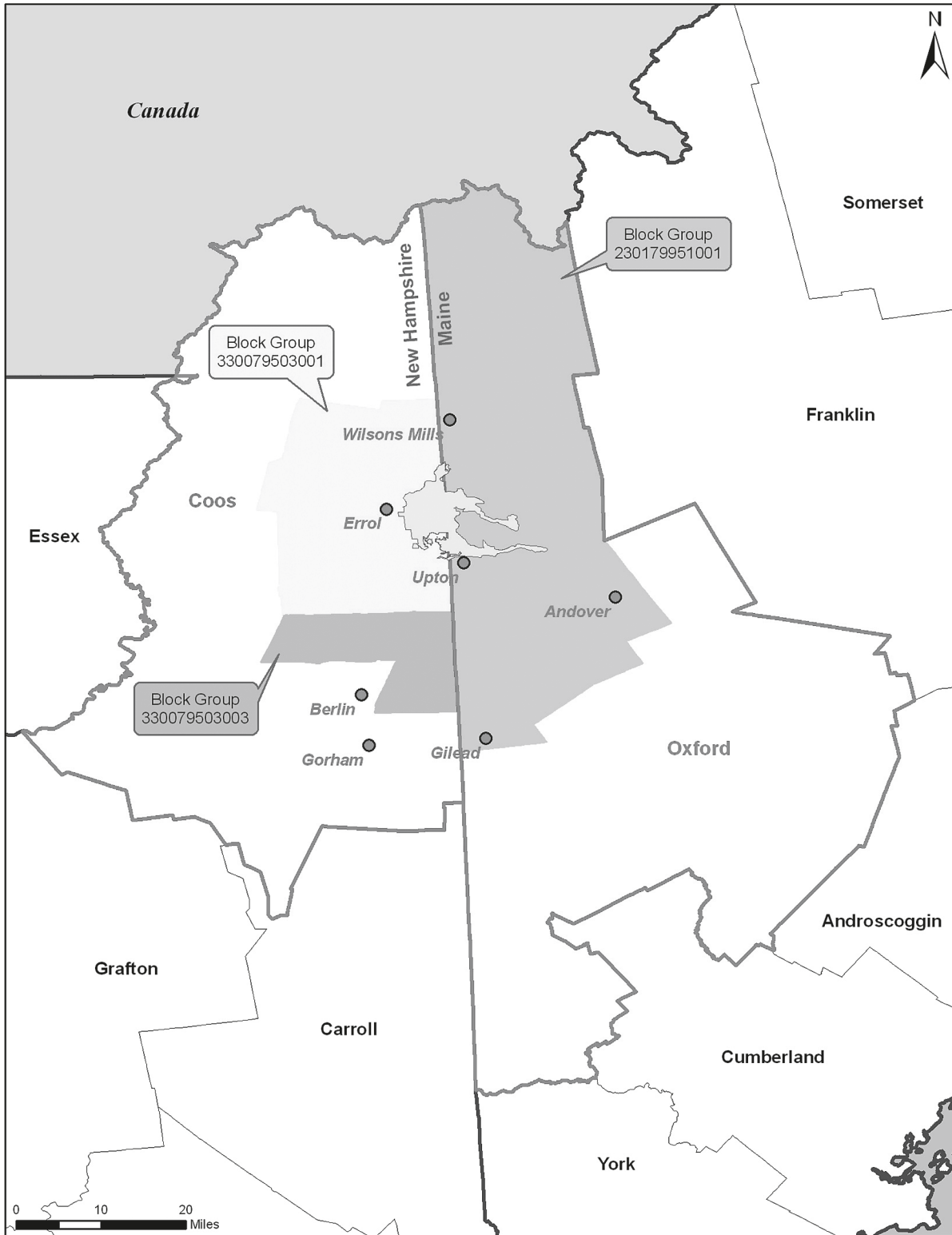


Table 4.13. Socially disadvantaged community indicators for areas surrounding the refuge

Indicators	Community		County		Community as Percent of County		State	
	ME ¹	NH ²	Oxford, ME	Coos, NH	Oxford, ME	Coos, NH	ME	NH
Per Capita Income	\$20,113	\$19,720	\$16,945	\$17,218	119%	115%	\$19,533	\$23,844
Median Value of Housing Units	\$85,400	\$81,600	\$82,800	\$70,500	103%	116%	\$98,700	\$133,300
Unemployed	2.6%	3.5%	3.3%	3.3%	79%	106%	3.1%	2.7%
Individuals Below the poverty Level	10.3%	7.0%	11.8%	10.0%	87.3%	70%	10.9%	6.5%

¹Census Block Group 230179951001

²Census Tract of Block Groups 330079503001 and 330079503003

Source: USCB 2000

Summary of Consequences to Environmental Justice

The communities surrounding the refuge are relatively homogenous; minority groups do not represent a substantial portion of the affected community. No differential impacts based on minority status would therefore be anticipated under any of the alternatives.

Oxford County, Maine and Coos County, New Hampshire are socially disadvantaged communities with greater percentages of persons living below the respective State poverty levels than in the state overall. The relevant Maine census block that includes the refuge is slightly more affluent than the State of Maine overall and the New Hampshire census tract that include the refuge is less affluent than the State of New Hampshire overall. Therefore, environmental justice considerations do apply to actions taken by the Service at the refuge with respect to the potential to adversely affect socioeconomically disadvantaged communities.

Economically, these communities would benefit under all management alternatives in terms of realizing increased revenues to offset property taxes on acquired lands and in terms of additional jobs and increased personal income. It is not likely that any of these communities would be adversely affected by loss of access to game or fish for those who use them to supplement their annual diet, because both hunting and fishing will remain a part of the compatible activities on the refuge. Although certain areas may be restricted for particular recreational activities, such as snowmobiling, that are an important source of income for nearby communities, it is expected that sufficient access to snowmobiling will be maintained on designated trails and off-refuge to continue to support this revenue base.

Table 4.14. Summarizes the effects predicted for each alternative and allows for a side-by-side comparison. Additional details on effects may be provided in the narrative descriptions in chapter 4 under respective subject headings.

Table 4.14- Summary of the effects of management alternatives on lake umbagog refuge resources

Lake Umbagog NWR Resources	Alternative A Continue Current Management	Alternative B Refuge Focal Species Management Service-preferred alternative	Alternative C Natural Processes Management
Socio-economic Resources	<p>Proposed actions were evaluated for their effect on the economic categories: local output, personal income, and employment. Refuge management or associated activities including refuge revenue sharing (RRS) payments and local property taxes, refuge visitor expenditures, refuge administration, and contributions from management activities that involve economic uses, are all considered.</p> <p>Refuge management activities directly related to all refuge operations generate an estimated \$1.45 million in local output, 17.7 jobs, and \$425,000 in personal income into the local economy.</p> <p>Including direct, indirect, and induced effects, all refuge activities would generate a total economic impact of \$1.86 million in local output, 23.1 jobs and \$558,900 in personal income. Total economic impacts represent less than 1% (0.03%) of total income and total employment (0.1%) in the overall Coos County, New Hampshire and Oxford County, Maine combined economy.</p>	<p>Using the same analysis as alternative A, alternative B would result in the following:</p> <p>Refuge management activities directly related to all refuge operations generate an estimated \$2.73 million in local output, 35 jobs and \$837,800 in personal income in the local economy.</p> <p>Including direct, indirect, and induced effects, all refuge activities would generate total economic impacts above those of alternative A of \$1.68 million in local output, 22.8 jobs and \$543,100 in personal income. Total economic impacts associated with refuge operations under alternative B represent less than one percent of total income (0.05%) and total employment (0.11%) in the combined economies of the two counties.</p> <p>Total economic effects of refuge operations play a much larger role in the smaller communities near the refuge such as Errol, NH and Upton, ME where most of the refuge related economic activity occurs as compared to the overall, combined economies of the two counties..</p>	<p>Using the same analysis as alternative A, alternative C would result in the following:</p> <p>Refuge management activities directly related to all refuge operations generate an estimated \$2.84 million in local output, 37 jobs and \$905,800 in personal income in the local economy.</p> <p>Including direct, indirect, and induced effects, all refuge activities would generate total economic impacts above those of alternative A of \$1.84 million in local output, 25.8 jobs and \$625,600 in personal income. Total economic impacts associated with refuge operations under alternative B represent less than one percent of total income (0.05%) and total employment (0.11%) in the combined economies of the two counties.</p> <p>Total economic effects of refuge operations play a much larger role in the smaller communities near the refuge such as Errol, NH and Upton, ME where most of the refuge related economic activity occurs as compared to the overall, combined economies of the two counties.</p>
Air Quality	<p>Proposed Refuge management activities would neither substantively benefit nor adversely affect currently good local and regional air quality, with no violations of Federal or State Clean Air Act standards, no impacts to nearby Class I areas, and no cumulative effects on regional ozone or particulate matter pollutant levels.</p>	<p>Effects similar to alternative A. No substantive change in air quality; no violation of standards, no impacts to Class I areas, and no cumulative effects. Locally more minor long-term benefits than alternative A but also more potential short-term adverse effects.</p>	<p>No violation of Federal or State Clean Air Act standards; no impacts to nearby Class I areas. Adverse effects same as B but more benefits than alternative A or B because C has largest refuge expansion.</p>

<p>Lake Umbagog NWR Resources</p>	<p>Alternative A Continue Current Management</p>	<p>Alternative B Refuge Focal Species Management Service-preferred alternative</p>	<p>Alternative C Natural Processes Management</p>
<p>Air Quality (cont'd)</p>	<p>Minor air quality benefits from air pollutant filtering effects of 15,450 current and up to 5,985 newly acquired acres of natural vegetation and from adopting energy efficient practices. Negligible reduction in atmospheric carbon by sequestering effects of 10,845 current and up to 4,838 newly acquired forested acres.</p> <p>There would be short-term (one-day) minor localized increases in particulate matter from fires used to dispose of demolished cabins, which might be done on average about one a year.</p> <p>An increase of about 5,000 annual Refuge visits by motor vehicle would cause a minor increase in air emissions in the long term and contribute minimally to potential cumulative effects.</p>	<p>Benefits would increase from maintaining up to 69,457 acres of natural vegetation (existing and expanded Refuge lands) to filter air and from more energy efficient Refuge operations. Acquiring up to 43,928 forested acres would stem nearby development growth and reduce potential air emissions. Longer forest rotations minimally increase carbon sequestration.</p> <p>Few ground disturbing activities and few additional emission sources. Construction of Potter Farm headquarters and visitor contact facility would cause short-term, localized effects from construction vehicle and equipment exhausts. Facility operations would slightly increase stationary source emissions.</p> <p>Other construction, renovation, and demolition projects would also cause short-term, minor local effects from vehicle and equipment emissions and dust during construction.</p> <p>Same cabin disposal fire impacts as alternative A.</p> <p>An increase of more than 40,000 annual Refuge visits by motor vehicle would contribute more to local air pollutant emission levels than alternative A over the longer term and increase the potential for cumulative effects. Precluding development in the expansion area would help offset potential cumulative air quality effects.</p>	<p>Greatest potential increase in benefits—up to 96,064 acres (existing and expanded Refuge lands) of natural vegetation and wetlands to filter air and energy efficient Refuge operations. Adding up to 69,702 forested acres would best stem nearby development growth and reduce potential emissions. Longer forest rotations would increase carbon sequestration and maintain forest health and resilience.</p> <p>Impacts of constructing and operating Potter Farm headquarters and visitor contact facility same as alternative B. Other construction, renovation, and demolition projects would also cause short-term, minor local effects from vehicle and equipment emissions and dust during construction.</p> <p>Same cabin disposal fire impacts as alternative A.</p> <p>An increase of more than 43,000 annual Refuge visits by motor vehicle would contribute more to local air pollutant emission levels than alternative A over the longer term and increase the potential for cumulative effects. Precluding development in the expansion area would help offset potential cumulative air quality effects.</p>

