



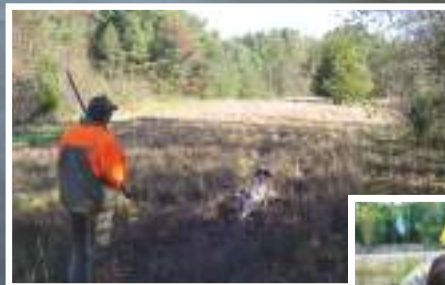
U.S. Fish & Wildlife Service

# Silvio O. Conte National Fish and Wildlife Refuge

## *Comprehensive Conservation Plan*

### *January 2017*

*Volume 1 — Chapters 1 through 7*  
*including Bibliography, Glossary, and Acronyms*



*Front and back cover:*

*Connecticut River*

USFWS

*Front cover insets:*

*Hunting on the refuge*

USFWS

*Conducting research on puritan tiger beetles*

USFWS

*Canoeing on the Connecticut River*

Kristen Sykes

*Enjoying the universally accessible trail*

*on the refuge's Fort River Division,*

*Massachusetts*

USFWS

*Fishing along the Connecticut River*

*near Hartford, Connecticut*

USFWS



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

The U.S. Fish and Wildlife Service is the principal Federal agency responsible for conserving, protecting, and enhancing fish, wildlife, plants, and their habitats for the continuing benefit of the American people. The Service manages the National Wildlife Refuge System comprised of over 150 million acres including over 565 national wildlife refuges, thousands of waterfowl production areas, and marine national monuments. The Service also operates national fish hatcheries and 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 on a refuge and set forth goals, objectives, and strategies needed to accomplish refuge purposes. CCPs also identify the Service's best estimate of future needs. These plans detail program levels that are sometimes substantially above current budget allocations and, as such, are primarily for Service strategic planning and program prioritization purposes. CCPs do not constitute a commitment for staffing increases, operational and maintenance increases, or funding for future land acquisition.



**U.S. Fish & Wildlife Service**

# **Silvio O. Conte National Fish and Wildlife Refuge**

## *Comprehensive Conservation Plan*

*January 2017*

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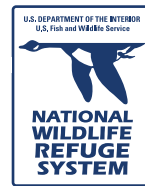


**Silvio O. Conte**  
**National Fish and Wildlife Refuge**  
Connecticut, Massachusetts, New Hampshire, Vermont



**Record of Decision**  
for the  
**Final Comprehensive Conservation Plan and  
Environmental Impact Statement**

**U.S. Fish and Wildlife Service**



**January 2017**

**U.S. Fish and Wildlife Service**  
**Silvio O. Conte National Fish and Wildlife Refuge**  
Connecticut, Massachusetts, New Hampshire, Vermont

The Department of the Interior, U.S. Fish and Wildlife Service (Service; we, our), has prepared this Record of Decision (ROD) for the Final Comprehensive Conservation Plan (CCP) and Environmental Impact Statement (EIS) for Silvio O. Conte National Fish and Wildlife Refuge (Conte Refuge, refuge), which encompasses the Connecticut River Watershed (watershed) in the states of Connecticut, Massachusetts, New Hampshire, and Vermont. This ROD includes a summary of the alternatives we considered in the final CCP/EIS, a description of the environmentally preferable alternative, an overview of public and partner involvement in the decision-making process, our basis for selecting alternative C for the CCP, and a summary of the practicable measures to minimize environmental harm. The Conte Refuge CCP will provide guidance for conserving the refuge's natural and cultural resources, and for managing public use activities, for the next 15 years.

**Management Alternatives Considered in the Final CCP/EIS**

We evaluated four management alternatives in the final CCP/EIS for Conte Refuge. Below is a summary of the key features of each alternative. More detailed information on the alternatives can be found in chapter 4 of the final CCP/EIS.

Alternative A—Current Management: This alternative proposes to continue current management, and serves as a baseline for comparing the other alternatives. Under this alternative, we would continue our current habitat and visitor services management activities on the existing 37,000-acre refuge. We would also continue to work with our existing partners throughout the watershed to support our conservation, education, and recreation programs. We would continue to actively manage forest habitats on the Nulhegan Basin Division (Vermont) to benefit forest-dependent species of conservation concern, and to manage grasslands and shrublands habitats on our Pondicherry (New Hampshire) and Fort River (Massachusetts) Divisions for species dependent on those habitats. We would maintain our hunting and fishing programs on refuge lands, which generally are managed consistent with respective State regulations. Wildlife observation, photography, environmental education, and interpretation would continue to be supported on refuge lands. Other historic, compatible recreational activities, such as snowmobiling on State-designated trails and trapping under State regulations, would continue on lands where these activities are currently approved. We would also continue to acquire lands from willing sellers under our existing land acquisition authority of approximately 97,830 acres. The focus of acquisition activities would continue to be on lands that were identified in the refuge's 1995 Master Plan and its accompanying EIS.

Alternative B—Consolidated Stewardship: This alternative would strategically focus our work with partners, and our staffing, funding, and other resource commitments across the watershed, in 15 defined geographic areas called Conservation Partnership Areas (CPAs). CPAs are large areas, defined by sub-watersheds, with concentrations of high-value habitat for fish and wildlife. Within CPAs, we have identified a total of 18 areas we call Conservation Focus Areas (CFAs). These are contiguous areas with particularly high value to Federal trust resources and represent

where we would focus our future refuge land acquisition. Under alternative B, we would not seek to expand the refuge beyond our current acreage authority. Instead, we propose to focus refuge acquisition from willing sellers in CFAs rather than in the smaller, scattered areas proposed in the refuge's 1995 Master Plan and EIS. Under alternative B, we would expand our current wildlife habitat and visitor services management activities to other refuge divisions, and support those same opportunities within CPAs on other ownerships across the watershed.

Alternative C—Enhanced Conservation Connections and Partnerships (Service's Preferred Alternative): Similar to alternative B, we would prioritize our work with partners in CPAs, and focus future refuge acquisition from willing sellers primarily in CFAs. Under alternative C, we propose to expand the refuge's approved acquisition authority in the watershed up to approximately 197,337 acres. Besides the total acreage acquisition authority, another important distinction from alternative B is that, on average, 90 percent of our target acquisition acreage would occur within CFAs, while 10 percent of the target acreage would occur in surrounding CPAs. The expanded network of 19 CPAs and 22 CFAs would allow for greater flexibility and opportunity for us to work with partners to achieve common conservation goals in keeping with the founding purposes of the refuge. Compared to alternatives A and B, in alternative C, refuge lands would make a more significant contribution to achieving a well-connected and resilient conserved lands network in the watershed. Alternative C would also more fully support the multi-partner-driven, collaboratively developed, *Connect the Connecticut* landscape conservation design (LCD). The goals of this LCD are to sustain a diverse suite of intact, connected, and resilient ecosystems, and healthy and diverse populations of fish, wildlife, and plants. Under alternative C, we would be able to increase our benefits to species of conservation concern by managing more acres of habitat that are better distributed across the watershed. Expanding the refuge land base would also enhance our ability to address, and adapt our management to, climate change. We would be able to provide more public access for compatible recreational opportunities such as hunting, fishing, wildlife observation, and photography. We would also expand our education and interpretive programs with an emphasis on engaging urban communities.

Alternative D—Conservation Connections Emphasizing Natural Processes: Similar to alternatives B and C, we would prioritize our work both on and off refuge lands in CPAs, and would focus refuge acquisition in CFAs. The CPAs and CFAs would be based on those described in alternative C. However, under alternative D, we would further expand individual CFAs and seek additional acquisition authority of up to approximately 231,307 acres. The increased acreage would further enhance the refuge's capability to establish ecological connections within the watershed's existing conserved lands network and support the *Connect the Connecticut* LCD. A major difference between alternatives C and D is that alternative D proposes to limit active habitat management. We would only intervene in natural processes when a federally listed species is in jeopardy, or a major wildfire or pest outbreak occurs and restoration is a critical need. Under alternative D, we would provide more public access due to the increased land base, but our visitor services programs would emphasize a reduced human footprint, fewer developed areas, and non-motorized recreation with a focus on backcountry opportunities.

Other Alternatives or Actions Considered but Eliminated From Further Study: In addition to the four alternatives discussed above, we considered several other alternatives and actions, but eliminated them from detailed analysis. These alternatives or actions include:

- Continuation of the Special Focus Area strategy for refuge land acquisition envisioned in the 1995 Final EIS creating Conte Refuge.
- No additional refuge land acquisition by the Service; partners would assume all future land protection.
- Using only conservation easements as the acquisition method, or another less-than-fee option, for all future refuge purchases.
- Pursuit of land acquisition outside the watershed boundary.
- Management of refuge forests and agricultural lands for net present value (i.e., for profit).
- Elimination of all hunting opportunities on refuge lands.

The full rationale for eliminating these alternatives or actions can be found in chapter 4 of the final CCP/EIS.

### **Environmentally Preferable Alternative**

The Service, in accordance with the Department of the Interior's National Environmental Policy Act (NEPA) Code of Federal Regulations (43 CFR part 46) and the Council on Environmental Quality's Forty Most Asked Questions, defines the environmentally preferable alternative (or alternatives) as the alternative that "causes the least damage to the biological and physical environment and best protects, preserves, and enhances historical, cultural, and natural resources" (43 CFR 46.30). NEPA does not require the decision-maker to select the environmentally preferable alternative or prohibit adverse environmental effects. Indeed, Federal agencies often have other concerns and policy considerations to take into account in the decision-making process, such as social, economic, technical, or national security interests. NEPA requires decision-makers be informed of the environmental consequences of their decisions.

After considering the environmental consequences of the four management alternatives, including consequences to the human environment, we have concluded that alternative D is the environmentally preferable alternative. Alternative D would result in the most undeveloped, contiguous land protected in perpetuity by the Service in what is increasingly a fragmented landscape. The increased land acquisition would afford the most habitat protection for Federal trust resources and the most protection for historical and cultural resources. Compared to the other alternatives, the additional acquisition authority would also increase the contribution of refuge lands to providing a resilient, connected network of conserved lands in the watershed, and do the most in support of the *Connect the Connecticut* LCD. Under alternative D, no new infrastructure would be built for administration or to support visitor services and no active habitat management would occur, so associated construction and wildlife disturbance impacts would not occur under this alternative. Motorized activities, such as snowmobiling, would also not be allowed resulting in a reduction of carbon emissions.



## Public and Partner Involvement

Public and partner involvement has occurred throughout the planning process in numerous ways. Opportunities for outreach and engagement has occurred through public informational meetings, public hearings, technical expert exchanges, planning update mailings, media releases, and meetings with local community organizations and elected officials. **Federal Register (FR)** notices were published several times during the development of this CCP (71 FR 62006 on October 20, 2006; 80 FR 50023 on August 18, 2015; and, 81 FR 91185 on December 16, 2016). Early in the planning process, the public and partner comments and concerns that we received were used to identify issues and draft preliminary management alternatives. Meetings with experts, stakeholders, and State and Federal agency partners helped us refine those alternatives and prepare a draft CCP/EIS. An extensive review of the draft CCP/EIS occurred when it was released for a 90-day public comment period from August 18, 2015 to November 16, 2015. During this period, we held 14 public meetings and 4 public hearings. We received over 360 correspondences from over 300 separate commenters, including Federal and State agencies, local municipalities and town committees, organizations, and individuals. These comments came in the form of postings on the website *regulations.gov*, or were provided as oral testimony at public hearings. We also received one petition with over 2,546 signatures. From these written and oral submissions, we distinguished over 1,770 individual comments. We evaluated all letters and e-mails sent to us during that comment period, along with comments recorded at our public hearing. A summary of all comments, and our responses to them, is included as appendix O in the final CCP/EIS.

Based on comments we received, we made several modifications to alternative C in the final CCP/EIS. All substantive issues raised in the comments on the draft CCP/EIS were addressed through revisions incorporated into the final CCP/EIS text, or in our responses contained in appendix O of the final CCP/EIS. Appendix O also includes a table summarizing the changes to alternative C made between draft and final plans.

### Comments Received On the Final CCP/EIS

We received 8 letters during the final CCP/EIS 30-day review period. None of the comments received were significant new issues, nor require significant changes to either our proposed action or our analysis of impacts. All substantive comments were previously addressed in appendix O of the final CCP/EIS. Changes were made to the final plan as indicated in appendix O.

### Decision to Select Alternative C for the CCP

Alternative C is the Service's selected alternative. It was also specified as the Service-preferred alternative in the final CCP/EIS. Alternative C is the most effective alternative at addressing the key issues and concerns identified during the planning process and will best achieve the purpose and need for developing the CCP, the purposes and goals of the refuge, and the mission and goals of the National Wildlife Refuge System (Refuge System). Implementation of the CCP will occur over the next 15 years, as funding permits.

The decision includes adoption of stipulations and measures referenced in the “Measures to Minimize Environmental Harm” section below. It also includes all the changes made between draft and final CCP/EIS, and as indicated in appendix O of the final CCP/EIS.

The required “wait period” before approval of the ROD was initiated on December 16, 2016, with the Environmental Protection Agency’s **FR** notification of the filing of the final CCP/EIS. This ROD is not the final agency action for those elements of the selected action that require promulgation of regulations to be effective. Promulgation of such regulations will constitute the final agency action for such elements of the selected action, including the implementation of a new hunt program.

### **Factors Considered in Making the Decision**

This decision to adopt alternative C for implementation was made after considering the following factors:

- How well the alternative achieves the stated purpose and need for a CCP and the four goals presented in chapter 1 of the final CCP/EIS.
- How well the alternative addresses the relevant issues, concerns, and opportunities identified in the planning process and summarized in chapter 2 of final CCP/EIS.
- How well the alternative fulfills the purposes for which the refuge was established.
- The results of public, partner, local towns, Federal and State agency, and other stakeholder comments on the draft and final CCP/EISs.
- The projected impacts identified in chapter 5 of the final CCP/EIS.
- Other relevant factors, including contributing to the mission and goals of the Refuge System, and statutory and regulatory guidance.

Compared to the alternatives A, B, and D, alternative C includes the suite of actions that best meet the factors above using the most balanced, reasonable, practicable, and integrated approach, and with due consideration for impacts on both the biological and human environment.