Lake Umbagog NWR Resources	Alternative A Continue Current Management	Alternative B Refuge Focal Species Management Service-preferred alternative	Alternative C Natural Processes Management
<p>Soils</p>	<p>Alternative A would provide benefits and cause localized adverse effects to refuge soils. Acquiring up to 5,830 acres of upland, lakeside and streamside land would increase soil benefits from site restoration within current refuge acquisition boundary.</p> <p>A 10% increase in visitor activities—hiking off designated trails, camping, boat launching—would minimally increase soil impacts.</p>	<p>Alternative B would increase long term benefits over alternative A in terms of protecting soils and restoring disturbed sites but also increases some short-term localized adverse effects to refuge soils. Expanding the Refuge by fee purchase and easement of up to 47,807 acres, would eliminate the soil impacts of development on these lands. Improved forest management practices on current and expansion lands would enhance vegetation protecting soils.</p> <p>Short-term, localized soils impacts from forest stand cutting, and clearing for access roads and skid trails, would be minimized using BMPs. Forest management in Special Management and Restricted Management zones would be strictly limited to preclude soil impacts</p> <p>There would be few ground disturbing activities and no active forest management to cause adverse soil effects. BMPs employed in building new Potter Farm headquarters and visitor contact facility would minimize short-term, localized soil impacts and eliminate potential cumulative effects.</p> <p>Trail, boat launch, parking area, and kiosk construction would cause short-term localized soil erosion, compaction, and loss of productivity on no more than 50 acres of Refuge lands. BMPs would minimize soil impacts in all construction projects.</p> <p>No construction except boardwalk pilings for trail access would be done in wetlands; boardwalks over saturated areas would protect wetland soils and sensitive vegetation. Groundwater and nutrient flows maintaining peatlands will be studied and any issues or threats addressed.</p> <p>Restoration of natural soil productivity on reclaimed cabin sites, campsites, skid trails, and unnecessary roads would help offset localized construction effects.</p>	<p>Expanding the Refuge land base under alternative C by up to 74,414 acres would better eliminate the potential for soil impacts associated with development than alternative B.</p> <p>Forest management would be less intensive where 4 % of each management unit is cut on a 15-20 year cycle versus 15% cut under alternative B with correspondingly lower impacts to soils. There may be a similar number of skid trails but they would haul a 75% lower volume than alternative B, so any soil damage should be less severe.</p> <p>Adverse effects from construction of the Potter Farm facility and trail, boat launch, parking area, and kiosk projects would be the same as alternative B. BMP's would be used to minimize adverse effects. Boardwalks would be used in wetlands. Soil productivity would be restored on reclaimed sites.</p>

<p>Lake Umbagog NWR Resources</p>	<p>Alternative A Continue Current Management</p>	<p>Alternative B Refuge Focal Species Management Service-preferred alternative</p>	<p>Alternative C Natural Processes Management</p>
<p>Hydrology and Water Quality</p>	<p>Alternative A would provide minor watershed benefits and cause minimal adverse effects to Refuge hydrology and water quality. Acquiring 6,536 additional acres of upland forest, lakeshore, and wetlands within the acquisition boundary would prohibit potentially damaging development.</p> <p>Camp restoration would reduce local erosion and restore site hydrology.</p> <p>Loons would continue as indicator of effectiveness of water level management on nesting wildlife.</p> <p>Water quality benefits from improved monitoring and cooperation of watershed landowners.</p> <p>Stringent precautions in conducting Refuge management activities would prevent chemical contamination of water directly through leaks or spills or indirectly through soil runoff.</p> <p>A minor increase in recreational boating activities might cause lake and river contamination with petroleum products. Public outreach on that and other issues such as invasive aquatic weeds, invasive fish, and lead contamination would help mitigate that risk.</p>	<p>Alternative B would substantially increase watershed benefits and cause minimal increased adverse effects to Refuge hydrology and water quality as compared to alternative A. Expanding the refuge by up to 47,807 acres would substantially increase watershed benefits by limiting land clearing and changes in local hydrology from development. Increased site restoration would reduce erosion and restore site hydrology. Local hydrology would improve through road reconstruction and unnecessary road removal, culvert removal, and hydrology restoration of areas such as the Day Flats area.</p> <p>Water quality benefits would improve from a strengthened partnership with the FERC licensee in determining beneficial lake water levels at all seasons, upgraded monitoring, and greater efforts in seeking cooperation of watershed landowners.</p> <p>Creating wetland openings and simulated beaver impoundments might cause turbidity and sedimentation impacts. BMPs for these techniques would limit impacts to short-term and localized.</p> <p>A minor increase in recreational boating activities on the refuge might contribute to lake and river contamination with petroleum products. The Service does not regulate Umbagog Lake boating, but increased public outreach on that and other issues such as invasive aquatic weeds, invasive fish, and lead contamination would help mitigate that risk. Umbagog Lake Working Group BMPs for lake and river activities, addressing proper waste disposal, elimination of lead fishing tackle, and use of wake zones and appropriate access, would help maintain good water quality.</p>	<p>Alternative C would substantially increase watershed benefits over A and B and would limit adverse hydrology and water quality effects compared to B. Expanding the refuge by 74,414 acres would further increase watershed benefits by limiting land clearing and changes in local hydrology from development.</p> <p>Camp site restoration, local hydrology restoration, and lake water quality benefits would be similar to alternative B.</p> <p>We would not create wetland openings or simulated beaver impoundments alternative C.</p> <p>Alternative C would have boating and related impacts from increased visitation and outreach efforts similar to B.</p>

Lake Umbagog NWR Resources	Alternative A Continue Current Management	Alternative B Refuge Focal Species Management Service-preferred alternative	Alternative C Natural Processes Management
<p>Wetland & Open Water Habitats</p>	<p>Wetlands and open water habitats would benefit from continuing protection of the current 3,233 wetland acres and 5,033 open water acres. Acquisition under alternative A would be limited to 706 wetland acres and 801 open water acres.</p> <p>Water level fluctuations, water quality problems and human disturbance of wildlife would continue to pose risks to wetland habitat; breeding, brood rearing, and migrating waterfowl; marsh birds, shorebirds, and wading birds; and other wildlife species of concern. Management limited to habitat inventory, mapping, and monitoring, wildlife surveys, water level effects and loon population research, and protection of nesting loons with no Refuge focal species management.</p> <p>Future adjacent development and increasing refuge visitation may affect Refuge water quality indirectly through the watershed. Impacts may be direct through increased use of the Lake and other water bodies. Alternative A has the greatest potential for adjacent development with its impacts but also has lowest future visitation that would somewhat offset those effects.</p>	<p>Alternative B substantially expands protection of wetlands and upgrades waterfowl and other Refuge focal species management compared to A. It would increase refuge protected wetlands by 3,674 acres and open water habitat by 5,906 acres and broaden our techniques for beaver management, waterfowl food plantings, and management of habitat productivity for breeding and migratory waterfowl.</p> <p>We will monitor habitat condition and propose to work cooperatively with the FERC licensee, FPLE, to promote water levels throughout the year to benefit wildlife and sustain rare wetland habitat types.</p> <p>Future adjacent development and increasing refuge visitation may affect Refuge water quality. Alternative B reduces adjacent development but has increased future visitation.</p> <p>No wetland impacts from construction of Potter Farm visitor center because site not adjacent to wetlands and does not drain to any wetlands. Part of the new loop trail adjacent to the Potter Farm is through wetlands. No construction would be done that would directly affect the wetland except for boardwalk pilings. Boardwalks would be constructed over saturated areas to protect sensitive vegetation.</p>	<p>Alternative C also substantially expands protection of wetlands but would not include management to directly benefit Refuge focal species as in alternative B. Alternative C would acquire and protect up to 4,472 acres of wetlands and promote a natural regime of disturbance and recovery with a natural complement of native wildlife species that would not necessarily benefit particular refuge focal species in the long term.</p> <p>Acquisition of expansion lands would increase watershed protection and reduce adverse effects of development. Controlling water level fluctuations to mimic a natural hydrologic regime may benefit some species but not others.</p> <p>Limiting human access to simulate a back country wilderness-type experience with no facilities development and no motorized access would benefit wildlife by reducing disturbance and localized habitat losses.</p> <p>Visitor center and Potter Farm loop trail impacts would be the same as described for alternative B.</p>

Lake Umbagog NWR Resources	Alternative A Continue Current Management	Alternative B Refuge Focal Species Management Service-preferred alternative	Alternative C Natural Processes Management
<p>Fen & Flooded Meadow</p>	<p>Adding 79 acres to protect a total 566 acres of fen and flooded meadow habitat would continue and minimally increase benefits to breeding and migrating waterfowl and other species using this habitat. We would monitor wetland conditions but not actively manage habitat for waterfowl or other species.</p> <p>Visitors fishing or boating in or near fen and flooded meadow habitat may disturb nesting or foraging birds but impacts would be minor because disturbance would be infrequent and would not likely adversely affect waterfowl productivity. Outreach efforts would help address this potential.</p>	<p>Alternative B improves management of fen and flooded meadow habitat with up to 123 added acres and actively managed for breeding and migrating waterfowl, marshbirds, shorebirds, and wading birds.</p> <p>An improved partnership with the FERC licensee to address water level management, expanded bird and aquatic invertebrate surveys, and promotion of wild rice and other food plants would substantially upgrade our ability to support breeding and migratory birds. Any effects of fluctuating levels would be minor and short-term</p> <p>Visitors fishing or boating in or near fen and flooded meadow habitat may disturb nesting or foraging birds but impacts would be minor because disturbance would be infrequent and would not likely adversely affect waterfowl productivity. Increased outreach efforts would better mitigate this potential.</p>	<p>Benefits to fen and flooded meadow habitat minimally higher with 209 acres of habitat acquired and protected under alternative C.</p> <p>No Refuge focal species management so benefits to Refuge focal species would be indirect from increase in habitat protection.</p> <p>Adverse impacts would be the same as described under alternative B.</p>
<p>Boreal Fen & Bog</p>	<p>Purchase of 167 additional acres would minimally increase protection of the peatland complex and benefits to peatland dependent species because the increase is less than 8 percent in FWS ownership. No active Refuge focal species management so no further wildlife benefits.</p> <p>No impacts from passive management actions. Disturbance of wildlife or damage to rare plants unlikely because peatland habitats generally not visited.</p>	<p>Protection and management of boreal fen and bog habitats would greatly improve compared to alternative A with up to 2,684 acres acquired in fee or easement. The Floating Islands National Natural Landmark (FINNL) would expand from 860 to 2181 acres. Monitoring and research efforts would identify threats to this habitat.</p>	<p>Benefits of protection and management of boreal fen and bog habitats would be similar to alternative B with up to 3,222 fee acquired acres. This alternative too would greatly increase protection of the refuge peatland complex and substantially benefit peatland dependent species.</p> <p>Peat coring of the FINNL and other peatlands on Lake Umbagog NWR under this alternative would not adversely affect these wetlands.</p>