Alternative C best balances the long-term protection and management of Federal trust resources with consideration of historic and traditional uses. Alternative C notably increases the acquisition authority to protect land for Federal trust resources, and includes provisions to actively manage those lands, where appropriate, for species that require early successional forest, shrublands, or grasslands. Restoration of degraded habitats, such as floodplain forest, is also a priority under this alternative. Alternative C is also best at promoting high-quality, wildlife-dependent recreation on the refuge, while providing sufficient protection for wildlife, cultural, and historic resources. Compared to alternatives A, B, and D, there are increased opportunities to provide accessible access for all six priority public uses: hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation, including the development of accessible trails, to the extent possible, on all refuge divisions. Accessible trail development would be more limited under alternatives A and B, and would not occur under alternative D. Alternative C would also allow bicycling on roads as a new opportunity on the Nulhegan Basin Division, which is a very popular activity and supports economic activity in the

surrounding community. Alternative C would not eliminate snowmobiling on State designated trails, or trapping under State regulations, as proposed in alternative D.

Under alternative C, we have also determined that there are some public use activities that are not appropriate or not compatible with resource protection and will not be allowed. Some of these activities may be occurring today, including the recreational use of manned and unmanned aircraft, such as drones. Our rationale for allowing certain activities, and not allowing others, are detailed in appendix D.

Alternative C best recognizes how important Conte NFWR is to the larger social and economic region of the watershed. It includes the most strategies for improving communications and coordination with other Federal, State agency, local municipalities, conservation partners, and other stakeholders. Alternative C objectives and strategies also specifically identify actions to improve outreach and engagement with residents in local communities encompassing refuge lands to ensure the refuge and its programs and resources are a relevant and vital contributor to the ecological, social, and economic well-being of those communities.

Alternative C complies with all major Federal laws that apply to this type of Federal action, including those noted below under “Findings Required by Other Laws and Executive Orders.” The final CCP/EIS was developed to comply with NEPA. The CCP/EIS was developed with sufficient detail to account for the greatest potential impacts that could result from proposed actions identified under all alternatives. However, additional NEPA analysis will be necessary for certain types of actions, even once we adopt a final CCP. We identified some of the actions we anticipate will require further NEPA analysis and public involvement in chapter 4 of the final CCP/EIS.

In summary, we selected alternative C for implementation because it best meets the factors identified above when compared to alternatives A, B, and D. Alternative C provides the greatest number of opportunities for Conte NFWR to contribute to the conservation of Federal trust resources at local, regional, and national levels. It will also increase our capacity to meet refuge purposes and contribute to the Refuge System mission, enhance visitor use and enjoyment by providing a diversity of compatible opportunities, and will provide the means to better respond to changing ecological conditions within the surrounding environment by making important contributions to the network of conserved lands in the watershed.

### **Measures to Minimize Environmental Harm**

Congress charged the Service with the mission of the Refuge System “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 System Improvement Act). Furthermore, the Service is directed to “ensure that the biological integrity, diversity, and environmental health of the Refuge System are maintained for the benefit of present and future generations of Americans.” As a result, the Service routinely evaluates and implements measures to minimize harm whenever conditions occur that could adversely affect the biological integrity, diversity, and environmental health of refuge resources.

All practicable measures to avoid or minimize environmental impacts that could result from implementation of alternative C have been identified and incorporated into chapter 4 (Alternatives Considered, including the Service-preferred Alternative), chapter 5 (Environmental Consequences), and appendix D (Findings of Appropriateness and Compatibility Determinations) of the final CCP/EIS. The findings of appropriateness and the stipulations identified in the compatibility determinations in appendix D ensure that refuge uses and visitor activities are appropriate and compatible with the purposes for which the refuge was established. The compatibility determination stipulations and other mitigation measures identified for alternative C in chapter 4 and appendix D are adopted in this ROD and will be followed or enforced by refuge staff or their designee.

### **Findings Required by Other Laws and Executive Orders**

The final CCP/EIS complies with all Federal laws and Executive Orders (EO) related to the planning process and Conte NFWR. These include, but are not limited to:

- 1) National Wildlife Refuge System Administration Act, as amended (Refuge System Improvement Act; 16 U.S.C. 668dd-668ee).
- 2) NEPA, as amended (P.L. 91-190, 42 U.S.C. 4321-4347; 83 Stat. 852).
- 3) Endangered Species Act, as amended (16 U.S.C. 1531-1544; 87 Stat. 884).
- 4) National Historic Preservation Act (16 U.S.C. 470 et seq.).
- 5) Archeological Resources Protection Act (16 U.S.C. 469-469c).
- 6) Coastal Zone Management Act, as amended (16 U.S.C. 1451-1464 86 Stat. 1280).
- 7) EO 12898, Environmental Justice.
- 8) EO 11988, Floodplain Management.
- 9) EO 11990, Protection of Wetlands.
- 10) EO 12372, Intergovernmental Review of Federal Programs.
- 11) EO 13186, Protection of Migratory Birds.
- 12) EO 13175, Consultation and Coordination with Indian Tribal Governments.

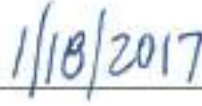
### **For Further Information**

For further information, contact Andrew French, Project Leader, Conte NFWR, 103 East Plumtree Road, Sunderland, MA 01375, phone 413-313-8682. Copies of the ROD, and the final CCP once compiled, may be viewed at the Conte NFWR office (see Project Leader's address), or at the refuge's Nulhegan Basin Division office, 5396 Route 105, Brunswick, Vermont, 05905, phone 802-962-5240.

The ROD, and the CCP once compiled, will be available for viewing and downloading online at:  
[http://www.fws.gov/refuge/Silvio\\_O\\_Conte/what\\_we\\_do/conservation.html](http://www.fws.gov/refuge/Silvio_O_Conte/what_we_do/conservation.html)



Wendi Weber, Regional Director, Region 5



Date





## U.S. Fish & Wildlife Service

# Silvio O. Conte National Fish and Wildlife Refuge

## *Comprehensive Conservation Plan*

*January 2017*

### **Vision Statement**

The Connecticut River is treasured by all for its majesty and significance in supporting diverse aquatic and terrestrial plant and animal life along its winding 410-mile passage through urban and rural communities in New Hampshire, Vermont, Massachusetts, and Connecticut. Working with our partners, we are inspired to protect and enhance the natural and cultural richness throughout the watershed, especially on lands and waters entrusted to our agency as the Silvio O. Conte National Fish and Wildlife Refuge.

Together with our partners, we design, support, and implement strategic conservation actions across the watershed, and communicate conservation needs and successes through extensive outreach and education programs. On refuge lands, and in our conservation partnership areas, we offer visitor programs and activities that promote an appreciation of the Connecticut River watershed as an intact, interconnected, and healthy ecosystem. Visitors respond to this greater awareness by becoming active stewards of the watershed's natural and cultural resources. Through our Urban Partnership Program, we are promoting the relevancy of conservation to healthy communities. Our actions exemplify the Service's vital role in conserving the Connecticut River watershed and the refuge's important contribution to the mission of the National Wildlife Refuge System.







## U.S. Fish & Wildlife Service

# Silvio O. Conte National Fish and Wildlife Refuge

## *Comprehensive Conservation Plan*

*January 2017*

### Summary

**Type of Action:** Administrative—Development of a Comprehensive Conservation Plan

**Lead Agency:** U.S. Department of the Interior, U.S. Fish and Wildlife Service

**Location:** Silvio O. Conte National Fish and Wildlife Refuge  
Connecticut, Massachusetts, New Hampshire, and Vermont

**Administrative Headquarters:** Silvio O. Conte National Fish and Wildlife Refuge  
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**Responsible Official:** Wendi Weber, Regional Director, Region 5

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This final comprehensive conservation plan (CCP) for Silvio O. Conte National Fish and Wildlife Refuge (Conte Refuge) is the culmination of a planning effort involving New Hampshire, Vermont, Massachusetts, and Connecticut state fish and wildlife agencies, Federal partners, regional and local conservation partners, and local town officials and residents, throughout the 7.2 million-acre Connecticut River watershed. This plan establishes 15-year goals and objectives for refuge programs encompassing wildlife and habitat conservation, education, recreation and partnerships.

This CCP sets forth the management direction that we think best achieves the refuge's purposes, vision, and goals, and responds to public issues and interests raised during the planning process. Under this plan, we will work closely with partners in our 19 Conservation Partnership Areas to achieve common conservation, education, and outdoor recreation goals. Refuge lands will make a significant contribution to a well-connected conserved lands network in the watershed. Benefits to Federal trust species conservation will be enhanced by our work with partners to protect, manage, and restore habitats vital to those species. Our inventory and monitoring programs will be designed to better inform our decisions and help us respond and adapt to changing ecological conditions, such as climate change. On refuge lands, we will support traditional, compatible public recreational uses, with emphasis on hunting, fishing, wildlife observation, and photography. Finally, we will enhance our partnerships in outreach and education with a priority to engage urban audiences.



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On CD ROM by request to: Nancy McGarigal, USFWS Planning Team Leader,  
 phone: 413–253–8562; Email: [nancy\\_mcgarigal@fws.gov](mailto:nancy_mcgarigal@fws.gov)

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## Chapter 1



J. Norton/USFWS

*Black Branch Falls on the Nulhegan Basin Division*

## **Purpose of, and Need for, Action**

- **Introduction**
- **The Connecticut River Watershed and Refuge's Context**
- **The CCP Structure**
- **Purpose of, and Need for, Action**
- **Regional Context and Project Analysis Area**
- **Refuge Establishment History**
- **Refuge Purposes**
- **Refuge Vision**
- **Refuge Goals**



## Introduction

The U.S. Fish and Wildlife Service (Service, we) has developed this Comprehensive Conservation Plan (CCP) for Silvio O. Conte National Fish and Wildlife Refuge (Conte Refuge, refuge). Congress authorized the refuge in 1991 through the Silvio O. Conte National Fish and Wildlife Refuge Act (Public Law 102-212; 105 Stat. 1655; Conte Refuge Act). The refuge is part of the National Wildlife Refuge System (Refuge System). The refuge was named in honor of Silvio O. Conte, the late Congressman who represented Massachusetts' First Congressional District from 1959 until his death in 1991. Conte Refuge was established with a boundary that coincides with the 7.2 million-acre Connecticut River watershed (watershed) in Connecticut, Massachusetts, New Hampshire, and Vermont in order to facilitate working with partners to conserve native fish, plants, and wildlife throughout the watershed (map 1.1). Appendix K includes the full text of the Conte Refuge Act. The Service officially created Conte Refuge through a Record of Decision (ROD), Final Action Plan, and Final Environmental Impact Statement (FEIS) in 1995 (USFWS 1995a).

From its inception, Conte Refuge has represented an important evolution for the Service in terms of the purpose, scope, and management of a national wildlife refuge. It was the first refuge in the Refuge System with a boundary that encompassed a large ecological landscape; that is, a major river's whole watershed, and with mandated conservation objectives that reached beyond refuge administrative units to affect the entire watershed (USFWS 1995a). Congressman Conte and the other authors of the establishing legislation recognized that the resources of the Service alone could never meet the full scope and scale of the conservation needs for the entire watershed (Conte Refuge Act of 1991). Those authors emphasized that the key to success would lie in creating partnerships, most notably with the four states' natural resource agencies, with other Federal agencies, and with regional and community organizations and individuals. Their vision was to seek wide support and initiate broad-based efforts through partnerships to achieve meaningful conservation action, including the protection of Federal trust resources so vitally important to our agency's mission. This landscape-scale, partnership-based approach to achieving conservation was prescient for the Refuge System. The approach is now established in the framework for the Refuge System's bold new vision which is articulated in "Conserving the Future: Wildlife Refuges and the Next Generation" (USFWS 2011a) and subsequent implementation documents (<http://americaswildlife.org>; accessed August 2016).

The emphasis on partnerships across the watershed remains the underpinning of this CCP as we look toward Conte Refuge's future. Partnerships are essential to all that we do. The ultimate goal is for Conte Refuge to be an integral component of the natural, cultural, and economic fabric of the diverse communities in the watershed. To convey our intent, early in the process we developed as the mission for Conte Refuge... "Work in partnership with others to inspire stewardship, magnify achievements, and celebrate shared successes that enhance, nurture, and protect the natural, cultural, and sustainable economic richness of the Connecticut River and its watershed on public and private land."

Our existing partnerships are diverse in scope and reflect the refuge's influence in the watershed. One highlight includes our partnership with the Friends of the Silvio O. Conte National Fish and Wildlife Refuge (Friends of Conte), which is comprised of more than 70 national, regional, and local conservation and environmental advocacy organizations. Other key partnerships include our collaborations across the watershed with the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) and National Forest Service offices, and respective state's fish and wildlife agencies. A list of our partnerships is included as appendix N.

Map 1.1. Location of the Connecticut River Watershed and the Service's Northeast Region (Region 5)





## The Connecticut River Watershed and Refuge's Context

The Connecticut River has had a storied human and ecological history. The present-day Connecticut River formed after the last ice-age and since that time humans have depended on it for their livelihood. The first people to inhabit the Connecticut River Valley were Paleo-Indians who hunted caribou, woolly mammoth, and other cold-adapted animals. Over time, as the climate became drier and warmer, native peoples continued to rely on the river and associated wetland areas for settlements, travel, hunting, gathering, fishing, and horticulture. During colonial times, its 410 miles were a highway from Long Island Sound to the Canadian border for fur traders. Others sought its bountiful fisheries and wildlife, its deep, fertile soil, hydropower from its waters, its beauty as inspiration for art, and its timber for shipbuilding and crafts (Levin 2009). For additional information on the history of the Connecticut River, see chapter 3.