Lake Umbagog NWR Resources	Alternative A Continue Current Management	Alternative B Refuge Focal Species Management Service-preferred alternative	Alternative C Natural Processes Management
Northern White Cedar	<p>Purchase of 202 additional acres, including the largest Northern white cedar swamp in NH, would substantially benefit protection of this habitat in the region as well as benefit Refuge focal species such as the black-backed woodpecker.</p> <p>No active management techniques would be employed so there is no potential for direct effects. Passive management actions would not adversely affect Northern white cedar habitat which generally is not used by visitors.</p>	<p>Benefits slightly higher than alternative A by adding up to 50 acres in expansion area. Some minimal additional benefit to black-backed woodpecker.</p> <p>No adverse effects from limited management actions. Not likely to be a priority in 15 year life of CCP but potential for restoring about 150 acres over that time.</p>	<p>Benefits and impacts similar to alternative B.</p>
Scrub-Shrub	<p>Purchase of 258 acres would increase protection of this habitat as well benefits to woodcock. No active management techniques would be employed and none of our passive management actions under alternative A would adversely affect scrub-shrub habitat.</p>	<p>Adding 867 acres to protect a total 1,807 acres of scrub-shrub habitat would double protected acreage and substantially increase benefits to scrub-shrub wetland habitat, Canada warbler and woodcock, and scrub-shrub wetland dependant species under alternative B.</p> <p>Manual or portable power tools would be used in vegetation management to manipulate or maintain habitat such as alder. Cutting would be done to minimize disturbance to nesting or foraging wildlife.</p> <p>Creating 1 to 10-acre simulated beaver ponds in seasonal drainages would cause short-term erosion, turbidity and sedimentation from excavation equipment and long-term changes to the habitat that would benefit focal species.</p>	<p>Adding 1,041 acres to protect a total 1,981 acres of scrub-shrub habitat would substantially increase benefits to scrub-shrub wetland habitat and dependent species under alternative C.</p> <p>Impacts similar to B except no construction of simulated beaver impoundments.</p>
Open Water	<p>Acquiring up to 801 acres to protect a total 5,834 acres of open water habitat under alternative A would benefit fish, invertebrates, and aquatic plants but no active management would be done.</p>	<p>Benefits would be greater under alternative B with addition of up to 69 open water acres and an expanded program of management activities to conserve and enhance the biota of open water habitats.</p>	<p>Alternative C would have benefits and minimal adverse impacts similar to alternative B.</p>

Lake Umbagog NWR Resources	Alternative A Continue Current Management	Alternative B Refuge Focal Species Management Service-preferred alternative	Alternative C Natural Processes Management
Open Water (cont'd)	<p>Watershed land protection would be limited to acquisition within the current refuge boundary thus limiting the indirect benefits to water quality and aquatic species.</p> <p>Refuge visitors who boat and fish may cause localized turbidity or minor spills or leaks of petroleum products. Outreach including brochures and signage will notify these users of proper precautions.</p>	<p>With added watershed land protection of more than 47,000 acres, risks to aquatic species from water quality problems would diminish in Umbagog Lake and river tributaries. Some of this benefit may be offset by increased visitation.</p> <p>Refuge visitors who boat and fish may disturb the bottom substrate in shallow areas or cause minor spills or leaks of petroleum products. Outreach including brochures and signage will notify these users of proper precautions.</p>	
Common Loon	<p>Continuing to protect nesting loons through water level management and restricting human activity in their proximity, and efforts to support research on loons and water level effects under alternative A would continue to benefit nesting loons. Protecting more open water habitat should also benefit loons.</p> <p>No additional active management techniques would be employed to increase loon productivity and none of our passive management actions under alternative A would adversely affect loons.</p>	<p>Increased management efforts including more intensive predator control would benefit loons with a proposed target of 14 nesting pairs on Umbagog Lake and 4 nesting pairs in the expansion area.</p> <p>Major expansion in watershed land base would increase indirect benefits to loons by protecting water quality and aquatic prey.</p> <p>Some predator control methods would eliminate individual predatory animals but would not adversely affect any sensitive predator species populations.</p> <p>The near doubling of refuge visitation will likely increase pressure to view loons and disturb nest sites. Upgrading signage and educational materials, increasing monitoring of visitors and excluding nesting areas would mitigate these effects.</p>	<p>Similar to alternative A, continuing to protect loons and support research on loons and water level effects under alternative C would continue to benefit loons. Protecting more open water habitat should also benefit loons.</p> <p>No additional active management techniques would be employed specifically to increase loon productivity although none of our management actions under alternative C would adversely affect loons.</p> <p>Major expansion of watershed land base would have benefits similar to alternative B. Major increase in visitation would have potential for adverse effects to be mitigated similar to B.</p>

Lake Umbagog NWR Resources	Alternative A Continue Current Management	Alternative B Refuge Focal Species Management Service-preferred alternative	Alternative C Natural Processes Management
<p>Floodplain, Lakeshore, and Riparian Habitats</p>	<p>Adding up to 441 acres of these habitats would increase protected floodplain, lakeshore, and riparian acres to over 1,800 acres but management to benefit these habitats would be limited to inventory, mapping, and monitoring; biotic surveys; support of related research, protection of nesting eagles and ospreys.</p> <p>Magalloway trail project would cause short term construction impacts and long-term loss of a minor amount of habitat. No other construction projects would affect these habitats.</p> <p>Remote camping would continue to have localized, long term impacts to lakeshore and floodplain habitats.</p> <p>Increased visitation may cause minimal increased risk of localized habitat impacts off managed trails from hiking, boating, and wildlife viewing activities that concentrate in these areas. Education, signage, and monitoring would mitigate these effects.</p> <p>Vernal pools on existing and acquired Refuge lands inventoried and protected under all alternatives.</p>	<p>Up to 577 acre increase provides protection benefits similar to alternative A. More active management would substantially increase benefits to Refuge focal species.</p> <p>Greater amount of restoration planned for expansion area to benefit primarily riparian habitat. Localized short term impacts and long term benefits of restoration projects would be similar to alternative A. Potter Farm facility construction would cause minor localized impacts along lakeshore. Impacts of other construction projects similar to alternative A.</p> <p>Greater increase in visitation would cause minimally higher risk than alternative A of localized habitat impacts from recreational activities.</p> <p>Remote camping would continue to have localized, long term impacts to lakeshore and floodplain habitats. Like alternative B, remote camping on the existing designated sites would continue to be allowed, but we would increase monitoring of individual sites, and rehabilitate, or close permanently or seasonally those in need of restoration. Increased efforts would be made to address these problems under this alternative.</p> <p>Increased benefits to vernal pools on more than 47,000 acres of expansion lands inventoried and protected under alternative B.</p>	<p>Up to 581 acre increase provides protection benefits similar to alternative A. No active management planned so benefits to Refuge focal species would be indirect.</p> <p>Localized short term impacts and long term benefits of restoration projects would be similar to alternative A.</p> <p>Greater increase in visitation would cause minimally higher risk of localized habitat impacts from recreational activities.</p> <p>Remote camping would continue to have localized, long term impacts to lakeshore and floodplain habitats. Like alternative B, remote camping on the existing designated sites would continue to be allowed, but we would increase monitoring of individual sites, and rehabilitate, or close permanently or seasonally those in need of restoration. Increased efforts would be made to address these problems under this alternative. Emphasis on wilderness experience camping would further reduce impacts compared to A and B.</p> <p>Increased benefits to vernal pools on more than 74,414 acres of expansion lands inventoried and protected under alternative C.</p>
<p>Wooded Floodplain</p>	<p>Minimal increased benefits to cavity nesting waterfowl, northern parula, and rusty blackbird from adding 153 acres of habitat but no active focal species management techniques would be employed.</p>	<p>Increased benefits to Refuge focal bird species from combined increased 289 acres of land protection and implementing active focal species management techniques.</p> <p>Mapping and monitoring of the Magalloway River floodplain would be conducted. Restoring hydrology of Day Flats area may cause minimal short-term erosion and sedimentation. Best management practices would mitigate these effects.</p>	<p>Increased benefits to habitat and indirect benefits to Refuge focal bird species from adding 293 acres to protected habitat base and from near term active management techniques to promote establishment of sustainable floodplain community.</p> <p>Restoring Day Flats area hydrology would have same impacts and BMPs to mitigate as alternative B.</p>

Lake Umbagog NWR Resources	Alternative A Continue Current Management	Alternative B Refuge Focal Species Management Service-preferred alternative	Alternative C Natural Processes Management
Lakeshore Pine-Hemlock	<p>Acquiring 288 additional acres of lakeshore pine-hemlock habitat would more than double refuge acreage from the current 232 acres and increase protection benefits to jack pine, bald eagle, osprey, and other raptors at the refuge.</p> <p>Localized, minimal, short term impacts to soils from camp or other site restoration activities on any of these newly acquired lands but long term benefits from restoration.</p>	<p>Same protection and site restoration benefits, and short-term impacts, as alternative A plus additional acreage to be identified in the expansion area would minimally increase benefits to jack pine, bald eagle, osprey, other raptors by providing additional nesting and roosting habitat.</p>	<p>Same protection and site restoration benefits, and short-term impacts, as alternative B plus additional acreage to be identified in the expansion area would minimally increase benefits to jack pine, bald eagle, osprey, other raptors.</p>
Bald Eagle & Osprey	<p>Bald eagle and osprey would benefit from protection of the lakeshore pine-hemlock habitat.</p> <p>Risk of human disturbance of nesting eagles and ospreys and impacts to nesting trees because of limited management resources and no active super-canopy tree recruitment measures. Effects minimally offset by lowest increase in visitation.</p> <p>Eagle and osprey food base may be adversely affected because watershed and open water protection limited to within acquisition boundary.</p>	<p>Increased bald eagle and osprey benefits from protection of the lakeshore pine-hemlock habitat and active management to eliminate human disturbance and protect and recruit nesting trees.</p> <p>Increased risk of human disturbance from increased visitation mitigated by upgrade in management.</p> <p>Water quality improved or maintained through monitoring. Eagle and osprey food base better protected by expanded watershed and open water protection.</p>	<p>Benefits and impacts similar to alternative B</p>

Lake Umbagog NWR Resources	Alternative A Continue Current Management	Alternative B Refuge Focal Species Management Service-preferred alternative	Alternative C Natural Processes Management
<p>Upland Forest Matrix</p>	<p>Up to 4,838 acre increase in protected upland forest matrix in the current refuge boundary would increase benefits to upland habitats and Refuge focal species</p> <p>No active management to benefit Refuge focal bird species or promote mammalian travel corridors but natural succession and disturbance would eventually lead to mature forests with a larger softwood component which would benefit mature-forest dependant species but not early succession dependent species such as the woodcock.</p> <p>No impacts from tree cutting or construction and use of skid trails and haul roads. Magalloway River Trail would be only walking trail maintained on refuge.</p> <p>Acquisition of 5,389 upland forest matrix acres and increased visitation under alternative A would minimally increase off-trail disturbance of upland forests with habitat impacts or disturbance of wildlife.</p> <p>Significant natural forest disturbance events, such as windstorms, could diminish the habitat value of portions of refuge for long periods because recovery only by natural regeneration.</p> <p>Snowmobiling would continue to be allowed with use confined to the two state-designated trails. Refuge compatibility determination describes substantial impacts for snowmobiling; however, allowing snowmobiling only on established trails means any important habitat and wildlife impacts have already occurred. Some level of winter wildlife disturbance effects would continue</p>	<p>Greatly expanded protection to total 59,611 acres of upland forest matrix and many significant upgrades in management activities would markedly increase benefits to Refuge focal species under alternative B.</p> <p>We would not implement management on expansion lands within 15 years of CCP until the forest has recovered from recent harvesting. Silvicultural practices on about 4,000 acres within acquisition boundary would cause some adverse impacts but best forest management practices would minimize effects.</p> <p>We would avoid impacts to all sensitive environments on the refuge by adhering to strict operability standards that prohibit or severely restrict forest management on protected resources and in buffer areas.</p> <p>Same snowmobiling impacts as alternative A, but more trails monitored because of expansion. No additional infrastructure installed to support snowmobiling. Relocation of trail portions where needed to meet habitat goals. Unauthorized trails closed and restored.</p>	<p>Benefits similar to alternative B, with major expansion in the total acreage of upland forest protected under alternative C but no Refuge focal species management measures. Refuge focal species will ultimately benefit as natural forest characteristics are attained, but no adjustment to otherwise benefit Refuge focal species. Benefits primarily to mature forest dependent species because the acreage of early successional vegetation would be limited to natural or simulated disturbance areas.</p> <p>Silvicultural practices and potential impacts, best management practices, and operability restrictions to protect sensitive environments same as alternative B.</p> <p>Snowmobiling impacts would be limited to current trails where any substantive habitat and wildlife impacts have generally already occurred. Winter wildlife disturbance effects would continue.</p>

Lake Umbagog NWR Resources	Alternative A Continue Current Management	Alternative B Refuge Focal Species Management Service-preferred alternative	Alternative C Natural Processes Management
Spruce-fir Habitat Type	<p>Acquiring up to 956 acres to total 3,302 refuge acres of spruce-fir protected would benefit Refuge focal species. Benefits limited because only through natural succession would spruce-fir become a larger component of the forest to benefit blackburnian and black-throated green warblers. Deer would benefit from winter yard protection on current and newly acquired lands.</p> <p>No active forest management so no related adverse impacts.</p>	<p>Acquiring up to 25,561 acres to total 28,863 Refuge acres of spruce-fir protected would increase benefits to refuge focal species. Specific measures to enhance spruce-fir habitats on current and expansion area lands under alternative B would benefit blackburnian and black-throated green warblers, and promote growth of travel corridors for lynx and other larger mammals. Deer would benefit from increased winter yard maintenance efforts on expansion lands.</p> <p>Forest management impacts, site and skid trail habitat disturbance and loss, soil compaction, soil erosion would be seen on up to 15% of each managed unit on 15-20 year rotation. BMPs would mitigate those effects. More sensitive sites would be protected by restrictions to single tree or group cuts.</p>	<p>Benefits similar to alternative B, with major expansion of 11,468 acres to total 14,770 of spruce-fir forest protected under alternative C but no refuge focal species management measures. Direct forest management effects similar to but more limited than alternative B because of smaller cuts (4%) to management units. Lower cumulative effects over the type within the Umbagog Lake watershed. Deer would benefit from protection of mature and maturing stands on expansion lands.</p> <p>If cutting a large area is necessary to simulate the effects of an insect outbreak or major windthrow event in the future, we would conduct a full NEPA analysis of the forest management project.</p>
Mixed Woods Habitat Type	<p>Acquiring up to 2,454 acres to total 6,313 refuge acres of mixed woods protected would benefit Refuge focal species. Benefits limited because only through natural succession would spruce and fir become a larger component of the mixed woods type to benefit Canada, black-throated green, and blackburnian warblers.</p> <p>No benefits to woodcock because no active woodcock management. In general, maturing forest with few large disturbed sites would not support woodcock. We would also not create openings to manage for woodcock in mixed forests.</p>	<p>Acquiring up to 10,952 acres to total 17,265 refuge acres of mixed woods protected would substantially increase benefits to refuge focal species. We would implement specific measures to enhance spruce and fir habitats on current and expansion area lands under alternative B to benefit Canada, black-throated green and blackburnian warblers and woodcock. Better management of age classes and structural classes would also benefit Canada warblers and woodcock.</p> <p>Substantial increase in woodcock benefits from program of forest management techniques focused to support woodcock.</p> <p>Human disturbance impacts would be limited by relative remoteness of management sites.</p>	<p>Benefits similar to alternative B, with major expansion of 27,918 acres to total 34,231 of mixed woods protected under alternative C but no refuge focal species management measures. Forest landscape mosaic would benefit Canada warblers and blackburnian warblers locally where habitat components are favorable. Impacts on these sites would be more limited than those described for alternative B on similar sites because the cuts would be smaller and entry to stands would be less frequent. Long term benefits to early successional dependent species not as high from landscape management as under alternative B because disturbance regime would tend toward more mature stands.</p>

Lake Umbagog NWR Resources	Alternative A Continue Current Management	Alternative B Refuge Focal Species Management Service-preferred alternative	Alternative C Natural Processes Management
Mixed-Woods Habitat Type (cont'd)	No active forest management so no related adverse impacts.	Potential adverse impacts similar to spruce-fir impacts above, with a slightly greater degree of risk of soil erosion from openings maintained for woodcock.	Natural clearings and early successional components in mixed stands would benefit woodcock only if singing grounds and large openings for night roosting are sufficient in number and proximity to the woodcock's other necessary habitat components to adequately support the species.
Northern Hardwood Habitat Type	Acquiring up to 1,428 acres to total 6,068 refuge acres of Northern hardwoods protected would benefit refuge focal species. Benefits limited because only natural disturbances would promote dense understory to benefit black-throated blue warblers, or intolerant hardwoods to benefit woodcock production, Canada warbler or other early successional species. No active forest management so no related adverse impacts.	Acquiring up to 7,415 acres to total 13,488 refuge acres of Northern hardwood forest protected would benefit refuge focal species. Refuge focal species benefits would increase through active management to promote dense understory to benefit black-throated blue warblers, and intolerant hardwoods to benefit woodcock production, Canada warbler or other early successional species. Adverse silvicultural impacts would be short-term, localized at managed sites and mitigated by best forest management practices.	Benefits similar to alternative B, with major expansion of 30,316 acres to total 36,384 of Northern hardwood forest protected under alternative C but no refuge focal species management measures. Impacts on silviculture sites would be more limited than for alternative B on similar sites because cuts would be smaller and entry to stands would be less frequent. In the long term, benefits to refuge focal species lower than alternative B because we would create as much optimal habitat.
Public Use & Access	Five of the six priority public uses (hunting, wildlife observation and photography, and environmental education and interpretation) are allowed on the refuge, and would be provided on lands to be acquired in the future. Fishing is the only priority public use not formally allowed at present. Popular, non-priority public uses that would be allowed to continue include snowmobiling and camping. We would maintain the current capacity for these activities. Other popular activities we would formally open to include dog-sledding, berry picking, bicycling and horseback riding. Education and interpretive programs are limited and we have very little visitor infrastructure in place to facilitate self-guided opportunities. We do not meet demand for these programs; however, we do meet demands for hunting, and wildlife observation and photography.	We would formally open the refuge to fishing and increase our infrastructure to support all six priority public uses. Visitor experiences would be enhanced as we provide new trails, wildlife viewing areas, and fishing and boating access. Educational programs would be facilitated on the refuge, but we would look to partners to develop and implement them. We may not meet demand for this activity. Potential impacts for expanding our hunt program to include turkey hunting (both states) and bobcat hunting (Maine only) would be analyzed in a separate EA to initiate within 2 years of CCP approval. We would continue to provide the existing level of opportunity for snowmobiling and lake camping, but no opportunity for expansion, or new infrastructure, is planned for these activities. Two popular river camp sites would be eliminated because of resource degradation. Typically these sites are full every weekend during the summer months. Visitors expecting to use the sites would be impacted.	Similar to alternative B except, less interpretive infrastructure would be provided and fewer trails constructed. The objective under alternative C would be to provide a low density, back country experience. The Potter Farm area would be developed with trails and interpretive infrastructure, but no other new trails would be developed. Thus, visitors that prefer developments to enjoy their visit would be less satisfied under alternative C than under alternative B. Snowmobiling, camping, and boating opportunities and impacts are similar to alternative B.

<p>Lake Umbagog NWR Resources</p>	<p>Alternative A Continue Current Management</p>	<p>Alternative B Refuge Focal Species Management Service-preferred alternative</p>	<p>Alternative C Natural Processes Management</p>
<p>Public Use & Access (cont'd)</p>	<p>Conflicts among motorized and non-motorized boaters would continue to be the biggest challenge.</p> <p>Some popular activities in the area would continue not to be allowed, but this is not a change of expectation on existing refuge lands as they have never been allowed. However, where they occur on lands to be acquired in fee simple (up to 7,500 acres), some of those user groups would be impacted. Unfortunately, we do not have an estimate of numbers.</p>	<p>Conflicts among motorized and non-motorized boaters are likely to increase; however, strategies would be implemented to try and minimize these concerns. We would work within the structure of the proposed Umbagog Working Group to address these conflicts among the agencies with jurisdiction on the lake.</p> <p>Similar to alternative A, as we acquire lands in fee simple (up to 28,840 acres); we would eliminate certain activities that are not allowed on current refuge lands. As with alternative A, we do not know how many people would be impacted. On the other hand, Service acquisition benefits priority public uses, and those other activities allowed, because it affords permanent public access.</p>	<p>Similar to alternative B, as we acquire lands in fee simple (up to 74,414 acres); we would eliminate certain activities that are not allowed on current refuge lands. As with alternative B, we do not know how many people would be impacted. On the other hand, Service acquisition benefits priority public uses, and those other activities allowed, because it affords permanent public access.</p>
<p>Cultural Resources</p>	<p>We have not conducted a detailed archeological or history survey of all refuge lands; however some specific project surveys have been done to determine the eligibility of certain sites. We know of one historic and four prehistoric sites on the refuge.</p> <p>We would continue to protect these sites under state and federal historic preservation act requirements. Any future actions with the potential to impact cultural resources will be reviewed and assessed under provisions of Section 106 of the National Historic Preservation Act.</p> <p>This document has been submitted to both state SHPOs for their review and concurrence.</p>	<p>In addition to impacts under alternative A:</p> <p>We would identify high probability sites to survey more intensely prior to refuge activities. Areas along rivers and lakes have particularly high potential and we will be especially vigilant in those areas.</p> <p>We would also increase outreach and education to inform visitors about the refuge's cultural resources.</p>	<p>Same as alternative B.</p>

Chapter 5



Bill Zimm/USFWS

Hosting a public meeting

Consultation and Coordination with Others

Background

We presented in chapter 1, figure 1-1, the steps in the comprehensive conservation planning process and how it integrates NEPA requirements including public involvement. What follows is the chronology of public outreach activities we conducted prior to releasing the final CCP/EIS.

Planning Updates, Issues Workbook, and other Newsletters and Publications

- August 2001 Distributed newsletter announcing that we were beginning the planning process and to ask if people wanted to be on our mailing list
- June 2002 Distributed the issues workbook and planning newsletter to approximately 1,000 names on our mailing list
- Fall/Winter 2004 Distributed 219 stakeholder surveys in cooperation with U.S. Geological Survey (USGS)
- August 2005 Distributed our “Planning Update” to everyone on our mailing list
- November 2005 Distributed the Executive Summary of USGS stakeholder survey
- June 2007 Distributed newsletter announcing release of draft CCP/EIS to approximately 1,000 names on our mailing list
- July 2007 Distributed Draft CCP/EIS for 77 days of public review and comment. A Federal Register Notice was published and hard copies and cd-roms were distributed at this time. Also, a copy was posted on the National Conservation Training Center website, and news releases and a newsletter were distributed.

Public Scoping Meetings— Meeting Our Refuge Neighbors at Open Houses

- July 30, 2002
Number of non-FWS attendants: 44
Location: Errol, NH
- August 1, 2002
Number of non-FWS attendants: 21
Location: Berlin, NH
- August 2, 2002
Number of non-FWS attendants: 13
Location: Bethel, ME
- August 3, 2002
Number of non-FWS attendants: 6
Location: Umbagog Wildlife Festival in Errol, NH
- August 28, 2002
Number of non-FWS attendants: 10
Location: Augusta, ME
- August 29, 2002
Number of non-FWS attendants: 21
Location: Concord, NH

Updating Various Constituents on Our Progress

- August 21, 2001
Number of non-FWS attendants: 1
Location: Phillips Brook Backcountry Recreation Area
Audience: Bill Altenberg, Timberland Trails, Inc.

January 15, 2002
Number of non-FWS attendants: 5
Location: Concord, NH
Audience: Society for the Protection of NH Forests

February 5, 2002
Number of non-FWS attendants: 6
Location: Concord, NH
Audience: The Nature Conservancy in NH

February 6, 2002
Number of non-FWS attendants: 10
Location: Concord, NH
Audience: NH Audubon Society

September 23, 2002
Number of non-FWS attendants: 2
Location: USFWS Regional Office, Hadley, MA,
Audience: The Wilderness Society

**Meeting with State
Partners and Other
Conservation Experts**

August 22, 2001
Outreach activity: NH Fish and Game - Director's Meeting
Purpose: Discuss refuge programs and how they will be addressed in the CCP.
Number of non-FWS attendants: 4
Audience: Wayne Vetter, Director NHFG; Steve Weber, Division Chief, NHFG; Charlie Bridges, Habitat and Diversity Programs Admin, NHFG; Will Staats, Regional Wildlife Biologist, NHFG; Dan Ashe, Chief, National Wildlife Refuge System; Tony Leger, Regional Chief, National Wildlife Refuge System; Dick Dyer, Refuge Supervisor; Sue McMahon, Chief-Division of Refuges; USFWS Planning Team Members: Paul Casey, Laurie Wunder, Nancy McGarigal

September 11, 2001
Outreach activity: Planning Meeting
Purpose: Discuss land conservation proposal as part of the CCP.
Number of non-FWS attendants: 1
Audience: Phil Bryce, Director of NH Division of Forests and Lands; USFWS Planning Team Members: Paul Casey, Ian Drew, Bill Zinni

September 19, 2001
Outreach activity: Planning Meeting
Purpose: Discuss core team representatives
Number of non-FWS attendants: 4
Audience: NH Fish and Game; USFWS Planning Team Member: Paul Casey

October 30, 2001
Outreach activity: Planning Meeting
Purpose: Identify NH Fish and Game as core team member
Number of non-FWS attendants: 4
Audience: Susan Arnold, Policy Director, Office of the Governor, Wayne Vetter, Steve Weber, Charlie Bridges, USFWS Planning Team Member: Paul Casey.