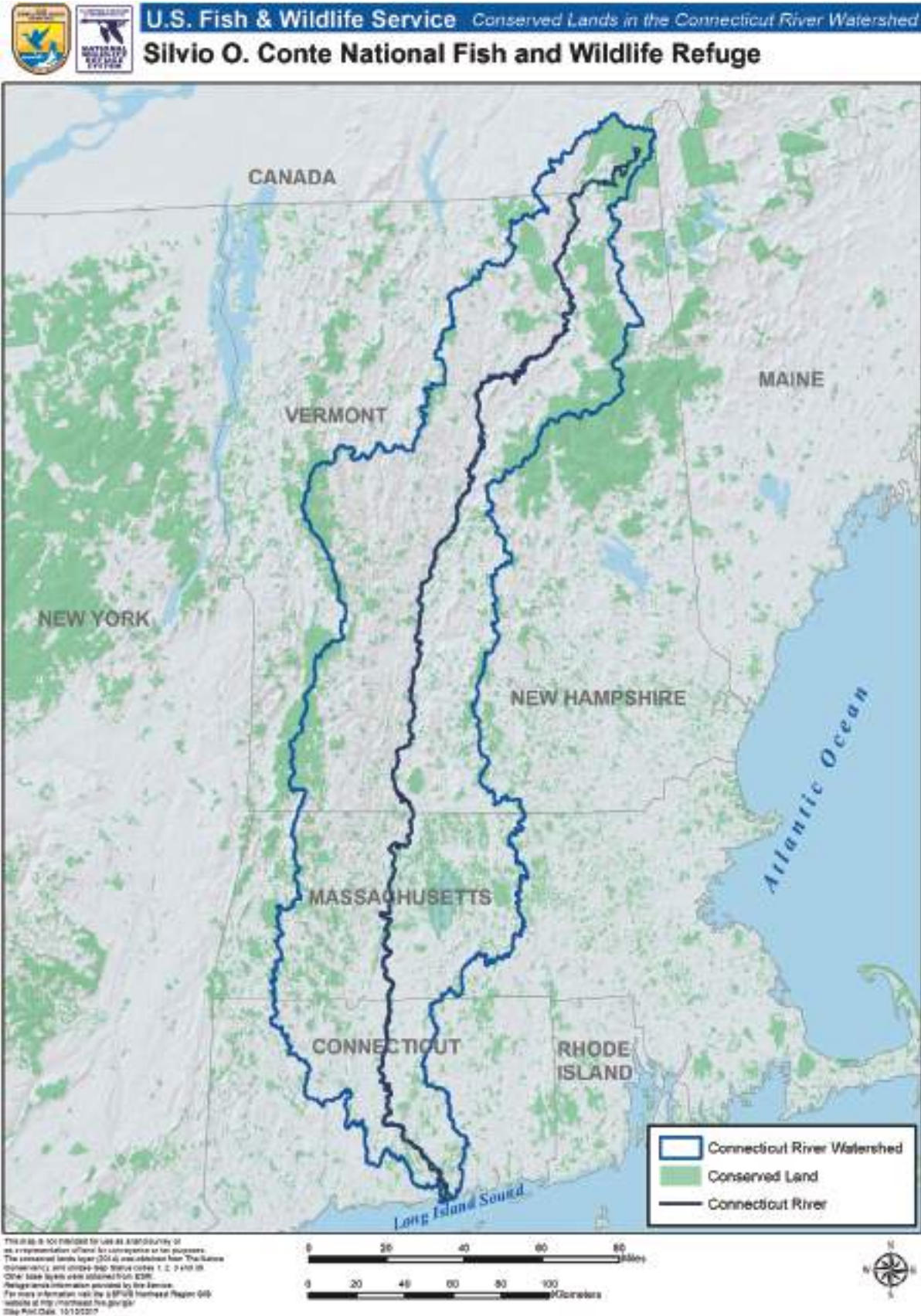
The current-day watershed retains many of the cultural, demographic, and political characteristics acquired at the time of its earliest habitation and development by European immigrants. It also maintains its diversity of natural resources and range of habitat types—from coastal estuaries in the south, to rich agricultural soils in the middle, and to alpine terrain in the north—that represent an unusually wide variety when compared with other refuges in the Refuge System. Understanding the history and diverse cultures of this iconic American landscape is instructive to capitalizing on the opportunities and challenges that face us as we pursue conservation action. Within the 7.2 million-acre watershed, over 1.8 million acres have some form of permanent protection, which we describe as the conserved lands network (map 1.2). Those conserved lands include the refuge and tracts owned by state and local governments, local and national non-governmental organizations, and other Federal agencies. The refuge is currently comprised of ten divisions and eleven units totaling 37,000 acres (as of February 2016; map 1.3). The current approved acquisition authority prior to finalizing this CCP was 97,830 acres, based on the 1995 ROD/FEIS and subsequent amendments to expand certain divisions pursued through subsequent National Environmental Policy Act (NEPA) compliant decisions. Chapter 3 provides a detailed history of land acquisition for the refuge. This CCP includes approval to expand the refuge to 197,296 acres as detailed in appendix C. The refuge footprint encompasses rural and urban communities throughout the watershed where political bodies, state agencies, and individual residents have vested interests in how refuge activities—from land protection to environmental education, recreation, and community partnerships—affect their work and daily lives. Refuge staff are developing cooperative relationships with a diverse array of municipal and community constituents who will be key in the success or failure of an appropriation for a needed refuge initiative.

## The CCP Structure

This CCP describes the Service's management direction for Conte Refuge for the next 15 years. This CCP incorporates changes made to address public and partner comments on the draft and final CCP/EIS. The draft and final CCP/EIS combined two documents required by Federal law:

- A CCP required by the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. § , as amended by the National Wildlife Refuge System Improvement Act of 1997 (16 U.S.C. 668dd, et seq.; Refuge Improvement Act), and
- A draft and final EIS required by NEPA of 1969 (42 U.S.C. § 4321 et seq.; 83 Stat. 852), as amended. NEPA requires a thorough analysis be made of a reasonable range of alternatives, including the proposed action and no action. It also requires that we analyze the socioeconomic, biological, physical, and cultural consequences of implementing each alternative.

Map 1.2. Conserved Lands in the Connecticut River Watershed



Map 1.3. Existing Refuge Ownership



This map reflects refuge ownership as of February 2016. For the most recent boundary files, contact refuge headquarters.

Our Northeast Regional Director made a decision to adopt alternative C for CCP implementation, as described in the final CCP/EIS and ROD, based on the Service and National Wildlife Refuge System (Refuge System) missions, the purposes for which the refuge was established, other legal mandates, and public and partner comments on the CCP/EIS. The final decision identifies the desired combination of species protection, habitat management, public use and access, and administration for the refuge, as explained in the ROD. The ROD, found in appendix P, presents and explains the decision, certifies that we have met agency compliance requirements, and notifies the reader that implementing the CCP will achieve the purposes of the refuge and help fulfill the Refuge System mission. We will notify the public of the availability of the ROD and the CCP as we begin implementation. This CCP will guide refuge management over the next 15 years. We will also use it to promote understanding and support for refuge management among the four State agencies, our conservation partners, local communities, and the public.

Early in the planning process, it became clear that because of the geographic scope and scale of the refuge's legislative boundary and the limited staff and other refuge resources available, it was important to prioritize where we directed our attention. To this end, we introduced two tiers of priority areas of interest for refuge staff to focus their time and resources. The first tier we refer to as "Conservation Partnership Areas" (CPAs). CPAs are areas within the watershed where refuge staff will use their resources to facilitate and support the great conservation, education, and recreation work led by others on other ownerships. The second tier we refer to as "Conservation Focus Areas" (CFAs). CFAs are areas of particularly high importance and significance to the Service, typically nested within CPAs, where refuge staff will take the lead role in conservation, education, and recreation actions. Any future land acquisition for the refuge will primarily be focused in CFAs. This framework is explained in more detail in appendix C.

This CCP replaces the 1995 Final Action Plan and will guide the refuge's management over the next 15 years. This CCP will become the new master plan for the refuge, setting out goals, objectives, and strategies organized by four major categories of management activities: wildlife and habitat conservation; environmental education, outreach, and interpretation; recreation; and partnerships. This CCP also identifies the Service's best estimate of future needs. It details program levels that are sometimes substantially above current budget allocations and, as such, are primarily for Service strategic planning and program prioritization. CCPs do not constitute a commitment for staffing increases, operational and maintenance increases, or funding for future land acquisitions.

Review and comment by the public and refuge partners on the draft and final CCP/EIS is an essential prerequisite to developing a final CCP. Concerns were raised during the review period of the draft CCP/EIS. When we published the final CCP/EIS, we included a summary of the comments received and our responses to them, in appendix O. We also highlighted in that appendix the changes we made between draft and final CCP/EIS as a result of those comments. Additional comments were received when the final CCP/EIS was distributed for public review, but they were similar to those addressed in appendix O. All comments were considered in selecting and approving alternative C for implementation by our Regional Director.

This CCP document has 6 chapters, 16 appendixes that provide supporting documentation, a glossary of terms, list of acronyms used, list of common and

*Cedar waxwing*

Bill Thompson

scientific names, and a bibliography. Below we describe what the reader can expect in each chapter.

The remainder of chapter 1 explains the purpose of, and need for, preparing a CCP for Conte Refuge. It also presents the regional context and project analysis area we considered in developing this plan, an overview of the refuge's establishment history, the refuge's legislated purposes, and our vision and four refuge goals.

**Chapter 2—The Planning Process:** This chapter explains the planning steps in developing the CCP; describes the influences of other national, regional, ecosystem, and state plans; and presents the regulations, policies, and laws covering units of the Refuge System. Its last section is a summary of the issues, concerns, and opportunities that were raised during the planning process and explains how they are addressed in this plan.

**Chapter 3—Affected Environment:** This chapter describes the physical, biological, historic, and human environment generally for the watershed, followed by details of what is known about those resources on refuge lands. It describes the threats posed by climate change and land use changes, and how dynamic influences have and will affect management outcomes.

**Chapter 4—Management Direction:** This chapter presents refuge goals, objectives, and strategies which, when implemented, are designed to achieve our desired outcomes. Appendix A “steps-down” these objectives and strategies to describe how they will be implemented in each CFA.

**Chapter 5—Consultation and Coordination with Others:** This chapter addresses a key element of NEPA and Service planning policy by describing the public and partner involvement used throughout the planning process.

## Purpose of, and Need for, Action

**Chapter 6—List of Preparers:** This chapter provides a list of members of the CCP Core Team, other Service and state personnel, and others who assisted in developing this CCP.

The CCP was developed in the context of a changing landscape. The watershed's natural environment, the influences of societal and land use changes, and the implications of climate change, have all affected the refuge setting since the 1995 establishing documents for the refuge were approved. This CCP is designed to address those changes and establish management and protection of valuable natural resources into the future, a future where continued change is even more likely to occur.

Thus, the *purpose* of this CCP is to establish strategic management direction to ensure that our management of the refuge will best integrate the areas of concern listed below. Our use of the term “strategic” means approaches that are ecologically sound and sustainable in light of physical and biological change, and are practical, viable, or economically realistic, and responsive to the following three areas of concern:

- (1) Abides by, and contributes to, the Service and Refuge System missions, legal mandates, Executive and Secretarial Orders, and Service and Refuge System policies. We provide a description of the Service and Refuge System missions, legal mandates, specific orders, and policies relevant to this planning process in chapter 2.
- (2) Helps meet the refuge's legislated purposes, vision, and CCP goals. The refuge's purposes, vision, and goals are listed below. The vision statement broadly interprets the refuge purposes and is an inspiring statement of the desired future for the refuge. The refuge goals articulate that desired future condition further and provide a framework for the development of management objectives and strategies.
- (3) Addresses key issues, including the concerns of the Service, other Federal and State agencies, and the public. Interest in the future management of Conte Refuge is widespread. The concerns and interests of our partners, local communities, and interested members of the public are diverse. Through our scoping and outreach, coupled with our understanding of the particular threats and challenges to conservation in the watershed, and the need to incorporate the best available scientific and technical information, we have identified seven key issue categories to focus on in this CCP and address through objectives and strategies. We provide additional details on the following issue categories in chapter 2:
  - Landscape-level land conservation and resource protection.
  - Habitat management.
  - Species management.
  - Public uses.
  - Socioeconomic factors.
  - Community relations and partnerships.
  - Administration (e.g., budget, staffing, and facilities).

The *need* for a CCP on this refuge is great due to landscape and demographic changes in the watershed, shifts in refuge management priorities due to the expanded refuge land base, and new opportunities for refuge management, new partnerships, and the Service's adoption of new policies and major initiatives since refuge establishment. In addition, the economy and patterns of land use and

land ownership in local communities are changing. The pressures for public use and access on existing and new refuge lands across the watershed have continued to increase. Climate change and natural processes have also altered, and will continue to alter, the refuge and watershed environment. For example, record-setting temperatures, ice and snowstorms, tornados, and flood events have occurred and significantly affected habitats in recent years. The CCP is needed to help ensure that the refuge continues to conserve the Connecticut River watershed's fish, wildlife, and ecosystems in the face of climate change and these other pressures. Also, when Conte Refuge was established in 1995, a fundamental concept was that refuge ownership would be limited to smaller SFAs scattered throughout the watershed, with a particular emphasis on federally listed and state-listed species. Since that time, conservation priorities and opportunities have resulted in a different configuration of Service acquisition. Support has increased for investments of land in the conservation estate for plants, fish, wildlife, and people.

Another need for a CCP is because, with the exception of invasive species control, limited active habitat management was detailed in the 1995 plan. Refuge staff are currently working on habitat restoration and management activities that will benefit from strategic direction. In addition, the 1995 Final Action Plan (USFWS 1995a) identified some partnership programs and infrastructure with the Service taking the lead that are no longer feasible while other partnerships and program emphases have emerged. Over the last 10 years, we have continually evaluated administrative and visitor facilities, including their locations, accessibility, and functionality, to ensure the best customer service possible, resulting in some differences from what was proposed in 1995.

One major Service initiative that is influencing refuge management is the agency's concerted shift to operating under a Strategic Habitat Conservation (SHC) planning framework (USFWS 2008a). This framework guides the Service in identifying, planning, implementing, and monitoring conservation priorities and activities. Relating to refuges, this planning framework and subsequent guidance, recommends steps to identify priority species, develop outcome goals for these species, design actions that allow refuge management to meet these goals by strategically addressing issues and threats to priority species, and—most importantly—implement the actions, measure their results, and adapt the actions as necessary to produce better outcomes. All of these steps have a solid basis in using sound scientific principles. Monitoring, evaluation, and adaptive management is required as part of this framework to ensure our actions protect and restore the ecological integrity of refuge and watershed resources, and do not result in additional degradation of environmental conditions.

In summary, this CCP details strategic management direction for the refuge for 15 years, by:

- (1) Stating clearly the desired future conditions for refuge habitat, wildlife, visitor services, staffing, and facilities through presentation of goals, objectives, and strategies.
- (2) Explaining concisely to state agencies, refuge neighbors, visitors, partners, and other stakeholders the reasons for management actions.
- (3) Ensuring that refuge management conforms to the policies and goals of the Refuge System and legal mandates.
- (4) Ensuring that present and future public uses on refuge lands are appropriate and compatible.

- (5) Providing long-term continuity and consistency in management direction.
- (6) Justifying budget requests for staffing, operations, and maintenance funds.

The CCP will serve as an important means of conveying the vision and priorities for Conte Refuge to our partners, watershed communities, and interested and affected individuals to encourage successful integration of Service priorities with partner priorities. Our hope is that creative and diverse coalitions will stimulate and maintain the vital momentum necessary to meet the conservation challenges and explore opportunities in the watershed.

## **Regional Context and Project Analysis Area**

As stated in the “Introduction,” it is essential to understand the geographical, ecological, and socioeconomic setting of the watershed, and the refuge’s context within it, to fully relate the actions described in this plan. The regional context for our analysis is the entire Connecticut River watershed (map 1.1). The watershed encompasses the heart of New England, covering 11,000 square miles—or 7.2 million acres. This river serves as the border between Vermont and New Hampshire and bisects Massachusetts and Connecticut. The river originates in Canada just north of Fourth Connecticut Lake in Pittsburg, New Hampshire, eventually emptying into Long Island Sound in Old Saybrook, Connecticut, after traveling 410 miles (CRWC 2012).

There is considerable diversity in both ecological and socioeconomic terms within the watershed, which influences opportunities and capabilities both on and off refuge lands. Along its length, the river flows through well-recognized landscapes—the Northern Forest of Vermont and New Hampshire; the Upper Valley of those same two states; the Pioneer Valley of Massachusetts, including Springfield, Massachusetts; the Tobacco Valley of Connecticut; and the urban corridor that stretches from Hartford, Connecticut, to Long Island Sound. It also includes the eastern slopes of the Green Mountains in Vermont and the Berkshires in Massachusetts, and the western slopes of the White Mountains in New Hampshire. Over 2.3 million people live in the watershed, with the majority of the population in its southern reaches. Its largest cities include Hartford, Connecticut (population 124,775), and Springfield, Massachusetts (population 153,060) (U.S. Census 2013).

The watershed boundary serves as the context for evaluating the physical, ecological, and socioeconomic relationship of the refuge and its management activities to regional resources of concern, and the communities within the watershed (CRWC 2012). The land ownership, land use, or management patterns in this political, social, and ecological environment affect our management of refuge lands. Of particular note, map 1.2 depicts the regional land conservation network in and around the watershed. Many prominent land-based partners cooperate in that network (appendix N). Greater detail on the project area and environment is provided in chapter 3.

## **Refuge Establishment History**

As discussed in the “Introduction,” the refuge was legislated by Congress through the 1991 Conte Refuge Act and was created by the Service in 1995 with completion of a ROD, FEIS, and a Final Action Plan (USFWS 1995a). A refuge becomes established into the Refuge System once its first parcel of land is acquired. Conte Refuge was established on October 3, 1997, when the Connecticut River Watershed Council (CRWC) donated Third Island in Deerfield, Massachusetts, to the Service. We highlight the refuge’s land acquisition history in chapter 3.

In 1996, even though there was no land base yet for the refuge, the Service began a competitive challenge cost-share program (USFWS 1995a). This was a unique program that provided matching grants to selected applicants who wished to accomplish education, research, inventory, or management projects



that would further refuge purposes. For example, funding for projects to conduct invasive species control in critical habitat or wetlands areas was a major interest. Unfortunately, the refuge challenge cost-share program was discontinued after 2001 due to the growing needs to use operational funds to support the refuge land base.

Also early in the refuge's development was the focus on establishing cooperatively run education centers—four as prescribed by the Conte Act, which we have interpreted as one in each state. In 2002, two cooperative education centers opened their doors: the Great North Woods Interpretive Center in Colebrook, New Hampshire, and the Conte Refuge Education Center at the Montshire Museum of Science in Norwich, Vermont. In 2003, a third major cooperatively run visitor facility opened as the Great Falls Discovery Center in Turners Falls, Massachusetts. Our Friends groups were instrumental in developing and supporting these facilities.

## Refuge Purposes

The 1991 Conte Refuge Act created the specific refuge purposes listed below. Refuge purposes guide management priorities and actions on refuges. The legislated purposes for the Conte Refuge are as follows:

- To conserve, protect, and enhance the Connecticut River populations of Atlantic salmon, American shad, river herring, shortnose sturgeon, bald eagles, peregrine falcons, osprey, black ducks, and other native species of plants fish and wildlife.
- To conserve, protect, and enhance the natural diversity and abundance of plant, fish, and wildlife species, and the ecosystem upon which these species depend within the refuge.
- To protect species listed as endangered or threatened, or identified as candidates for listing, pursuant to the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 et seq.).
- To restore and maintain the chemical, physical, and biological integrity of wetland and other waters within the refuge.
- To fulfill the international treaty obligations of the United States relating to fish, wildlife, and wetlands.
- To provide opportunities for scientific research, environmental education, and fish and wildlife-oriented recreation and access to the extent compatible with the other purposes stated in this section.

## Refuge Vision

This vision statement was developed by the planning team and is intended to capture the essence of what is important as we look to the future about refuge resources and activities, and to excite and motivate people to action. The vision should also reflect the refuge's purposes and goals. We developed the following vision statement with those considerations in mind.

*The Connecticut River is treasured by all for its majesty and significance in supporting diverse aquatic and terrestrial plant and animal life along its winding 410-mile passage through urban and rural communities in New Hampshire, Vermont, Massachusetts, and Connecticut. Working with our partners, we are inspired to protect and enhance the natural and cultural richness throughout the watershed, especially on lands and waters entrusted to our agency as the Silvio O. Conte National Fish and Wildlife Refuge.*

*Together with our partners, we design, support, and implement strategic conservation actions across the watershed, and communicate conservation needs and successes through extensive outreach and education programs. On refuge lands, and in our conservation partnership areas, we offer visitor programs and activities that promote an appreciation of the Connecticut River watershed as an intact, interconnected, and healthy ecosystem. Visitors respond to this greater awareness by becoming active stewards of the watershed's natural and cultural resources. Through our Urban Partnership Program, we are promoting the relevancy of conservation to healthy communities. Our actions exemplify the Service's vital role in conserving the Connecticut River watershed and the refuge's important contribution to the mission of the National Wildlife Refuge System.*

## Refuge Goals

Goals are designed to direct management priorities toward achieving the refuge's vision and legislative purposes, and contribute to the Refuge System's mission. Goals are succinct, descriptive, broad statements of the desired future condition of a refuge, and comprise the whole of the refuge's effort in pursuit of its vision. Goals lay the foundation from which all refuge activities arise as they provide the platform upon which the more measurable and time sensitive objectives and strategies are developed (USFWS 2004a).

Our planning team developed these four goals after reviewing the refuge purposes, the mission of the Service and Refuge System, our vision, and the mandates, plans, and conservation strategies mentioned above. We also updated these goals based on input from the public and our partners.

### **Goal 1. Habitat Conservation**

*Promote the biological diversity, integrity, and resiliency of terrestrial and aquatic ecosystems within the Connecticut River watershed in an amount and distribution that sustains ecological function and supports healthy populations of native fish, wildlife, and plants, especially Federal trust species of conservation concern, in anticipation of the effects of climate, land use, and demographic changes.*

*Forest, Nulhegan  
Basin Division*



Sharon Lindsey

This goal supports the purposes of the Conte Refuge Act related to the protection of important wildlife and associated habitats that are of special concern. The act's purposes highlighted the protection and conservation of migratory fish, migratory birds, threatened and endangered species, and native fish and wildlife across the watershed. That charge to protect this diversity is immense with the many species which occur here, including approximately 59 mammals, 250 birds, 22 reptiles, 23 amphibians, 142 fish, 1,500 invertebrates; and, approximately 3,000 plants (USFWS 1995a). The Conte Refuge Act purposes also noted the urgency to protect and enhance the natural diversity and abundance of the ecosystems upon which these species depend in the watershed, and to restore and maintain the chemical, physical, and biological integrity of wetlands and other waters within the refuge. A foundation of this goal involves the use of scientific research, and inventory and monitoring programs to support management decisions.

Diverse habitats in the watershed include:

- Internationally important tidal wetlands and riverine habitats valuable to migratory and resident fish, freshwater mussels, and other aquatic species.
- Floodplain forests and other riparian habitats valuable to migrating songbirds, waterfowl, and many other species of plants and animals.
- Old field grasslands, sandplains, and agricultural fields valuable to grassland-nesting birds and other species.
- A wide variety of forest types, including large areas of relatively unfragmented northern forest types, valuable to nesting migrant interior forest birds, as well as many other plant and animal species.

Forests are the dominant land cover type and are increasing as abandoned agricultural lands revert to forest cover. Generally, the forests in the northern section of the watershed are northern hardwood (maple–beech–birch) at lower elevations and coniferous (spruce–fir) at higher elevations (and more northerly latitudes). Stretching southward into Massachusetts, the northern hardwoods are intermixed with red and white pine. An oak–hickory forest predominates in the lower reaches of the watershed. Other upland plant communities include grasslands maintained for pastures, hayfields, airports, and retired landfills; shrubby fields which occur as abandoned fields experiencing plant succession; orchards; and cultivated fields.

Restoring and maintaining the integrity of wetlands and other waters is specifically mentioned in the refuge's purposes. The watershed contains approximately 257,000 acres of wetlands, representing 3.6 percent of its area.

## **Goal 2. Education, Outreach, and Interpretation**

*Inspire residents and visitors to actively participate in the conservation and stewardship of the exceptional natural and cultural resources in the Connecticut River watershed, and promote a greater understanding and appreciation of the role of the Silvio O. Conte National Fish and Wildlife Refuge in conserving those resources.*

This goal supports the purposes of the Conte Refuge Act to provide opportunities for environmental education. Using a network of education centers, exhibits, and programming, refuge personnel and partners introduce visitors to watershed fish, wildlife, and habitats, and emphasize the value of species and habitat diversity, and habitat connectivity. Through partnerships and targeted outreach, educators try to motivate specific groups of citizens to tackle tough problems like controlling invasive plants, improving water quality, and minimizing

habitat fragmentation in the face of a changing climate and land use patterns. Interpreters work with teachers and students to enrich their visits and their own curricula using an array of entertaining, interactive, and informational material, media, and formats. The refuge also has a mobile visitor center, the Watershed on Wheels Express (WoW Express). The WoW Express allows refuge staff and volunteers to bring interpretive and environmental educational experiences directly to the 396 communities within the watershed.

### **Goal 3. Recreation**

*Promote high quality, public recreational opportunities in the Connecticut River watershed that are complementary between ownerships and provide regional linkages, with emphasis on promoting wildlife-dependent activities that connect people with nature in the outdoors.*

This goal supports the purposes of the Conte Refuge Act to provide opportunities for fish and wildlife oriented recreation and access to the extent compatible with the other purposes stated in this section. Many of the refuge's existing divisions and units provide opportunities for hunting and fishing according to state regulations. In addition, visitors may view and photograph wildlife while driving on gravel roads (Nulhegan Basin Division), hiking on nature trails (Nulhegan Basin, Pondicherry, and Fort River Divisions) or using wheelchair accessible trails (Nulhegan Basin, Pondicherry, and Fort River Divisions) that include overlooks, interpretive displays, and informational kiosks. Also, all refuge divisions and all but three of the refuge units are open to one or more of the priority public uses (Wissatinnewag, Saddle Island, and Dead Man's Swamp units are closed to the public to protect sensitive resources, and the Mount Tom Unit is closed due to public safety and vandalism concerns).

### **Goal 4. Partnerships to Conserve and Enjoy the Connecticut River Watershed**

*Enhance the conservation, protection, and stewardship of natural and cultural resources, and promote wildlife-dependent recreation, throughout the Connecticut River watershed by initiating, supporting, and promoting partnerships with other Federal, State, and local agencies, Tribal governments, and private organizations.*

While this goal is listed fourth, it is by no means lowest in priority. We present this goal last to illustrate how significant partnerships are to implementing the priority actions we describe in goals 1 through 3 in chapter 4 and appendix A. In fact, it is very important to us that we convey that our partnerships underpin all that we do. We recognize daily the critical importance of working with diverse and extensive partnerships to achieve the purposes of the refuge, as well as support the compatible and complementary missions, goals, and objectives of our partners.

Refuge personnel maximize beneficial effects across the landscape by working with public and private landowners and other partners on a variety of research, inventory, habitat improvement, and education projects. Partnerships often are established and nurtured by refuge management with state environmental and wildlife agencies in Vermont, New Hampshire, Massachusetts, and Connecticut, other Federal agencies such as NRCS, and with a host of non-governmental conservation organizations, many of whom comprise the Friends of Conte. Since its inception, the refuge has contributed funds to at least 170 grants within the watershed for habitat restoration, research, surveys, environmental education, and outreach with hundreds of partners large and small. Examples of these partners include the University of Massachusetts, Vermont Institute of Natural



Bill Thompson

*Red-breasted mergansers*

Science, Roaring Brook Nature Center, University of Connecticut, Woodstock Conservation Commission, and Cromwell Fish and Game Club.