January 22, 2002
Outreach activity: Planning Meeting
Purpose: To discuss the feasibility of doing the cover type mapping following National Vegetation Classification standards.
Number of non-FWS attendants: 2
Audience: NH Heritage Program; USFWS Planning Team Member: Laurie Wunder, Jennifer Casey

February 11, 2002

Outreach activity: Planning Meeting

Purpose: Forest and woodcock management strategies.

Number of non-FWS attendants: 2

Audience: Will Staats, NHFG, Chuck Hulse, MDIFW; USFWS Planning Team Member: Ian Drew

August 28, 2002

Outreach activity: Planning Meeting

Purpose: To explain the CCP process to all ME state agencies with jurisdiction or management interest in the refuge, and to discuss any issues, concerns or opportunities with refuge management and refuge resources.

Number of non-FWS attendants: 11

Audience: Meeting with ME state agencies; USFWS Planning Team Members: Paul Casey, Ian Drew, Laurie Wunder, Nancy McGarigal

August 29, 2002

Outreach activity: Planning Meeting

Purpose: To explain the CCP process to all NH state agencies with jurisdiction or management interest in the refuge, and to discuss any issues, concerns or opportunities with refuge management and refuge resources.

Number of non-FWS attendants: 10

Audience: Meeting with NH state agencies; USFWS Planning Team Members: Paul Casey, Ian Drew, Laurie Wunder, Nancy McGarigal

November 20, 2002

Outreach activity: Planning Meeting

Purpose: To discuss available information and information needs for addressing visitor services issues; to discuss a vision related to visitor services on the refuge; and to develop draft goals for visitor services.

Number of non-FWS attendants: 6

Audience: David Thurlow, Director of the Northern Forest Heritage Park; Johanna Lyons, NH DRED; Charlie Bridges, NH F&G; Judy Silverberg, NHFG; Chuck Hulse, MDIFW; Forrest Bonney, MDIFW; USFWS Planning team members: Paul Casey, Ian Drew, Laurie Wunder, Jennifer Tietjen, Nancy McGarigal, Bill Zinni, Sarah Bevilacqua, Susan J. Russo

November 22, 2002

Outreach activity: Planning meeting

Purpose: Discuss use of ELU's in development of the CCP.

Number of non-FWS attendants: 1

Audience: Mark Anderson, TNC, USFWS Planning Team Members: Paul Casey, Laurie Wunder, Jennifer Casey

December 3-5, 2002

Outreach activity: Partners Workshop

Purpose: The purposes were to exchange information and identify species priorities so they could begin an integrated approach to planning in this region.

Number of non-FWS attendants: approximately 30

Audience: North Atlantic Forest (Lake Umbagog Region; BCR 14) NABCI partners; USFWS Planning Team Members: Jennifer Casey, Laurie Wunder

April 2, 2003

Outreach Activity: Planning Meeting

Purpose: To discuss how the Penobscot, Passamaquoddy (Pleasant Point and Indian Township reservations), Micmac, and Maliseet Tribal Governments can best participate in the CCP Process.

Number of non-FWS Attendants: 6

Audience: Steve Crawford, Passamaquoddy Tribe; Fred Corey, Aroostock Band of the Micmacs; Dave Macek, Aroostock Band of the Micmacs; Sharri Venno, Houlton Band of the Maliseet; John Banks, Penobscot Nation; Trevor White, Passamaquoddy Tribe. USFWS Planning Team Members: John Wilson, Nancy McGarigal, D.J. Monette, Stan Skutek, Tom Comish.

April 9, 2003

Outreach activity: Technical Workshop

Purpose: To determine goals and management options for emergent marsh, peatlands, and any adjacent communities that directly influence, or are influenced by, these community types.

Number of non-FWS attendants: 7

Audience: Charlie Bridges, NHFG; Will Staats, NHFG; Chuck Hulsey, MDIFW; Andy Weik, MDIFW; Ron Davis, University of Maine; Curtis Bohlen, Bates College; Jerry Longcore, USGS-BRD; Andrew Milliken, Migratory Bird Program, USFWS; USFWS Planning team members: Paul Casey, Ian Drew, Laurie Wunder, Jennifer Casey, Nancy McGarigal, Bill Zinni, Jennifer Tietjen

April 15, 2003

Outreach activity: Field trip

Purpose: Compare ELU's with actual site and vegetation conditions.

Number of non-FWS attendants: 2

Audience: Mark Anderson, TNC, Greg Kehm, TNC; USFWS Planning Team Members: Paul Casey, Laurie Wunder, Ian Drew, Jennifer Casey.

May 14, 2003

Outreach activity: Technical Workshop

Purpose: To discuss the importance of upland forests and identify goals and management options for this community type.

Number of non-FWS attendants: 11

Audience: Tom Hodgman, MDIFW; Chuck Hulsey, MDIFW; Charlie Bridges, NHFG; Will Staats, NHFG; John Lanier, NHFG; John Kanter, NHFG; Carol Foss, NH Audubon; Kevin Evans, Dartmouth College; Peter Ellis, Univ. of Vermont; Bill Keaton, Univ. of Vermont; Dave Capen, Univ. of Vermont; Randy Dettmers, Migratory Bird Program, USFWS; USFWS Planning team members: Paul Casey, Ian Drew, Laurie Wunder, Jennifer Casey, Nancy McGarigal, Bill Zinni

August 4, 2003

Outreach activity: Planning meeting

Purpose: Develop a more detailed soil survey map.

Number of non-FWS attendants: 2

Audience: Joe Homer and Steve Huntley, NRCS; USFWS Planning Team Member: Laurie Wunder

August 27, 2003

Outreach Activity: Planning meeting with Tribal Natural Resources Coordinators

Purpose: to further develop opportunities/action items identified at April 2, 2003 meeting related to tribal involvement in refuge comprehensive conservation planning and other activities on refuges in Maine.

Number on non-FWS attendants: 6

Audience: Fred Corey, Aroostook Band of Micmacs; John Banks, Penobscot Nation; Steve Crawford, Passamaquoddy Tribe; Trevor White, Passamaquoddy Tribe; Sharri Venno, Houlton Band of Maliseet; Donald Soctomah, Passamaquoddy Joint Council. USFWS Planning Team Members: DJ Monette, Tom Comish, Brian Benedict, John Wilson, Nancy McGarigal.

January 13, 2004

Outreach activity: Planning Meeting

Purpose: To discuss disturbance regimes and forest conditions of pre-settlement New England forests (based on data from mid 1700's to early 1800's); and to use the information obtained to help develop our alternative C.

Number of non-FWS attendants: 2

Audience: Dr. Cogbill, New England Historical Ecologist; Will Staats, NHFG; USFWS Planning Team Member: Laurie Wunder

June 2, 2004

Outreach activity: Field trip

Purpose: Assess lake for Bald Eagle habitat

Number of non-FWS attendants: 3

Audience: Charlie Todd, MDIFW, Chuck Hulse, MDIFW, Will Staats, NHFG; USFWS Planning Team Members: Paul Casey, Ian Drew

June 7, 2004

Outreach activity: Field Trip

Purpose: To visit field locations where trajectory of forest succession was questionable; e.g. given the soils type, the group was to evaluate what the vegetation might look like under unmanaged conditions.

Number of non-FWS attendants: 4

Audience: Steve Fay, Soil Scientist, USFS; Bill Leek, Soil Scientist, USFS; Dave Farick, Forester, NH Division of Forests and Lands; Joe Homer, Soil Survey Leader, NRCS; USFWS Planning team members: Paul Casey, Ian Drew, Laurie Wunder, Jennifer Casey

June 14, 2004

Outreach activity: Field trip

Purpose: Assess Refuge habitat for waterfowl

Number of non-FWS attendants: 1

Audience: Jerry Longcore, USGS; USFWS Planning Team Members: Laurie Wunder, Ian Drew, Paul Casey.

October 26, 2004

Outreach activity: Land acquisition planning meeting with NH Fish and Game Personnel

Purpose: To discuss land acquisition

Number of non-FWS attendants: 4

Audience: Ed Robinson, NH; Jill Kelly, NH; Will Staats, NH; Diane Emerson, NH; USFWS Planning Team Members: Paul Casey, Ian Drew.

March 25, 2005

Outreach activity: CCP Update and Land Acquisition Discussion

Purpose: To discuss topics such as Refuge Improvement Act, CCP, Land Acquisition, Public Use, Habitat Management, and Administration of the Refuge.

Number of non-FWS attendants: 6

Audience: Phil Bryce, State Forester, NH DRED; Lee Perry, Director, NHFG, Charlie Bridges, NHFG; Steve Weber, NHFG; Johanna Lyons, NH DRED; Allison McLean, Director of Parks, NH DRED; USFWS Planning Team
Members: Paul Casey, Ian Drew

Briefing Elected Officials and Others

October 30, 2001	New Hampshire Governor's Office
March 14, 2002	NH Senators in Washington, DC
June 11, 2002	Aides to Senator Gregg in NH
June 19, 2002	Aides to Representative Bass in NH
February 15, 2005	Matt Hogan, Acting Director of USFWS
July 10, 2005	Aide to Senator Sununu in NH
July 26, 2005	Senator Gregg in NH
August 16, 2006	Aides to Senator Gregg in NH
October 28, 2006	Dale Hall, Director USFWS
June 6, 2007	Aides to Senator Gregg in NH
June 14, 2007	Aides to Senator Sununu in NH
July 24, 2007	Aides to Senators Snow and Collins, and Representative Michaud in ME
July 24, 2008	NH Executive Councilor Raymond Burton, NH State Senator John Gallus, and Berlin Cit Councilor Timothy Donovan
July 16, 2008	NH Fish and Game Director

Public Release of Draft CCP/EIS

July 10, 2007
 Information Session
 Location: Errol, NH

July 30, 2007
 Public Hearing
 Errol, NH

July 31, 2007
 Public Hearing
 Newry, ME

August 1, 2007
 Public Hearing
 Berlin, NH

August 6, 2007
Public Hearing
Concord, NH

August 7, 2007
Public Hearing
Augusta, ME

August 9, 2007
WMOU radio Q&A program
Berlin, NH

August 16, 2007
Information Session
Errol, NH

**Updating Various
Constituents on Draft
CCP/EIS**

June 10, 2008
Audience: Thirteen Mile Woods Association

July 21, 2008
Audience: Dartmouth College Grant Management Committee

2008
Audience: Various; approximately 8 general presentations on the refuge were given during the year, and CCP updates were provided and questions related to the plan were addressed when appropriate. In addition, at least three meetings were held with individuals interested in discussing particulars about the draft CCP/EIS. Details on the presentations or meetings with individuals can be provided upon request.

Chapter 6



USFWS

Planning Team meeting

List of Preparers

Members of the Core Planning Team

Charles A. Bridges, Habitat and Diversity Program Administrator, NH Fish and Game Department

Education: M.S. Wildlife Management; B.S. Zoology
Experience: UNH Cooperative Extension, Wildlife Specialist; NH Fish and Game 20 years, in addition to current position has served as state lands habitat biologist and inland fisheries and wildlife division chief
Contribution: Participated in all aspects of plan preparation
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Paul Casey, Refuge Manager, Lake Umbagog NWR

Education: B.S. Wildlife Management
Experience: 22 years USFWS
Contribution: Participated in all aspects of plan preparation
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Jennifer Casey, Assistant Regional Refuge Biologist

Education: B.S. Wildlife Management; B.S. Biology
Experience: 15 years USFWS; 5 years with state wildlife departments and non-profit organizations
Contribution: Participated in all aspects of developing biological goals and objectives
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Ian Drew, Deputy Refuge Manager, Lake Umbagog NWR

Education: B.S. Environmental Studies and Biology
Experience: 10 years USFWS; 3 years County Soil and Water Conservation District; 3 Years Environmental Consulting
Contribution: Participated in all aspects of plan preparation
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Email: ian_drew@fws.gov

Chuck Hulsey, Regional Wildlife Biologist, ME Dept. of Inland Fisheries and Wildlife

Education: B.S. Wildlife Management; B.S. Forest Management
Experience: 8 years District Forester, Maine Forest Service; 10 years Assistant Regional Wildlife Biologist, MDIFW; 10 years Regional Wildlife Biologist, MDIFW.
Contribution: Participated in all aspects of plan preparation
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Johanna Lyons, State Park Planning and Development Specialist, NH Dept. of Resources and Economic Development, Division of Parks and Recreation

Education: University of New Hampshire, BA in Zoology with minor in Spanish (1988)
Experience: 22 years NH Division of Parks and Recreation in various positions
Contribution: Provided technical advice on public use, participated in developing public use goals and objectives, and represented a key partner in the project
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Nancy McGarigal, Regional Natural Resource Planner

Education: B.S. Forestry and Wildlife, Virginia Polytechnic Institute and State University
Experience: 17 years Forest Service; 10 years USFWS biologist
Contribution: Planning Team Leader; participated in all aspects of plan preparation
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Carolina Ferro Vasconcelos, Former Assistant Planner (transferred to private sector)

Education: B.S. Biology; B.S. Wildlife and Fisheries Conservation, UMass Amherst
Experience: 2 years with USFWS under ECOIntern program
Contribution: Helped write and edit portions of the Lake Umbagog CCP. Assisted with the format, layout and other tasks necessary to compile and distribute the plan.

Laurie Wunder, Wildlife Biologist, Lake Umbagog NWR

Education: B.A. in Anthropology at SUNY at Binghamton; M.S. in Environmental Science at University of Montana, Missoula; PhD Colorado State University
Experience: 9 years with USFWS, prior to that Washington Dept. of Fish and Wildlife and U.S. Forest Service, Olympia, WA
Contribution: Participated in all aspects of plan preparation
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Judith Silverberg PhD, Wildlife Education Supervisor, NH Fish and Game Department

Education: PhD. Univ. of New Hampshire - conducted research on wildlife viewing behaviors and attitudes; MS. University of Wisconsin-Madison; B.S. University of Wisconsin-Madison
Experience: 32 years experience working with natural resource agencies in education; past 22 years at NH Fish and Game. Currently serves as the wildlife viewing coordinator for New Hampshire and oversees wildlife education and interpretive programs.
Contribution: Provided technical advice on public use, participated in developing public use goals and objectives, and represented a key partner in the project
Phone: 603-271-3211
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Will Staats, Regional Wildlife Biologist, NH Fish and Game Department

Education: B.S. Wildlife Biology
Experience: Last 15 years with NH Fish and Game; 2.5 years Champion International; 8 years Vermont Fish and Wildlife Department
Contribution: Participated in all aspects of plan preparation
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Email: william.staats@wildlife.nh.gov

Bill Zinni, Regional Wildlife Biologist

Education: B.S. Natural Resources/Wildlife, University of Rhode Island
Experience: Last 25 years with USFWS; 4 years with UMass Dept of Forestry and Wildlife
Contribution: Participated in all aspects of Land Protection Plan and biological goals and objectives
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Assistance from Other Service Personnel

Sarah Bevilacqua, Former Regional Visitor Services Specialist (transferred to Silvio O. Conte Fish and Wildlife Refuge)

Education: B.S. Resource Recreation Management, Oregon State University
 Experience: 12 years with U.S. Forest Service; 15 years with the USFWS as a public use specialist.
 Contribution: Edited visitor services descriptions and proposed action, participated in developing public use goals and objectives.
 Phone: 413-548-8002
 Email: sarah_bevilacqua@fws.gov

Randy Dettmers, Migratory Bird Biologist

Education: Ph.D. Zoology, Ohio State University
 Experience: 9 years with USFWS
 Contribution: Provided recommendations on which priority landbird species were most applicable to Lake Umbagog refuge and suggested management objectives for those species
 Phone: 413-253-8567
 Email: randy_dettmers@fws.gov

Susan Fuller, Senior Biologist/GIS Specialist

Education: M.S. Wildlife and Fisheries Conservation/GIS, University of Massachusetts
 Experience: 9 years with USFWS as GIS Specialist; 3 years, combined, Wildlife Biologist field work with U.S. Forest Service, and the University of Massachusetts
 Contribution: GIS mapping and spatial analysis for LPP and CCP
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Shelley Hight, Archaeologist

Education: B.A. Anthropology, 1980, University of Massachusetts
 M.A. Anthropology, 1982, University of South Carolina, Public Archaeology
 Experience: 7 years Vermont Division for Historic Preservation, 4 years U.S. Forest Service archeologist; 12 years USFWS Field Archaeologist
 Contribution: Edited cultural resources descriptions and proposed action.
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Thomas LaPointe, Forester

Education: Assoc in Forestry, 1996 University of New Hampshire; B.S. Forestry, 1998, University of New Hampshire
 Experience: 5 years private forester, licensed in NH since 2000; 5 years USFWS
 Contribution: Contributed to forest management objectives
 Phone: 802-962-5240
 Email: tom_lapointe@fws.gov

Lelaina Marin, Former Assistant Planner (transferred to National Park Service)

Education: B.S in Natural Resources, Cornell University
 Experience: 4 years with USFWS (2 years as SCEP student, 2 years as Assistant Planner)
 Contribution: Helped edit portions of the CCP. Assisted with the format, layout and other tasks necessary to compile and distribute the plan.
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Andrew Milliken, Atlantic Coast Joint Venture Coordinator

Education: B.A. Northern Studies/Biology, Middlebury College; M.S. Biological Oceanography, University of Rhode Island
Experience: New York State, University of Rhode Island, U.S. EPA, USFWS Coastal Ecosystems Program and Atlantic Coast Joint Venture
Contribution: Helped evaluate significance of habitat for migratory birds.
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Rick Schaffler, Cartographic and Spatial Data Specialist

Education: B.A. Human Ecology, M.S. Wildlife Biology
Experience: 7 years with USFWS, 4 years as University Research Assistant
Contribution: GIS mapping and spatial analysis for LPP and CCP
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Assistance from Others

Ellen Snyder, Wildlife Biologist, Ibis Wildlife Consulting

Education: B.S. Wildlife Management, M.S. Animal Ecology
Experience: 22 years in wildlife and natural resources
Contribution: Consultant - contributed to Chapter 2
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Lynne Koontz, U.S. Geological Survey, Fort Collins Science Center

Education: Ph.D. Colorado State Univ. (CSU) in Natural Resources Economics; M.S. CSU Natural Resources Economics; B.S. CSU Agricultural and Natural Resources Economics
Experience: USGS 11 years
Contribution: Provided technical information on socio-economic environment and impacts
Phone: 970-226-9384
Email: lynne_koontz@usgs.gov

Phil Sczerzenie, Mangi Environmental Group, Inc.

Education: B.S. Forestry & Wildlife Management, Rutgers University; M.S. and Ph.D. in Wildlife Management, UMASS, Amherst
Experience: 26 years NEPA environmental analysis and management, risk assessment, and statistics consulting
Contribution: Consultant – contributed to writing goals and objectives, Chapter 3- Affected Environment and Chapter 4- Environmental Consequences
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Glossary



Paul Casey/USFWS

Umbagog Lake in winter

Glossary **(including list of acronyms)**

Glossary

accessibility	the state or quality of being easily approached or entered, particularly as it relates to complying with the Americans With Disabilities Act
accessible facilities	structures accessible for most people with disabilities without assistance; facilities that meet UFAS standards; ADA-accessible [E.g., parking lots, trails, pathways, ramps, picnic and camping areas, restrooms, boating facilities (docks, piers, gangways), fishing facilities, playgrounds, amphitheaters, exhibits, audiovisual programs, and wayside sites.]
adaptation	adjustment to environmental conditions
adaptive management	the process of treating the work of managing natural resources as an experiment, making observations and recording them, so the manager can learn from the experience.
advanced regeneration	tree seedlings or small saplings that develop in the understory prior to the removal of the overstory.
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	a proposed or existing use on a refuge that meets at least one of the following three conditions: <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 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 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

aquatic barrier	any obstruction to fish passage
avian	of or having to do with birds
avifauna	all birds of a given region
barrier	cf. “aquatic barrier”
basin	the land surrounding and draining into a water body (cf. “watershed”)
benthic	living at, in, or associated with structures on the bottom of a body of water
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
biodiversity conservation	the goal of conservation biology, which is to retain indefinitely as much of the earth’s biodiversity as possible, with emphasis on biotic elements most vulnerable to human impacts
biomass	the total mass or amount of living organisms in a particular area or volume
biota	the plant and animal life of a region
bog	a poorly drained area rich in plant residues, usually surrounded by an area of open water, and having characteristic flora
breeding habitat	habitat used by migratory birds or other animals during the breeding season
buffer species	alternate prey species exploited by predators when a more preferred prey is in relatively short supply; i.e., if rabbits are scarce, foxes will exploit more abundant rodent populations
buffer zones	land bordering and protecting critical habitats or water bodies by reducing runoff and nonpoint source pollution loading; areas created or sustained to lessen the negative effects of land development on animals, plants, and their habitats
candidate species	species for which we have sufficient information on file about their biological vulnerability and threats to propose listing them

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
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]
compatibility determination	a required determination for wildlife-dependent recreational uses or any other public uses of a refuge
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”
conifer	a tree or shrub in the phylum Gymnospermae whose seeds are borne in woody cones. There are 500–600 species of living conifers (Norse 1990)
connectivity	community occurrences and reserves have permeable boundaries and thus are subject to inflows and outflows from the surrounding landscape. Connectivity in the selection and design of nature reserves relates to the ability of species to move across the landscape to meet basic habitat requirements. Natural connecting features within the ecoregion may include river channels, riparian corridors, ridgelines, or migratory pathways.
conservation	managing natural resources to prevent loss or waste [N.b. Management actions may include preservation, restoration, and enhancement.]
conservation agreements	written agreements 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
cord	an 8-foot-long pile of wood stacked 4 feet high and composed of 4-foot-long pieces.
critical habitat	according to U.S. Federal law, the ecosystems upon which endangered and threatened species depend
cultural resource inventory	<p>a professional study to locate and evaluate evidence of cultural resources within a defined geographic area</p> <p>[N.b. Various levels of inventories may include background literature searches, comprehensive field examinations to identify all exposed physical manifestations of cultural resources, or sample inventories for projecting site distribution and density over a larger area. Evaluating identified cultural resources to determine their eligibility for the National Register follows the criteria in 36 CFR 60.4 (cf. FWS Manual 614 FW 1.7).]</p>
cultural resource overview	<p>a comprehensive document prepared for a field office that discusses, among other things, project prehistory and cultural history, the nature and extent of known cultural resources, previous research, management objectives, resource management conflicts or issues, and a general statement of how program objectives should be met and conflicts resolved</p> <p>[An overview should reference or incorporate information from a field office's background or literature search described in section VIII of the Cultural Resource Management Handbook (FWS Manual 614 FW 1.7).]</p>
database	a collection of data arranged for ease and speed of analysis and retrieval, usually computerized
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.
dedicated open space	land to be held as open space forever
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
designated wilderness area	an area designated by Congress as part of the National Wilderness Preservation System [FWS Manual 610 FW 1.5 (draft)]
desired future condition	the qualities of an ecosystem or its components that an organization seeks to develop through its decisions and actions.
digitizing	the process of converting maps into geographically referenced electronic files for a geographic information system (GIS)