We strive to do the best we can with the staff and funds allotted, but always need help to do more. Volunteers provide vital assistance in refuge offices, education centers, and afield on refuge land and in the greater watershed. There are several Friends groups that work tirelessly to assist: the Friends of Conte, the Friends of Nulhegan Basin Division, the Friends of the Great Falls Discovery Center, and the Friends of Pondicherry Division. Additional Friends groups are forming at the Fort River, Salmon River, and Blueberry Swamp Divisions. Members of these groups generously donate their time and enthusiasm working on a wide variety of projects that contribute to their division in the form of conservation, education, and recreation initiatives and accomplishments. The partnership between the Friends groups and refuge staff is a relationship that thrives on a balance between the preferences and abilities of the Friends members and the needs of the refuge resources. In addition, the refuge staff have been actively working within subwatershed-based invasive species partnerships in the watershed. Such partnerships, generally termed Cooperative Invasive Species Management Areas (CISMAs) currently exist in the upper watershed, Ottauquechee, Upper White, Westfield, Upper Farmington, and Eightmile watersheds and are making considerable progress in creating surveys, control plans, and raising awareness about invasive species among landowners and target audiences.



## Chapter 2



David Govatski

*Moose at Moose Bog near Nulhegan Basin Division*

## The Planning Process

- Introduction
- Service Policies, Legal Mandates, Service and Refuge System Conservation Priorities and Initiatives, and Resource Plans Guiding the Planning Process
- Conservation Plans and Initiatives Guiding Development of the CCP
- The Comprehensive Conservation Planning Process
- Issues, Concerns, and Opportunities



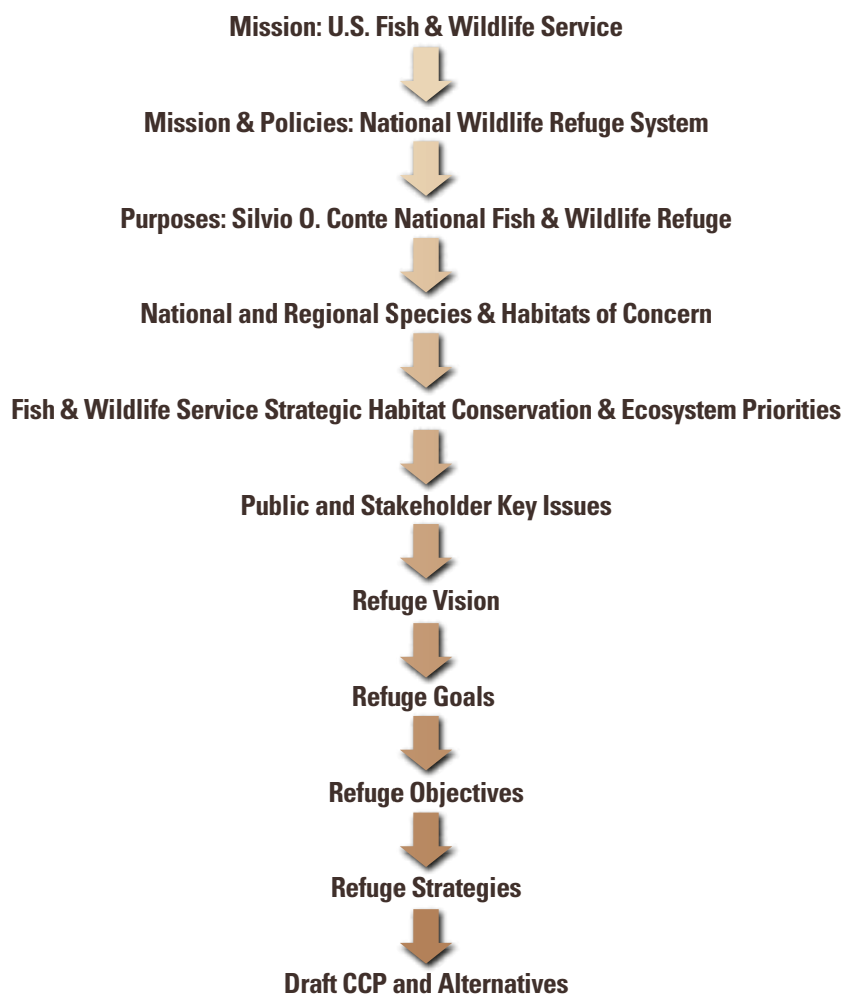


## Introduction

This chapter highlights Service policies, legal mandates, Service and Refuge System conservation priorities and initiatives, and existing Federal, regional, state, and local resource plans that influenced development of this CCP. We follow that discussion with a description of the Refuge System's conservation planning process steps, indicating what we accomplished at each step as we developed this final plan. The final sections in this chapter briefly mention the issues, concerns, and opportunities that were raised during step D of the planning process, and how we addressed them in the final CCP/EIS.

## Service Policies, Legal Mandates, Service and Refuge System Conservation Priorities and Initiatives, and Resource Plans Guiding the Planning Process

As part of the Refuge System, Conte Refuge is subject to all applicable Federal laws, regulations, and policies pertaining to refuge management and administration. This section presents the Service and Refuge System mission, policy, legal mandates, and conservation priorities that directly influenced the development of this CCP.



**Figure 2.1. Information Used in Development of a CCP**

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

The Service, an agency in the Department of the Interior (DOI), administers the Refuge System, along with many other conservation programs. The Service's mission is: "Working with others, to conserve, protect, and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people."

Ryan Hagerly/USFWS



Canadian bunchberry

Through legislation, Congress entrusts certain natural resources, referred to as “Federal trust resources,” to the Service for conservation and protection. These include migratory birds, federally listed endangered or threatened species, migratory inter-jurisdictional fish, wetlands, certain marine mammals, and national wildlife refuges. The Service also enforces Federal wildlife laws and international treaties on importing and exporting wildlife, assists states with their fish and wildlife programs through grants, regulates recreational harvest of migratory game birds, advises other Federal agencies on reducing their operational impacts to fish and wildlife, hosts major conservation partnerships, offers partnership grants for national and international habitat conservation, and helps countries around the world develop conservation programs.

Although Service and Refuge System policies and the refuge’s purposes provide foundation for its management, other Federal laws, executive orders (Presidential, Secretarial, or Service Director), treaties, interstate compacts, and regulations on the conservation and protection of natural and cultural resources also affect how national wildlife refuges are managed. The Digest of Federal Resource Laws of Interest to the Service provides a comprehensive list and description of all Federal laws under which the Service functions, including administrative laws, treaties, executive orders, interstate compacts, and memoranda of agreement. The digest is available online at: <http://fws.gov/laws/Lawsdigest.html> (USFWS 2010a; accessed August 2016).

The Service Manual describes the Services authorities and responsibilities, as well as provides guidance on its activities (USFWS 2013a; <http://www.fws.gov/policy/manuals/>; accessed August 2016). Part of the Service’s responsibilities includes regulating certain activities of public and private interests, such as development of lands used by endangered and threatened species or hunting on national wildlife refuges. These regulated activities are published in the U.S. Code of Federal Regulations (CFR). Most of the current regulations that pertain to the Service are issued in 50 CFR parts 1 to 99 that can be viewed at: <https://www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR> (GPO 2013; accessed August 2016).

Policies are developed to implement and administer laws and directives. The Refuge System manual provides a central reference for current policy governing the operation and management of the Refuge System not covered by the Service manual, including technical information on implementing Refuge System policies and guidelines. This manual can be reviewed at: <http://www.fws.gov/policy/manuals/> (accessed August 2016). Policies can also be viewed at: <http://www.fws.gov/refuges/policiesandbudget/refugepolicies.html> (USFWS 2012a; accessed August 2016). Following are brief descriptions of the policies that most directly pertain to the development of CCPs.

### **The National Wildlife Refuge System, 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 ecosystem protection. The Refuge System began in 1903, when President Theodore Roosevelt designated Pelican Island, a pelican and heron rookery in Florida, as a bird sanctuary. Today, more than 560 national wildlife refuges are part of the Refuge System. They encompass more than 150 million acres of lands and waters in all 50 States and several island territories. Over 40 million visitors hunt, fish, observe and photograph wildlife, or participate in environmental education and interpretive activities on national wildlife refuges across the nation each year (Carver and Caudill 2007).

In 1997, the Refuge Improvement Act passed as an amendment to the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd, et seq.).

The amended law established a unifying mission for the Refuge System, a new process for determining compatible public use activities on refuges, and the requirement to prepare CCPs for each refuge. The Refuge Improvement Act states, first, that the Refuge System must focus on wildlife conservation. It further states that the Refuge System's national mission, coupled with the purpose(s) for which each refuge was established, will provide the principal management direction for each refuge. As provided by Section 4 of the Refuge Improvement Act, the mission of the Refuge System is: "To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans."

In July 2011, the Refuge System convened the "Conserving the Future: Wildlife Refuges and the Next Generation" conference to renew and update its 1999 vision document, originally called Fulfilling the Promise. After the conference and an extensive public engagement process, a renewed vision document was finalized in October 2011 (USFWS 2011a). The document has 24 recommendations, covering a variety of topics from habitat and species management, visitor services, refuge planning, land conservation, communications, building partnerships, and urban refuges. Currently, implementation teams are developing strategies to help us accomplish the vision. We will incorporate implementation strategies, as appropriate, in our refuge step-down plans. You may view the document and see the latest updates at: <http://americaswildlife.org> (National Wildlife Refuge Association 2013; accessed August 2016).

The following list of Refuge System policies represents those that most directly affected the development of this CCP. They are presented in the order in which they appear in the Service manual, in Series 600 (Land Use and Management), Parts 601 to 609 covering refuge management.

Policy on National Wildlife Refuge System Mission, Goals, and Refuge Purposes:

This policy (601 FW 1, USFWS 2006a) presents the mission and goals of the Refuge System and their relationship to refuge purposes. This policy recognizes the priority of the Refuge System for management activities and uses set forth in the Refuge Improvement Act (i.e., conserve fish, wildlife, and plants and their habitats; facilitate compatible wildlife dependent recreational uses; and other uses). This policy describes the Refuge System mission, revises the Refuge System goals, and provides guidance for identifying or determining the purpose(s) of individual refuges and their incremental land additions within the Refuge System.

Policy on Maintaining Biological Integrity, Diversity, and Environmental Health:

This policy (601 FW 3, USFWS 2001) provides guidance on maintaining or restoring the biological integrity, diversity, and environmental health of the Refuge System, including protecting the broad spectrum of fish, wildlife, and habitat resources found in refuge ecosystems. The policy includes the following definitions:

- Biological diversity is the "variety of life and its processes, including the variety of living organisms, the genetic differences among them, and communities and ecosystems in which they occur."
- Biological integrity is the "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."

- Environmental health is 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.”

The policy also provides refuge managers with a process for evaluating the best management direction to prevent additional degradation of environmental conditions and restore lost or severely degraded environmental components. Guidelines are provided for dealing with external threats to the biological integrity, diversity, and environmental health of a refuge and its ecosystem.

Policy on Coordination and Cooperative Work with State Fish and Wildlife Agencies: This policy (601 FW 7; 2008a) establishes procedures for coordinating and working cooperatively with state fish and wildlife agency representatives on management of units of the Refuge System. The purpose of this policy is to ensure timely and effective cooperation with state fish and wildlife agencies during the course of acquiring and managing refuges. A focus of this policy is the importance of state agency involvement in CCPs. Specifically, the policy calls for inviting state fish and wildlife agency participation on CCP core teams, and otherwise provide them timely and meaningful participation opportunities throughout the planning process, and that we include a summary of state comments in the CCP. With regard to hunting and fishing programs developed for a refuge, we are to ensure regulations for those programs, are, to the extent practicable, consistent with state fish and wildlife laws, regulations, and management plans.

Policy on Refuge System Planning: The requirements for refuge planning are covered in two chapters (602 FW 1, USFWS 2000a; 602 FW 3, USFWS 2000b). Part 602 FW 1 provides an overview of Refuge System planning, identifies who is responsible, defines terms, and establishes when certain refuge plans are required. This chapter stipulates that all refuges will be managed in accordance with an approved CCP, which, when implemented, will achieve refuge purposes; help fulfill the Refuge System mission; maintain and, where appropriate, restore the ecological integrity of each refuge and the Refuge System; help achieve the goals of the National Wilderness Preservation System (National Wildlife Preservation System); and meet other mandates. Further, this policy states that the CCP will guide management decisions and set forth goals, objectives, and strategies to accomplish these ends. It also establishes that refuge step-down management plans may also be required to provide additional details about meeting CCP goals and objectives and to describe strategies and implementation schedules. This policy requires that each plan will be founded on principles of sound fish and wildlife management and available science, and be consistent with legal mandates and our other policies, guidelines, and planning documents. Finally, this policy requires that we comply with NEPA and its regulations in developing plans, and provide opportunities for others to participate in refuge planning, including other Service programs; Federal, state, and local agencies; Tribal governments; conservation organizations; adjacent landowners; and the public.

The purpose of chapter 602 FW 3 is to describe a systematic decision-making process that fulfills the requirements for developing a CCP. This chapter provides guidance, step-by-step direction, and establishes minimum requirements for all CCPs. This chapter establishes the following goals for comprehensive conservation planning:

- A. To ensure that wildlife comes first in the Refuge System and that we manage each refuge to help fulfill the mission of the Refuge System, maintain and, where appropriate, restore the ecological integrity of each refuge and the Refuge System, as well as achieve the specific purposes for which the refuge was established.
- B. To provide a clear and comprehensive statement of desired future conditions for each refuge or planning unit.
- C. To encourage use of an ecosystem approach when we conduct refuge planning. This includes conducting concurrent refuge planning for refuges within the same watershed or ecosystem and considering the broader goals and objectives of the refuges' ecosystems and watersheds when developing management direction (see Ecosystem Approach to Fish and Wildlife Conservation [Part 052 of the Fish and Wildlife Service Manual]).
- D. To support management decisions and their rationale by using a thorough assessment of available science derived from scientific literature, on-site refuge data, expert opinion, and sound professional judgment.
- E. To ensure that the six priority wildlife-dependent recreational uses receive priority consideration during the preparation of CCPs.
- F. To provide a forum for the public to comment on the type, extent, and compatibility of uses on refuges, including priority wildlife-dependent recreational uses.
- G. To provide a uniform basis for budget requests for operational, maintenance, and capital improvement programs.
- H. To ensure public involvement in refuge management decisions by providing a process for effective coordination, interaction, and cooperation with affected parties, including Federal agencies, state conservation agencies, Tribal governments, local governments, conservation organizations, adjacent landowners, and interested members of the public.

According to refuge policy, a final approved CCP is intended to provide the refuge manager with a 15-year management plan for the conservation of fish, wildlife, and plant resources and their related habitats, while providing opportunities for compatible wildlife-dependent recreational uses. To the extent practical, these plans should be consistent with respective state's fish and wildlife conservation plans. Below we highlight where in this CCP we include certain specific details required by Section 7 of the Refuge Improvement Act and planning policy:

- The purposes of the refuge (see chapter 1).
- The distribution, migration patterns, and abundance of fish, wildlife, and plant populations and related habitats within the planning unit (see chapter 3).
- The archaeological and cultural values of the planning unit (see chapter 3).
- Areas within the planning unit that are suitable for use as administrative sites or visitor facilities (see chapters 3 and 4).
- Significant problems that may adversely affect the populations and habitats of fish, wildlife, and plants within the planning unit and the actions necessary to correct or mitigate such problems (see chapters 2, 3, and 4).

- Opportunities for compatible wildlife-dependent recreational uses (see chapters 2, 3, and 4).

Policy on Appropriate 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 all visitors can enjoy its lands and waters. This Service policy (603 FW 1) provides a national framework for determining appropriate refuge uses to prevent or eliminate those that should not occur in the Refuge System. It describes the initial decision process the refuge manager follows when first considering whether to allow a proposed use on a refuge. An appropriate use must meet at least one of the following four conditions:

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

Appendix D includes the findings of appropriateness for Conte Refuge prepared concurrent with this CCP. You may view the appropriateness policy on the Web at: <http://www.fws.gov/policy/603fw1.html> (accessed August 2016).

Policy on Compatibility: This policy (603 FW 2) complements the appropriateness policy and provides guidance on how to prepare a compatibility determination.

The refuge manager first must find a use appropriate before determining if the use is compatible. If the proposed use is found not to be appropriate, a compatibility determination is unnecessary and the use is not allowed. According to this policy, 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."

Other guidance in that chapter follows:

- The Refuge Improvement Act and its regulations require that the refuge manager must find a public use compatible before it is allowed on a refuge.

*Monarch butterfly*



Ron Holmes/USFWS

- The act defines six wildlife-dependent uses that are to receive enhanced consideration on refuges: hunting, fishing, wildlife observation, photography, environmental education, and interpretation. The refuge manager may authorize these six priority uses on a refuge when they are compatible and consistent with public safety.
- When the refuge manager publishes a compatibility determination, it will specify 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 a 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 (603 FW 2.11, 2.12).
- The refuge manager may allow or deny any use, even one that is compatible, based on other considerations such as public safety, policy, or available funding.

Appendix D includes the compatibility determinations for Conte Refuge prepared concurrent with this CCP. You may also view the compatibility policy on the Web at: <http://www.fws.gov/policy/603fw2.html> (accessed August 2016).

Policy on Wildlife-Dependent Recreation Uses: This policy (605 FW 1-7) presents specific guidance about wildlife-dependent recreation programs within the Refuge System. We develop our wildlife-dependent recreation programs in consultation with state fish and wildlife agencies and with stakeholder input based on the following criteria:

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

Policy on Managing Cultural Resources: This policy (614 FW 1-6) provides the authorities, definitions, and responsibilities for managing cultural resources on the lands, facilities, and programs we administer. Our policy is to identify,

protect, and manage cultural resources located on our lands and affected by Service and Service-authorized activities, in consultation with tribes where appropriate, and in compliance with cultural resources legislation. A full list of relevant legal authorities for cultural resources management can be found in the handbook as listed above. The scope of the Service's cultural resources program is broad, including both prehistoric and historic archaeological resources, historic and architectural properties, and areas or sites of traditional or religious significance to Native Americans.

Program objectives are to:

- Recognize the intrinsic value of the Service's cultural resources by properly protecting and maintaining them in compliance with historic preservation legislation and Departmental policy;
- Plan for the potential public and scientific use of Service-managed cultural resources for the benefit of present and future generations;
- Maintain and preserve unique cultural resources and make them applicable to our ongoing natural resource and wildlife conservation mission;
- Identify, evaluate the importance of, and seek the appropriate protective designation of cultural resources in compliance with existing legal requirements, regulations, and professional standards;
- Ensure that when we are conducting activities to meet the Service's mission and program goals, we do not inadvertently transfer, sell, demolish, or alter our cultural resources until we can adequately identify them, evaluate impacts, and make informed decisions and necessary plans;
- Ensure that when acquiring property, potential historic resources are identified prior to acquisition and anticipatory demolition does not occur;
- Prevent or avoid damage and deterioration to cultural resources that result from erosion, abandonment, lack of maintenance, and neglect;
- Encourage and enhance educational, interpretive, and research opportunities for Service cultural resources consistent with overall Service management objectives;
- Ensure employees recognize the importance of cultural resources to habitat and land management issues and safeguard them so that the Service can maximize opportunities to enhance the public's knowledge and understanding of the environmental and cultural contexts of conservation; and
- Protect and manage cultural resources that are important for maintaining the traditional culture of Native American tribes, Native Hawaiians, Alaska natives, and other traditional communities.

Policy on Climate Change Adaptation: This policy (056 FW 1) establishes overall Service policy and staff responsibilities on climate change adaptation. The policy recognizes the role adaptation plays in reducing the negative impacts of climate change on the Service's trust resources. The policy directs the Service to take steps to understand, evaluate, and address the impacts of climate change, and then use this information to effectively and efficiently implement climate change adaptation measures into the Service's operations.



Director’s Land Protection Planning Interim Guidance: This guidance was issued on May 18, 2016. It is intended to ensure that the strategic growth of the Refuge System is based on explicit priorities, rigorous biological planning, and conservation design that support achieving measurable population objectives that are developed in cooperation with State fish and wildlife agencies and our conservation partners. This guidance applies to new refuges and to additions to existing refuges where land acquisition is the proposed method of land protection.

Chief’s Guidance on Landscape Conservation Design: This guidance was issued on October 3, 2016. Its purpose is to help build a consistent understanding across the Refuge System of what constitutes a landscape conservation design (LCD) and to provide guidance on our responsibilities in the collaborative processes and product development associated with LCD. The guidance is also designed to help regional leadership prioritize the participation in, and advocacy for, LCDs that are relevant to priorities of the Refuge System, regardless of planning funding levels.

## Other Mandates

Although Service and Refuge System policy and the purposes of each refuge provide the foundation for a refuge’s management, refuges are also administered consistent with other Federal laws, executive orders, treaties, interstate compacts, and regulations on conserving and protecting natural and cultural resources. A centralized library of Servicewide policies, executive orders, Secretarial orders, Service 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> (accessed August 2016).

## Federal Laws

Below we highlight some of the more than 100 Federal laws that could affect refuge planning. The laws below directly influenced development of this CCP.

National Environmental Policy Act: NEPA (42 U.S.C. 4321 et seq.; 83 Stat. 852) requires Federal agencies to take a systematic, interdisciplinary approach to analyze the effects of agency decision-making on the human environment (Bass et al. 2001). The final CCP/EIS represents our compliance with NEPA and the Council on Environmental Quality (CEQ) regulations for implementing NEPA (40 CFR 1500–1508). The primary purpose of an EIS is to define a proposed action, describe reasonable alternatives to that action, disclose potential environmental impacts and any actions that would avoid or minimize adverse impacts, and provide opportunities for public review and comment before a final decision is made.

Historic Resources: Federal laws 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 identify the refuge’s archaeological and cultural values. The following four Federal laws also cover historic and archaeological resources on national wildlife refuges:

- The Archaeological Resources Protection Act (ARPA) (16 U.S.C. § 470aa–470ll; Public Law 96–95), approved October 31, 1979 (93 Stat.721). ARPA establishes detailed requirements for issuance of permits for any excavation for, or removal of, archaeological resources from Federal or Native American lands. It also establishes civil and criminal penalties for the unauthorized excavation, removal, or damage of those resources; for any trafficking in those resources removed from Federal or Native American land in violation of any provision of Federal law; and for interstate and foreign commerce in such resources acquired, transported, or received in violation of any state or local law.

- The Archaeological and Historic Preservation Act (AHPA) (16 U.S.C. § 469–469c; Public Law 86–523), approved June 27, 1960 (74 Stat. 220), as amended by Public Law 93–291 approved May 24, 1974 (88 Stat. 174). AHPA carries out the policy established by the Historic Sites Act (see below). It directs Federal agencies to notify the Secretary of the Interior whenever they find that a Federal or federally assisted licensed or permitted project may cause the loss or destruction of significant scientific, prehistoric, or archaeological data. The act authorizes the use of appropriated, donated, or transferred funds for the recovery, protection, and preservation of that data.
- The Historic Sites, Buildings, and Antiquities Act (16 U.S.C. § 461–462, 464–467; 49 Stat. 666) of August 21, 1935, popularly known as the Historic Sites Act, as amended by Public Law 89–249, approved October 9, 1965 (79 Stat. 971). This Historic Sites Act declares it a national policy to preserve historic sites and objects of national significance, including those located on refuges. It provides procedures for designating, acquiring, administering, and protecting these sites and objects. Among other things, National Historic and Natural Landmarks are designated under the authority of this act.
- The National Historic Preservation Act of 1966 (NHPA) (16 U.S.C. § 470–470b, 470c–470n), Public Law 89–665, approved October 15, 1966 (80 Stat. 915), and repeatedly amended. The NHPA provides for the preservation of significant historical features (buildings, objects, and sites) through a grant-in-aid program to the states. It establishes the National Register of Historic Places (National Register) and a program of matching grants under the existing National Trust for Historic Preservation (16 U.S.C. § 468–468d). This act establishes an Advisory Council on Historic Preservation, which became a permanent, independent agency in Public Law 94–422, approved September 28, 1976 (90 Stat. 1319). The act created the Historic Preservation Fund. It directs Federal agencies to take into account the effects of their actions on items or sites listed or eligible for listing on the National Register.

The Service also owns and cares for museum properties. The most common are archaeological, zoological, and botanical collections, and historical photographs, objects, and art. Each refuge maintains an inventory of its museum property. Our regional museum property coordinator in Hadley, Massachusetts, guides the refuges in caring for that property, and helps us comply with the Native American Grave Protection and Repatriation Act and Federal regulations governing Federal archaeological collections. Our program ensures that those collections will remain available to the public for learning and research.

The Wilderness Act of 1964: (16 U.S.C. 1131–1136; Public Law 88–577) establishes a NWPS that is composed of federally owned areas designated by Congress as “wilderness areas.” The act directs each agency administering designated wilderness to preserve the wilderness character of areas within the NWPS, and to administer the NWPS for the use and enjoyment of the American people in a way that will leave those areas unimpaired for future use and enjoyment as wilderness. The act also directs the Secretary of the Interior, within 10 years, to review every roadless area of 5,000 acres or more and every roadless island (regardless of size) within National Wildlife Refuge and National Park systems for inclusion in the NWPS. Service planning policy (602 FW 3) requires that we evaluate the potential for wilderness on refuge lands, as appropriate, during the CCP planning process. At this time, we are not recommending that any existing refuge lands be designated as wilderness areas. Our wilderness review for this refuge is detailed in appendix E.

The Wild and Scenic Rivers Act of 1968: (16 USC 1271-1287; Public Law 90-542) as amended, selects certain rivers of the nation possessing remarkable scenic,

recreational, geologic, fish and wildlife, historic, cultural, or other similar values, preserves them in a free-flowing condition, and protects their local environments. Service planning policy (602 FW 3) requires that we evaluate the potential for wild and scenic rivers designation on refuge lands, as appropriate, during the CCP planning process. Our wild and scenic rivers review for this refuge is detailed in appendix F.

Other Laws: Final CCP/EIS chapter 5, “Environmental Consequences,” evaluated this plan’s compliance with the acts noted above, and with the Clean Water Act of 1977 as amended (33 U.S.C. 1251, et seq.; Public Law 107–303), the Clean Air Act of 1970 as amended (42 U.S.C. 7401 et seq.), and the ESA of 1973 (16 U.S.C. 1531–1544), as amended.

### **Presidential, Secretary, and Service Director Orders**

The Presidential Executive Order 13443–Facilitation of Hunting Heritage and Wildlife Conservation: This order, issued on August 16, 2007, directs Federal agencies that have programs and activities affecting public land management, outdoor recreation, and wildlife management, including the Department of the Interior and the Department of Agriculture, to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat. Federal agencies are directed to pursue certain activities listed in the executive order, consistent with their missions. Those activities include managing wildlife and habitats on public lands in a manner that expands and enhances hunting opportunities, and working with state and Tribal governments to manage wildlife and habitats to foster healthy and productive populations and provide appropriate opportunities for the public to hunt those species. The Service issued a memorandum on November 30, 2007, outlining short-term and long-term steps the agency will take to implement the order, including promoting new youth hunts, expanding education on America’s hunting heritage, and using Web-based technology and the evolving social media to improve communication on hunting opportunities.

The Presidential Executive Order 13653–Preparing the United States for the Impacts of Climate Change: This order, issued on November 1, 2013, directs federal agencies to build on existing agency Adaptation Plans first issued in 2013, by continuing to develop, implement, and update comprehensive plans that integrate consideration of climate change into agency operations and overall mission objectives. The plans must identify and assess climate change related impacts on and risks to the agency’s ability to accomplish its missions, operations, and programs; describe the agency’s plans and actions to manage climate risks in the near term and build resilience in the short and long term; describe how they will deal with any climate change related risk that is deemed so significant that it impairs an agency’s statutory mission or operation;” and discuss how they will consider the costs and benefits of actions needed to improve climate adaptation and resilience.

The Presidential Executive Order 13693–Planning for Federal Sustainability in the Next Decade: This purpose of this order, issued on March 19, 2015 is to maintain Federal leadership in sustainability and greenhouse gas emission reductions. It introduces new requirements and expands upon previous requirements for Federal agencies to reduce greenhouse gas emissions, improve energy conservation and use of renewable energy, use green building technology, improve agency water use and efficiency (including stormwater management), divert at least 50% of non-hazardous solid waste annually, and other requirements.