distribution pattern	the overall pattern of occurrence for a particular conservation target. In ecoregional planning projects, often referred to as the relative proportion of the target's natural range occurring within a give ecoregion (e.g. endemic, limited, widespread, disjunct, peripheral).
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	<p>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. An agreement by which landowners give up or sell one of the rights on their property</p> <p>[E.g., landowners may donate rights-of-way across their properties to allow community members access to a river (cf. "conservation easement").]</p>
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 land unit (ELU)	mapping units used in large-scale conservation planning projects that are typically defined by two or more environmental variables such as elevation, geological type, and landform (e.g., cliff, stream, summit).
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 process approach	an approach to managing for species communities that manages for ecological process (e.g., flooding, fire, herbivory, predator-prey dynamics) within the natural range of historic variability. This approach assumes that if ecological processes are occurring within their historic range of spatial and temporal variability, then the naturally occurring biological diversity will benefit.
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.
ecoregion	a territory defined by a combination of biological, social, and geographic criteria, rather than geopolitical considerations; generally, a system of related, interconnected ecosystems.
ecosystem	a natural community of organisms interacting with its physical environment, regarded as a unit

ecosystem service	a benefit or service provided free by an ecosystem or by the environment, such as clean water, flood mitigation, or groundwater recharge
ecotourism	visits to an area that maintains and preserves natural resources as a basis for promoting its economic growth and development
ecosystem approach	a way of looking at socio-economic and environmental information based on the boundaries of ecosystems like watersheds, rather than on geopolitical boundaries
ecosystem-based management	<p>an approach to making decisions based on the characteristics of the ecosystem in which a person or thing belongs</p> <p>[N.b. This concept considers interactions among the plants, animals, and physical characteristics of the environment in making decisions about land use or living resource issues.]</p>
edge effect	the phenomenon whereby edge-sensitive species are negatively affected near edges by factors that include edge-generalist species, human influences, and abiotic factors associated with habitat edges. Edge effects are site-specific and factor-specific and have variable depth effects into habitat fragments.
emergent wetland	wetlands dominated by erect, rooted, herbaceous plants
endangered species	a Federal- or State-listed protected species in danger of extinction throughout all or a significant portion of its range
endemic	a species or race native to a particular place and found only there
environment	the sum total of all biological, chemical and physical factors to which organisms are exposed
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 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 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]
euphotic	relating to the upper, well-illuminated zone of a lake where photosynthesis occurs

eutrophic lake	a lake possessing low or a complete absence of oxygen in the deeper portion in midsummer, rich in nutrients and plankton
eutrophication	enrichment of a body of water by the addition of nutrients which stimulate the growth of aquatic plants and may cause a decrease in the organoleptic properties of the water source.
evaluation	examination of how an organization's plans and actions have turned out — and adjusting them for the future.
even-aged	a stand having one age class of trees
exemplary community type	an outstanding example of a particular community type
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)
extirpated	status of a species or population that has completely vanished from a given area but that continues to exist in some other location
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
extant	in biology, a species which is not extinct; still existing
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
federal-listed species	a species listed either as endangered, threatened, or a species at risk (formerly, a “candidate species”) under the 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).
fen	A type of wetland that accumulates peat deposits. Fens are less acidic than bogs, deriving most of their water from groundwater rich in calcium and magnesium
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
fish passage project	providing a safe passage for fish around a barrier in the upstream or downstream direction
flora	all the plants found in a particular place
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
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.
focus areas	cf. “special focus areas”
forest association	the community described by a group of dominant plant (tree) species occurring together, such as spruce-fir or northern hardwoods
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.]
forested wetlands	wetlands dominated by trees
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.]
graminoid	grasses and grasslike plants, such as sedges.
grant agreement	the legal instrument used when the principal purpose of the transaction is the transfer of money, property, services, or anything of value to a recipient in order to accomplish a public purpose of support or stimulation authorized by Federal statute and substantial involvement between the Service and the recipient is <i>not</i> anticipated (cf. “cooperative agreement”)

grassroots conservation organization	any group of concerned citizens who act together to address a conservation need
groundwater	water in the ground that is in the zone of saturation, from which wells and springs and groundwater runoff are supplied
guild	a group of organisms, not necessarily taxonomically related, that are ecologically similar in characteristics such as diet, behavior, or microhabitat preference, or with respect to their ecological role in general
habitat block	a landscape-level variable that assesses the number and extent of blocks of contiguous habitat, taking into account size requirements for populations and ecosystems to function naturally. It is measured here by a habitat-dependent and ecoregion size-dependent system
habitat fragmentation	the breaking up of a specific habitat into smaller, unconnected areas [N.b. A habitat area that is too small may not provide enough space to maintain a breeding population of the species in question.]
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
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.]
historic conditions	the composition, structure and functioning of ecosystems resulting from natural processes that we believe, based on sound professional judgement, were present prior to substantial human-related changes to the landscape
hydrologic or flow regime	characteristic fluctuations in river flows
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
important fish areas	the aquatic areas identified by private organizations, local, state, and federal agencies that meet the purposes of the Conte Act
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
indicator species	a species used as a gauge for the condition of a particular habitat, community, or ecosystem. A characteristic or surrogate species for a community or ecosystem
indigenous	native to an area
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
interpretive facilities	structures that provide information about an event, place, or thing by a variety of means, including printed, audiovisual, or multimedia materials [E.g., kiosks that offer printed materials and audiovisuals, signs, and trail heads.]
interpretive materials	any tool used to provide or clarify information, explain events or things, or increase awareness and understanding of the events or things [E.g., printed materials like brochures, maps or curriculum materials; audio/visual materials like video and audio tapes, films, or slides; and, interactive multimedia materials, CD-ROM or other computer technology.]
interpretive materials projects	any cooperative venture that combines financial and staff resources to design, develop, and use tools for increasing the awareness and understanding of events or things related to a refuge
introduced invasive species	non-native species that have been introduced into an area and, because of their aggressive growth and lack of natural predators, displace native species
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).]
lake	an inland body of fresh or salt water of considerable size occupying a basin or hollow on the earth's surface, and which may or may not have a current or single direction of flow
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.
landscape approach	an approach to managing for species communities that focuses on landscape patterns rather than processes and manages landscape elements to collectively influence groups of species in a desired direction. This approach assumes that by managing a landscape for its components, the naturally occurring species will persist.
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.
late-successional	species, assemblages, structures, and processes associated with mature natural communities that have not experienced significant disturbance for a long time
limiting factor	an environmental limitation that prevents further population growth
limits of acceptable change	a planning and management framework for establishing and maintaining acceptable and appropriate environmental and social conditions in recreation settings
local land	public land owned by local governments, including community or county parks or municipal watersheds
local agencies	generally, municipal governments, regional planning commissions, or conservation groups
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
macroinvertebrates	invertebrates large enough to be seen with the naked eye (e.g., most aquatic insects, snails, and amphipods)
management alternative	a set of objectives and the strategies needed to accomplish each objective [FWS Manual 602 FW 1.4]
management concern	cf. “issue” and “migratory nongame birds of management concern”
management opportunity	cf. “issue”

management plan	<p>a plan that guides future land management practices on a tract</p> <p>[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”).]</p>
management strategy	<p>a general approach to meeting unit objectives</p> <p>[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).]</p>
marshlands	<p>areas interspersed with open water, emergent vegetation (hydrophytes), and terrestrial vegetation (phreatophytes).</p>
matrix forming (or matrix community)	<p>communities that form extensive and contiguous cover may be categorized as matrix (or matrix-forming) community types. Matrix communities occur on the most extensive landforms and typically have wide ecological tolerances. They may be characterized by a complex mosaic of successional stages resulting from characteristic disturbance processes (e.g. New England northern hardwood-conifer forests). Individual occurrences of the matrix type typically range in size from 2000 to 500,000 hectares. In a typical ecoregion, the aggregate of all matrix communities covers, or historically covered, as much as 75-80% of the natural vegetation of the ecoregion. Matrix community types are often influenced by large-scale processes (e.g., climate patterns, fire), and are important habitat for wide-ranging or large area-dependent fauna, such as large herbivores or birds.</p>
mesic soil	<p>sandy-to-clay loams containing moisture-retentive organic matter, well drained (no standing matter)</p>
migratory nongame birds of management concern	<p>species of nongame birds that (a) are believed to have undergone significant population declines; (b) have small or restricted populations; or (c) are dependent upon restricted or vulnerable habitats</p>
mission statement	<p>a succinct statement of the purpose for which the unit was established; its reason for being</p>
mitigation	<p>actions to compensate for the negative effects of a particular project</p> <p>[E.g., wetland mitigation usually restores or enhances a previously damaged wetland or creates a new wetland.]</p>
mosaic	<p>an interconnected patchwork of distinct vegetation types.</p>
National Environmental Policy Act of 1969	<p>(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</p> <p>[Federal agencies must integrate NEPA with other planning requirements, and prepare appropriate NEPA documents to facilitate better environmental decision-making (cf. 40 CFR 1500).]</p>
National Wildlife Refuge System	<p>(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 for the protection and conservation of fish and wildlife, including those that are threatened with extinction</p>

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
natural disturbance event	any natural event that significantly alters the structure, composition, or dynamics of a natural community: e.g., floods, fires, and storms
natural range of variation	a characteristic range of levels, intensities, and periodicities associated with disturbances, population levels, or frequency in undisturbed habitats or communities
niche	the specific part or smallest unit of a habitat occupied by an organism
Neotropical migrant	birds, bats, or invertebrates that seasonally migrate between the Nearctic and Neotropics
non-consumptive, wildlife-oriented recreation	wildlife observation and photography and environmental education and interpretation (cf. “wildlife-oriented recreation”)
non-native 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 (Eckhardt 1998)
nonforested wetlands	wetlands dominated by shrubs or emergent vegetation
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 (Lotspeich and Platts 1982)
Notice of Intent	(NOI) an announcement we publish in the Federal Register that we will prepare and review an environmental impact statement [40 CFR 1508.22]
objective	cf. “unit objective”
obligate species	a species that must have access to a particular habitat type to persist
occurrence site	a discrete area where a population of a rare species lives or a rare plant community type grows
outdoor education project	any cooperative venture that combines financial and staff resources to develop outdoor education activities like labs, field trips, surveys, monitoring, or sampling
outdoor education	educational activities that take place in an outdoor setting

palustrine wetlands	“The Palustrine system includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0%.”—Cowardin et al. 1979
Partners for Wildlife Program	a voluntary, cooperative habitat restoration program among the Service, other government agencies, public and private organizations, and private landowners to improve and protect fish and wildlife habitat on private land while leaving it in private ownership
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
payment in lieu of taxes	cf. Revenue Sharing Act of 1935, Chapter One, Legal Context
point source	a source of pollution that involves discharge of waste from an identifiable point, such as a smokestack or sewage-treatment plant (Eckhardt 1998)
population	an interbreeding group of plants or animals. The entire group of organisms of one species.
population monitoring	assessing the characteristics of populations to ascertain their status and establish trends on their abundance, condition, distribution, or other characteristics
prescribed fire	the application of fire to wildland fuels, either by natural or intentional ignition, to achieve identified land use objectives [FWS Manual 621 FW 1.7]
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 landowner	cf. “private land”
private organization	any non-government organization
proposed wilderness	an area of the Refuge System that the Secretary of the Interior has recommended to the President for inclusion in the National Wilderness Preservation System
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 involvement plan	long-term guidance for involving the public in the comprehensive planning process
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
rare community types	plant community types classified as rare by any State program; includes exemplary community types
recharge	refers to water entering an underground aquifer through faults, fractures, or direct absorption
recommended wilderness	areas studied and found suitable for wilderness designation by both the Director (FWS) and Secretary (DOI), and recommended by the President to Congress for inclusion in the National Wilderness System [FWS Manual 610 FW 1.5 (draft)]
Record of Decision	<p>(ROD) a concise public record of a decision by a Federal agency pursuant to NEPA</p> <p>[N.b. A ROD includes:</p> <ul style="list-style-type: none"> * the decision; * all the alternatives considered; * the environmentally preferable alternative; * a summary of monitoring and enforcement, where applicable, for any mitigation; and, * whether all practical means have been adopted to avoid or minimize environmental harm from the alternative selected (or if not, why not).]
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)
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)
refuge lands	lands in which the Service holds full interest in fee title or partial interest like an easement