This order supercedes Executive Order 13514 (“Federal Leadership in Environmental, Energy, and Economic Performance”). It also expands on the energy reduction and environmental performance requirements for Federal

the development of adaptive management tools to address the impact of climate change on our natural and cultural resources. The Council will help coordinate activities within and among Federal agencies. Land management agencies are directed to pursue appropriate activities to reduce their carbon footprint, adapt water management strategies to address the possibility of a shrinking water supply, and protect and manage land in anticipation of sea level rise, shifting wildlife populations and habitats, increased wildland fire threats, and an increase in invasive and exotic species. This order can be accessed at: <http://www.doi.gov/whatwedo/climate/cop15/upload/SecOrder3289.pdf> (accessed August 2016).

#### *Landscape Conservation Cooperatives*

As part of this secretarial order, the Secretary also directed the Department of the Interior's bureaus to develop a network of Landscape Conservation Cooperatives (LCCs) to respond to stressors, such as climate change.

LCCs are public-private partnerships composed of states, tribes, Federal agencies, nongovernmental organizations, universities, and others (NALCC 2013). Although originally developed in the context of climate change concerns, LCCs are working to transcend political and jurisdictional boundaries to address a variety of complex, broad-scale conservation issues and opportunities in a holistic, collaborative, adaptive, and science-based approach. The science provided by these partnerships will inform future habitat management and land conservation planning, as well as help direct research and monitoring to support these efforts.

Currently, a network of 22 individual LCCs has been established. The Connecticut River watershed lies within the North Atlantic LCC, which is led by the Service's Northeast Region (map 2.1). The North Atlantic LCC extends from the Atlantic coast of Canada to central Virginia, including most of New England and the Mid-Atlantic Coast. The vision of this LCC is to conserve landscapes that sustain our natural resources and cultural heritage through active collaboration between conservation partners in the North Atlantic region.

We have used a variety of information from the North Atlantic LCC while developing this CCP. In particular, we used the North Atlantic LCC's lists of terrestrial and aquatic representative species to help us identify priority refuge resources of concern (USFWS 2013b, [http://www.fws.gov/northeast/science/representative\\_species.html](http://www.fws.gov/northeast/science/representative_species.html); accessed August 2016). According to the North Atlantic LCC, a representative species is a species "whose habitat needs, ecosystem function, or management responses are similar to a group of other species." Based on this, it is assumed that land conservation and habitat management for that representative species will also address the needs of other species. We include our lists of priority refuge resources in appendix A. To learn more about the process we used to identify priority refuge resources of concern, please see appendix B "Process for Establishing Refuge Focal Species and Priority Habitats."

In addition, during 2014-15 we participated in a project with the North Atlantic LCC, and about 30 other Federal, state, and non-governmental conservation partners to pilot the development of a landscape conservation design<sup>1</sup> for the Connecticut River watershed. The *Connect the Connecticut* landscape conservation design integrated the best available spatial and ecological scientific data to produce a complete design package. During the process, partners identified shared conservation goals and objectives, and deliberated on how to combine and balance trade-offs among the various species and ecosystem

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<sup>1</sup> Landscape conservation design is a partner-driven approach to achieve a sustainable, resilient socio-ecological landscape. It is an iterative, collaborative, and holistic process resulting in strategic and spatial products that provide information, analytical tools, maps, and strategies to achieve landscape goals collectively held among partners.

Map 2.1

Map 2.1. North Atlantic Landscape Conservation Cooperative (LCC) and the Connecticut River Watershed



agencies identified in Executive Order 13423 (“Strengthening Federal Environmental, Energy, and Transportation Management”).

Secretarial Order 3289–Addressing the Impacts of Climate Change on America’s Water, Land, and Other Natural and Cultural Resources: This Order was issued on March 11, 2009, and establishes a Department-wide, science-based approach to increase understanding of climate change and to coordinate an effective response to its impacts on tribes and on the land, water, ocean, fish and wildlife, and cultural heritage resources that the Department manages.

This order replaces Secretarial Order No. 3226, Amendment No. 1, issued on January 16, 2009, and reinstates the provisions of Secretarial Order No. 3226, issued on January 19, 2001.

The order calls for the incorporation of climate change into long-term planning documents such as CCPs: “Each bureau and office of the Department must consider and analyze potential climate change impacts when undertaking long-range planning exercises, setting priorities for scientific research and investigations, developing multi-year management plans, and when making major decisions regarding potential use of resources under the Department’s purview (these requirements were set forth in Secretarial Order No. 3226, and remain in effect). Departmental activities covered by this Order include, but are not limited to, programmatic and long-term environmental reviews undertaken by the Department, management plans and activities developed for public lands, planning and management activities associated with oil, gas, and mineral development of public lands, and planning and management activities of water projects and water resources.

The order establishes a “Climate Change Response Council” that will execute a coordinated Department-wide strategy to increase scientific understanding and

*Youth  
Conservation Corps  
tree restoration*



USFWS

components of the design. The final products include prioritized core and connector networks within the watershed that take into account the needs of both common and rare species of fish, wildlife, and the ecosystems that support them. The conservation design informed by this planning effort is intended to guide collective conservation actions within the watershed and connect to broader regional conservation goals for conserving sustainable fish and wildlife populations. The design process established through this pilot project is currently being applied in geographies within the Northeast region as well as the region as a whole (<http://northatlanticlcc.org/teams/rcoa>). It is also being used as a model for landscape conservation design. We will use results from *Connect the Connecticut*, where applicable, to inform the implementation of this CCP. More on this project can be found at: <http://connecttheconnecticut.org> (accessed August 2016).

For additional information on the North Atlantic LCC, its near-term priorities, and projects, visit: <http://northatlanticlcc.org> (accessed August 2016). We will continue to partner with the North Atlantic LCC and adapt management if additional supporting information becomes available.

*“Rising to the Urgent Challenge: Strategic Plan for Responding to Accelerating Climate Change”*

This was a plan developed in 2010 in response to this order and Secretarial Order 3226, “Evaluating Climate Change Impacts in Management Planning” described above. This strategic plan establishes a basic framework for the Service’s work as part of the conservation community to help ensure the sustainability of fish, wildlife, plants, and habitats in the face of accelerating climate change (USFWS 2010b). It also details specific steps the Service will take during the next 5 years to implement the strategic plan. The plan can be accessed online at: <http://www.fws.gov/home/climatechange/strategy.html> (accessed August 2016).

The strategic plan’s six guiding principles are:

- (1) We will continually evaluate our priorities and approaches, make difficult choices, take calculated risks, and adapt to climate change.
- (2) We will commit to a new spirit of coordination, collaboration, and interdependence with others.
- (3) We will reflect scientific excellence, professionalism, and integrity in all our work.
- (4) We will emphasize the conservation of habitats within sustainable landscapes, applying our SHC (see 1-10) framework.
- (5) We will assemble and use state-of-the-art technical capacity to meet the climate change challenge.
- (6) We will be a leader in national and international efforts to address climate change.

The plan also lists three key strategies to address climate change: adaptation, mitigation, and engagement.

The Intergovernmental Panel on Climate Change (IPCC) defines adaptation as “Initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects” (IPCC 2007). For example, this could include raising river or coastal dikes. In the strategic plan, adaptation refers to planned management actions the Service will take to reduce

the impacts of climate change on fish, wildlife, and their habitats. Adaptation forms the core of the Service's response to climate change and is the centerpiece of our strategic plan. This adaptive response to climate change will involve strategic conservation of terrestrial, freshwater, and marine habitats within sustainable landscapes.

The IPCC defines mitigation as technological changes or substitutions that reduce greenhouse gas emissions (IPCC 2007). Mitigation involves reducing our "carbon footprint" by using less energy, consuming fewer materials, and appropriately changing our land management practices. Mitigation is also achieved through biological carbon sequestration, which is a process in which carbon dioxide (CO<sup>2</sup>) from the atmosphere is taken up by plants through photosynthesis and stored as carbon in biomass (e.g., tree trunks and roots). Sequestering carbon in vegetation, such as native hardwood forests or grassland, can often restore or improve habitat and directly benefit fish and wildlife.

Engagement involves reaching out to Service employees; local, national, and international partners in the public and private sectors; key stakeholders; and the general public to find solutions to the challenges to fish and wildlife conservation posed by climate change.

The Association of Fish and Wildlife Agencies (AFWA) has developed guidance for states as they update and implement their respective wildlife action plans (AFWA 2009). This publication, "Voluntary Guidance for States to Incorporate Climate Change into State Wildlife Action Plans and Other Management Plans," also includes strategies that will help conserve fish and wildlife species and their habitats and ecosystems as climate conditions change. The broad spatial and temporal scales associated with climate change suggest that management efforts that are coordinated on at least the regional scale will likely lead to greater success. The Service will work with our state partners, among others, to meet the climate change challenge.

The Service's Climate Change Web site at: <http://www.fws.gov/home/climatechange/strategy.html> (USFWS 2013c; accessed August 2016), provides detailed information on the priority actions the Service is taking to begin to implement the strategic plan.

Secretarial Order 3331–Supporting Watershed Partnerships: This order was issued on January 3, 2014, affirming the Department's commitment to supporting regionally or nationally significant rivers, their watersheds, and community-based watershed partnerships. It maintains the designation of the Connecticut River as a National Blueway, which recognizes the economic, recreation, and natural values of the Connecticut River watershed. The order recognizes the importance of watershed partnerships that work across Federal agencies, state, local, and Tribal governments, nonprofit organizations, private landowners, and businesses that are able to successfully accomplish their shared conservation objectives. This program is voluntary, and when sought out by local communities and stakeholders, Federal agencies will help support collaboration among communities and across jurisdictions to strive for an integrative adaptive approach for sustaining the whole river system. The order does not affect private property rights, does not create any new regulations, and does not interfere with any Federal, state, local, or Tribal laws or regulations.

Director's Order 217 – Collaboration with the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) to Conserve Listed, Candidate, and Other At-Risk Species: This order, issued on August 9, 2016, directs the Service to prioritize working with NRCS to promote voluntary conservation actions by non-Federal landowners and managers through Working Lands for Wildlife and other wildlife conservation-focused programs. It supplements U.S. Fish and Wildlife Service policy on USDA Conservation Programs (504 FW 5).



It calls for Service employees to work closely with NRCS to implement more effective and efficient programs that advance both agencies' missions, with a special emphasis on addressing conservation of at-risk and ESA-listed species. The order can be accessed online at <https://www.fws.gov/policy/do217.html> (accessed August 2016).

### Other Conservation Priorities and Initiatives for the Refuge System

#### America's Great Outdoors

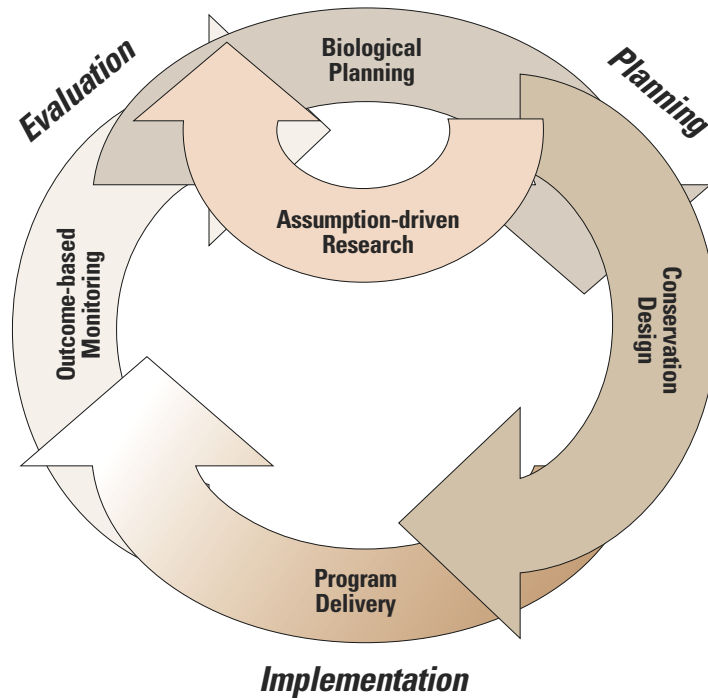
On April 16, 2010, President Obama launched the America's Great Outdoors (AGO) Initiative—a conservation and recreation effort to help increase Americans' connections to the outdoors. The premise of the AGO initiative is that lasting conservation solutions should come from citizens who share in the responsibility to conserve, restore, and provide better access to our nation's lands and waters.

In February 2011, America's Great Outdoors: A Promise to Future Generations Report (U.S. Department of the Interior et al. 2011) was released. This report laid the foundation for the initiative by identifying 10 major goals for the AGO, from expanding youth programs to increasing public awareness about conservation to better managing our public lands. Three of these goals focus on the Federal government's collective conservation and recreation efforts: creating and enhancing urban parks and greenspaces, renewing and restoring rivers, and conserving large, rural landscapes.

#### Strategic Habitat Conservation

SHC (USFWS 2008a, USFWS 2009a) is a structured, science-driven approach for making efficient, transparent decisions about where and how to expend Service resources to conserve species that are limited by the amount or quality of habitat. It is an adaptive management framework that integrates planning, design, delivery, and evaluation (figure 2.2).

Figure 2.2. Strategic Habitat Conservation Process



The conservation problems we now face are much broader and complex and cannot be addressed within the boundaries of refuges alone. In response, the Service has adopted a management framework capable of facilitating conservation at the national and continental scale. This SHC approach becomes more urgent as we continue to address the ever-expanding, multiple threats of human development and invasive species that now converge in a 21st century environmental “perfect storm” with a changing climate. The former requires the Service to act quickly, while the latter demands that we move forward strategically. More specifically, SHC incorporates the following elements within a framework that allows Service managers to improve management actions based upon lessons learned from previous management plans and activities:

- Biological planning involves identifying priority trust resources, determining population objectives, assessing the current status of populations, identifying threats and limiting factors, and using models to describe the relationship of populations to habitat and other limiting factors. The conservation plans discussed below contribute to an SHC approach.
- Conservation design uses the results of biological planning to develop decision support tools, including maps and models, to guide management. It also identifies priority geographic areas for conservation and determines population-based objectives for habitat or other limiting factors based on these tools.
- Conservation delivery involves implementing conservation actions through programs and partnerships that are guided by decision support tools and targeted to achieve specific biological results (outcomes).
- Monitoring collects data to evaluate the effectiveness of conservation actions in reaching biological outcomes and to provide feedback to future planning and delivery.
- Research tests assumptions in biological planning and conservation design that have the greatest impact on management decisions and provides feedback to future planning.