regenerating	establishing a new age class. Silviculture does this in a way that controls the species composition, seedling density, and other characteristics consistent with the landowner's objectives.
relatively intact	the conservation status category indicating the least possible disruption of ecosystem processes. Natural communities are largely intact, with species and ecosystem processes occurring within their natural ranges of variation.
relatively stable	the conservation status category between <i>vulnerable</i> and <i>relatively intact</i> 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.]
restoration ecology	the process of using ecological principles and experience to return a degraded ecological system to its former or original state
riparian	referring to the interface between freshwater habitats and the terrestrial landscape
riparian forested land	forested land along a stream or river
riparian habitat	habitat along the banks of a stream or river [cf. note above]
riverine	within the active channel of a river or stream
riverine wetlands	generally, all the wetlands and deepwater habitats occurring within a freshwater river channel not dominated by trees, shrubs, or persistent emergents
rotation	the period of time from establishment of an even-aged stand until its maturity
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
Selection cutting/selection system	The silvicultural system used to regenerate and maintain uneven-aged stands. Selection cuttings are used to remove individual or small groups of mature trees to regenerate a new cohort, as well as to thin the immature age classes to promote their growth and improve their quality.
Service presence	Service programs and facilities that it directs or shares with other organizations; public awareness of the Service as a sole or cooperative provider of programs and facilities

shifting mosaic	an interconnected patchwork of distinct vegetation types that may shift across the land surface as a result of dynamic ecosystem processes, such as periodic wildfire or flooding.
shrublands	habitats dominated by various species of shrubs, often with many grasses and forbs
silviculture	tending and regenerating forest stands to realize sought after benefits and sustain them over time
site improvement	any activity that changes the condition of an existing site to better interpret events, places, or things related to a refuge [E.g., improving safety and access, replacing non-native with native plants, refurbishing footbridges and trailways, and renovating or expanding exhibits.]
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 disproportionately 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.
source population	a population in a high-quality habitat where the birth rate greatly exceeds the death rate, and the excess individuals emigrate
spatial pattern	within an ecoregion, natural terrestrial communities may be categorized into three functional groups on the basis of their current or historical patterns of occurrence, as correlated with the distribution and extent of landscape features and ecological processes. These groups are identified as matrix communities, large patch communities, and small patch communities.
special focus area	an area of high biological value [N.b. We normally direct most of our resources to SFA's that were delineated because of: 1. the presence of Federal-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.]

special habitats	wetlands, vernal pools, riparian habitat, and unfragmented rivers, forests and grasslands [N.b. Many rare species depend on specialized habitats that, in many cases, are being lost within a watershed.]
special riparian project	restoring, protecting, or enhancing an aquatic environment in a discrete riparian corridor within a special focus area
species	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.
species assemblage	the combination of particular species that occur together in a specific location and have a reasonable opportunity to interact with one another
species at risk	a species being considered for Federal listing as threatened or endangered (formerly, a “candidate species”)
species of concern	species not Federal-listed as threatened or endangered, but about which we or our partners are concerned
species diversity	usually synonymous with “species richness,” but may also include the proportional distribution of species
species richness	a simple measure of species diversity calculated as the total number of species in a habitat or community (Fiedler and Jain 1992)
stand	an area of trees with a common set of conditions (e.g., based on age, density, species composition, or other features) that allow a single management treatment throughout
state agencies	natural resource agencies of State governments
state land	State-owned public land
state-listed species	cf. “Federal-listed species”
step-down management plan	a plan for dealing with specific refuge management subjects, strategies, and schedules, e.g., cropland, wilderness, and fire [FWS Manual 602 FW 1.4]
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.
stratification	thermal layering of water both in lakes and streams

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
sustainable development	the attempts to meet economic objectives in ways that do not degrade the underlying environmental support system. Note that there is considerable debate over the meaning of this term...we define it as “human activities conducted in a manner that respects the intrinsic value of the natural world, the role of the natural world in human well-being, and the need for humans to live on the income from nature’s capital rather than the capital itself.”
terrestrial	living on land
territory	an area over which an animal or group of animals establishes jurisdiction
thinning	reducing the density of trees in a stand primarily to improve the growth and condition of residual trees and prevent mortality. The term describes treatments in immature even-aged stands that do not attempt to establish regeneration.
threatened species	a Federal-listed, protected species that is likely to become an endangered species in all or a significant portion of its range
tiering	incorporating by reference the general discussions of broad topics in environmental impact statements into narrower statements of environmental analysis by focusing on specific issues [40 CFR 1508.28]
tributary	a stream or river that flows into a larger stream, river, or lake, feeding it water
trust resource	<p>a resource that the Government holds in trust for the people through law or administrative act</p> <p>[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.]</p>
trust responsibility	In the federal government, a special duty required of agencies to hold and manage lands, resources, and funds on behalf of Native American tribes.
turbidity	refers to the extent to which light penetrates a body of water. Turbid waters are those that do not generally support net growth of photosynthetic organisms
understory	the lower layer of vegetation in a stand, which may include short trees, shrubs, and herbaceous plants

uneven-aged	a stand having three or more age classes of trees with distinctly different ages
unfragmented habitat	large, unbroken blocks of a particular type of habitat
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	depressions holding water for a temporary period in the spring, and in which various amphibians lay eggs
vision statement	a concise statement of what the unit could achieve in the next 10 to 15 years
watchable wildlife	all wildlife is watchable [N.b. A watchable wildlife program is one that helps maintain viable populations of all native fish and wildlife species by building an active, well informed constituency for conservation. Watchable wildlife programs are tools for meeting wildlife conservation goals while at the same time fulfilling public demand for wildlife-dependent recreational activities (other than sport hunting, sport fishing, or trapping).]
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.
watershed-wide education networks	systems for sharing educational information, like curriculum development projects, student activities, and ongoing data gathering; a combination of telecommunications and real-life exchanges of information
well-protected	in CCP analysis, a rare species or community type is considered well protected if 75 percent or more of its occurrence sites are on dedicated open space
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 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: 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 610 FW 1.5 (draft)).]
wilderness	cf. “designated wilderness”
wildfire	a free-burning fire requiring a suppression response; all fire other than prescribed fire that occurs on wildlands [FWS Manual 621 FW 1.7]
wildland fire	every wildland fire is either a wildfire or a prescribed fire [FWS Manual 621 FW 1.3]
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]
working landscape	the rural landscape created and used by traditional laborers [N.b. Agriculture, forestry, and fishing all contribute to the working landscape of a watershed (e.g., keeping fields open by mowing or by grazing livestock).]

Acronyms

Acronym	Full Name
ADA	Americans with Disabilities Act
AMC	Appalachian Mountain Club
ASNH	Audubon Society of New Hampshire
ATV	all-terrain vehicles
BAER	Burned Area Emergency Rehab
BCR	Bird Conservation Region
BI	Burn Index
BMP	Best Management Practices
BRI	Biodiversity Research Institute
CCF	C unit, 100 cubic feet of solid wood
CCP	Comprehensive Conservation Plan
CEQ	Council of Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CWCS	Comprehensive Wildlife Conservation Strategy
dbh	diameter breast height
DDT	Dichloro-Diphenyl-Trichloroethane
EA	Environmental Assessment
EIS	Environmental Impact Statement
ELU	Ecological Land Unit
EMAP	Environmental Monitoring and Assessment Program
EPA	Environmental Protection Agency
ERC	Energy Release Component
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
FINNL	Floating Island National Natural Landmark
FMO	Fire Management Officer
FMP	Fire Management Plan
FMU	Fire Management Unit
Friends group	Friends of Umbagog National Wildlife Refuge

FPA	Fire Program Analysis
FPLE	Florida Power & Light Energy Hydro Maine, LLC
FPU	Fire Planning Unit
FY	fiscal year
GIS	Geographical Information Systems
GPRA	Government Performance and Results Act
HMP	Habitat Management Plan
HPO	Historical Preservation Office
IAFWA	International Association of Fish and Wildlife Agencies
ICS	Incident Command System
IMP	Habitat and Species Implementation and Monitoring Plan
IMPLAN	Impact Analysis for Planning
IQCS	Incident Qualifications and Certification System
KBDI	Keetch-Byram Drought Index
LMRD	Land Management Research and Development
LOAEL	Lowest Observed Adverse Effect Level
LPC	Loon Preservation Committee
LPP	Land Protection Plan
LUNWR	Lake Umbagog National Wildlife Refuge
MDEP	Maine Department of Environmental Protection
MDIFW	Maine Department of Inland Fisheries and Wildlife
MDOC	Maine Department of Conservation
MFS	Maine Forest Service
MGM2	Money Generation Model Version 2
MIST	Minimum Impact Suppression Tactics
MMS	Maintenance Management System
MNAP	Maine Natural Areas Program
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
msl	Mean sea level
NABCI	North American Bird Conservation Initiative
NAWCP	North American Waterbird Conservation Plan

NAWMP	North American Waterfowl Management Plan and Joint Ventures
NECC	Northeast Dispatch Coordination Center
NEFA	North East State Foresters Association
NEFRTC	Northeast Furbearer Resources Technical Committee
NEPA	National Environmental Policy Act
NERA	New England Regional Assessment
NFDRS	National Fire Danger Rating System
NFFL	Northern Forest Fire Laboratory
NFPORS	National Fire Plan Operating and Reporting System
NHFSSWT	New Hampshire Forest Sustainability Standards Work Team
NGO	Non-Governmental Organization
NHCR	National State Agency Herpetological Conservation Report
NHDES	New Hampshire Department of Environmental Services
NHDRED	New Hampshire Department of Resources and Economic Development
NHFG	New Hampshire Fish and Game Department
NHNHB	New Hampshire Natural Heritage Bureau
NHPA	National Historic Preservation Act
NNL	National Natural Landmark
NPS	National Park Service
NRCC	Natural Resource Conservation Service
NRCM	Natural Resources Council of Maine
NSHFWR	National Survey of Fishing, Hunting, and Wildlife Associated Recreation
NSRE	National Survey on Recreation and the Environment
NVCS	National Vegetation Classification System
NWCG	National Wildfire Coordinating Group
NWR	National Wildlife Refuge
NWRS	National Wildlife Refuge System
PARC	Partners in Amphibian and Reptile Conservation
PIF	Partners In Flight
PNV	present net value
PPE	personal protective equipment
RFA	Rural Fire Assistance Program

RFMC	Regional Fire Management Coordinator
RM	Refuge Manager
ROD	Record of Decision
RONs	Refuge Operation Needs System
RRS	Refuge Revenue Sharing
SAMMS	Service Asset Maintenance Management System
SAV	submerged aquatic vegetation
SC	Spread Component
SCORP	Statewide Comprehensive Outdoor Recreation Plan
SERA	Syracuse Environmental Research Associates, Inc.
Service	United States Fish and Wildlife Service
SHPO	State Historic Preservation Office
SPACE	Statewide Program of Action to Conserve Our Environment
SUP	Special Use Permit
SWG	State Wildlife Grant Program
TIEE	Teaching Issues and Experiments in Ecology
TNC	The Nature Conservancy
TWS	The Wildlife Society
US SCP	U.S. Shorebird Conservation Plan
USDA	United States Department of Agriculture
USDOI	United States Department of Interior
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UWP	Union Water Power Company
VDFPR	Vermont Department of Forest, Parks, and Recreation
VSP	Visitor Services Professional
WAP	Wildlife Action Plan
WFSA	Wildland Fire Situation Analysis
WMU	Wildlife Management Unit
WUI	Wildlife-urban interface
YCC	Youth Conservation Corps

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Common loon on nest

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