Development of CCPs fully embraces the elements of SHC through the setting of specific goals, measurable objectives, and implementation strategies. There is ample room for evaluating the management effects of a CCP, and making appropriate adjustments over time, especially during revisions to CCPs and step-down management plans. More information regarding SHC can be found at: <http://www.fws.gov/landscape-conservation/> (accessed August 2016).

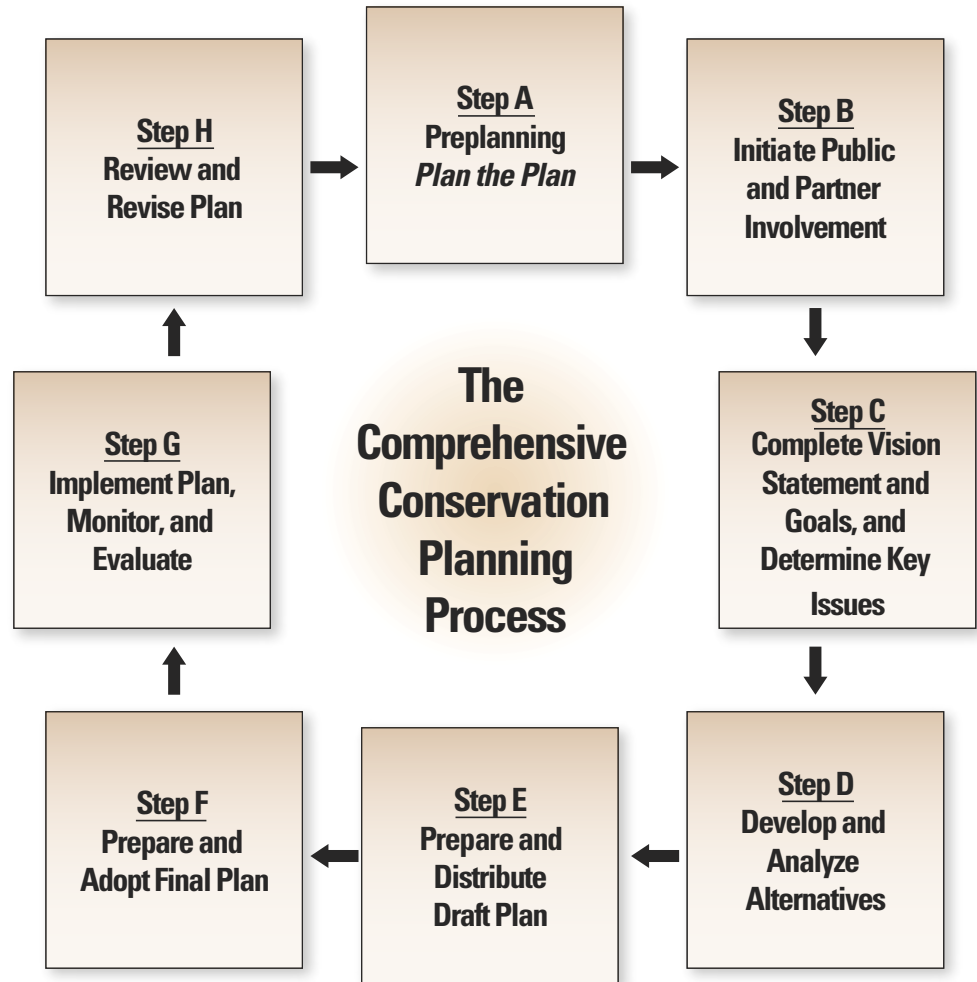
### **Conservation Plans and Initiatives Guiding Development of the CCP**

In addition to the laws, orders, and policies previously presented in this chapter, the planning for, and management of, a refuge is guided by its establishment purpose(s) and vision, and further directed by goals and objectives detailed in an approved CCP. The goals and objectives, in particular, are greatly influenced by the ecological role a refuge may play within its local and regional ecological landscape. That role can be determined with the help of existing national and regional conservation plans that relate to the refuge’s planning analysis area.

Refuge planning should consider the goals and objectives of existing regional and ecosystem conservation plans for the landscapes in which the refuges reside to determine how a refuge can best contribute to the functioning of the ecosystems, while also achieving refuge purposes and vision. This is also important because the Service is directed to coordinate refuge planning with state fish and wildlife agencies, and, to the extent practicable, develop CCPs consistent with state fish and wildlife action plans. We also strive to be as consistent as possible with the conservation programs of Tribal, other Federal agency, and nongovernmental and private partners within the ecosystem.

The number of conservation plans and initiatives that relate to our project analysis area is staggering. New plans and information are being produced at such a rapid pace that it has been challenging for the planning team to stay current and be aware of them all. Appendix M includes a brief summary of the over 60 habitat, species, and other conservation plans we consulted during development of this CCP. In particular, these plans were helpful as we developed our goals, objectives, and strategies.

Figure 2.3. The CCP Planning Process and its Relationship to NEPA.



### The Comprehensive Conservation Planning Process

Service policy (602 FW 3) describes the eight-step comprehensive conservation planning process and provides detailed guidelines for developing CCPs (figure 2.3). This policy also ensures that CCPs comply with NEPA by integrating NEPA requirements into the CCP process. The full text of the policy and a detailed description of the planning steps are at: <http://policy.fws.gov/602fw3.html> (accessed August 2016).

Below we describe the planning process for the Conte Refuge’s CCP, including each step’s relationship to NEPA and what actions we have completed under

each of the eight steps. With the release of this CCP, we have completed steps A through F.

### Step A: Preplanning

During the preplanning step, the planning team:

- Reviews the refuge purposes, history, and establishing authority.
- Reviews the Service mission and policies; the Refuge System mission, vision, and goals; and other relevant legal mandates, Executive orders, and Secretarial orders.
- Gathers existing data and identifies knowledge gaps, including referring to other, existing conservation plans and initiatives.
- Identifies the purpose and need for the plan (see chapter 1).
- Conducts internal scoping to identify management issues and concerns, and opportunities to resolve them.
- Drafts a vision and goals for the refuge.

The planning team started the preplanning step for this CCP in 2006. We began to gather existing information on wildlife, habitat, historical and archaeological, and socioeconomic resources, as well as refuge management and administration. We also started mapping refuge habitats. Much of this information is included in chapter 3, which describes the existing physical, biological, and socioeconomic environment of the watershed and the refuge.

### Step B: Initiate Public Involvement and Scoping

The Service recognizes that effective and responsive conservation begins with community involvement. During this step, the planning team notified the public that the Service is developing a CCP for the refuge and sought public involvement in the planning process. CCP development provides opportunities for state

*Eastern bluebird*



Bill Thompson

agencies, refuge neighbors, visitors, partners, and the public to be involved, and to gain a clear understanding of the reasons for refuge management actions. Through this planning process, we sought to develop the most environmentally appropriate CCP possible that addressed key issues and public points of interest.

From these various sources of information, we developed a list of points of interest, challenges, opportunities, or any other item requiring a management decision.

We announced the initiation of the Conte Refuge CCP/EIS and a public scoping and comment period through a Federal Register notice of intent on October 20, 2006 (71 FR 62006). During the

public and partner scoping period we used the following techniques to ensure we reached out to a wide variety of stakeholders and obtained all of the points of interest, challenges, and opportunities identified by the public, our conservation partners, and other Service program staff:

- An “issues workbook” which asked recipients questions about their interests and concerns related to the refuge.
- Public scoping meetings throughout the watershed (at these meetings, we explained the planning process and gathered comments. We held 9 meeting in the fall of 2006 and then another 12 in the winter of 2007 to 2008).
- CCP planning team meetings with state representatives and invited guest experts to share information.
- Meetings sponsored by the Friends of Conte.
- Meetings to coordinate with other Service programs and other Federal and state agencies.
- Conversations between staff and individuals or groups.

**Step C: Review Vision Statement and Goals, and Determine Significant Issues**

Based on comments we received during the public and partner scoping period, we revised our vision statement and goals (see chapter 1). We also developed a list of key issues, concerns, and opportunities to respond to in the plan based on both our internal and public scoping periods, and updated as we proceeded through the planning process. Due to the length of the narrative describing those issues, concerns, and opportunities, they are briefly presented under a separate subheading below and are described in more detail in chapter 2 of the final CCP/EIS.

**Step D: Develop and Analyze Alternatives, Including the Proposed Action**

Following a review of the issues generated under steps B and C, we refined our range of proposed alternatives. We then proceeded to develop them fully in the form of objectives and strategies, and assessed the impacts that might be expected with their implementation. Issues, concerns, and opportunities were also considered during this phase of the planning process. They are briefly listed below but described in more detail in chapter 2 of the final CCP/EIS. In both the draft and final CCP/EIS, we described and analyzed four alternatives in chapter 4 and their anticipated impacts in chapter 5. We identified alternative C as our proposed action and the Service-preferred alternative.

**Step E: Prepare Draft Plan and NEPA Document for Public Review**

With the release of the draft CCP/EIS, we completed Step E. The draft CCP/EIS was available for 90 days of public review and comment. We announced the release of the draft CCP/EIS in the *Federal Register* (80 FR 50023), through news releases on local media, and in a newsletter sent to our CCP project mailing list. We held 14 public information meetings and 4 public hearings. During this comment period, we sought substantive comments on the draft document. We used these comments to help create the final CCP/EIS.

The final CCP/EIS was made available for a 30-day review period from December 16, 2016 to January 17, 2017. We notified everyone on the CCP mailing list by newsletter or email, and the availability of the final CCP/EIS was announced in an NOA published in the December 16, 2016 *Federal Register* (81 FR 91185). During this latter review period, we received additional comments from 8 individuals and organizations, but all comments were previously addressed in appendix O of the final CCP/EIS.

**Step F: Prepare and Adopt Final Plan**

Following review of comments on the final CCP/EIS, the Service’s Northeast Regional Director signed a ROD on January 18, 2017 which documented the decision to adopt alternative C, the rationale for this decision, and the certification that we have met agency compliance requirements. The availability of the ROD was publicly announced, completing Step F. A copy of the ROD and final CCP document will be made available to interested parties and published on our website. See appendix P in the CCP for the full ROD.

Woodchuck



Andrew MacLachlan

The Regional Director selected alternative C based on:

- How well it meets the Service and Refuge System missions.
- How well it achieves the refuge purposes.
- How well it complies with other legal mandates.
- How well it anticipates and responds to predicted impacts.
- Public and partner responses to the draft and final versions of the CCP/EIS.
- The Service Director's approval of a refuge expansion.

This final decision identifies the desired combination of species protection, habitat management, public use and access, land protection, and administration for the refuge. Our management direction, presented in chapter 4 of this CCP, will guide refuge management decisions over the next 15 years.

Based on comments we received during the public review period for the draft CCP/EIS, we made several modifications to alternative C in the final CCP/EIS. All substantive issues were addressed through revisions made to text in the final CCP/EIS, or in our responses to comments contained in appendix O of the final document. None of the comments received on the final CCP/EIS raised significant new issues, nor did the comments require significant changes to either alternative C or our analysis of impacts. All substantive comments were previously addressed in appendix O.

**Step G: Implement, Monitor, and Evaluate Plan**

Once the ROD is signed and publically released, we will begin implementation of the CCP. The CCP will serve as the principal guiding document for management of the refuge for the next 15 years. As we implement the plan, we will monitor our success in achieving our refuge goals and objectives.

**Step H: Review and Revise Plan**

We will also review and revise the CCP at least every 15 years in accordance with the Refuge Improvement Act, NEPA regulations, and Service planning policy (602 FW 3). Annual, or other periodic reviews, could lead to revisions prior to the required minimum 15-year update. Minor revisions that meet the criteria for a categorical exclusion (550 FW 3.3C) will require only an Environmental Action Memorandum.

**Issues, Concerns, and Opportunities**

The Service defines an issue as “any unsettled matter requiring a management decision” (602 FW 1). Issues can include an “initiative, opportunity, resource management problem, threat to a resource, conflict in use, or a public concern.” Issues arise from many sources, including refuge staff, other Service programs, state agencies, public and local officials, other Federal agencies, Tribes, other partners, neighbors, user groups, individuals with an interest in the refuge, or Congress. One of the distinctions among the management alternatives that we evaluated in the final CCP/EIS is how each addressed issues, concerns, and opportunities. The decision to adopt alternative C for implementation, in large part, was due to how well it addressed the issues, concerns, and opportunities that arose during our planning process.

We defined three categories of issues, concerns, and opportunities early in the planning process:

- **Issues, concerns, and opportunities outside the scope of the final CCP/EIS analysis.** These were issues, concerns, and opportunities whose resolution fell outside the scope of the final CCP/EIS, or were outside the jurisdiction or authority of the Service. Although we discussed them briefly in chapter 2 of the final CCP/EIS, we did not address them further.
- **Issues, concerns, and opportunities that did not need alternative management options.** These were issues, concerns, and opportunities that deserved management attention; however, there was often only one reasonable solution to the issues. Due to this, we resolved them similarly across all of the alternatives. These issues are listed in chapter 2 of the final CCP/EIS, and some were described in more detail in the final CCP/EIS in chapter 4 as “Management Actions Common to all Alternatives”. These issues are carried forth in the final CCP in chapter 4, “General Refuge Management Direction.”
- **Issues, concerns, and opportunities that were evaluated under alternative management options in the final CCP/EIS.** These were issues, concerns, and opportunities needing management attention that may have had more than one viable solution and their resolution fell within the jurisdiction and authority of the Service. Typically, these issues generated a wide range of opinions on how to resolve them. The range of options for addressing them helped form the basis for developing and comparing objectives and strategies among the four proposed management alternatives detailed in final CCP/EIS chapter 4.

Specific issues, concerns, and opportunities that were raised during the planning process are presented in chapter 2 of the final CCP/EIS. They are organized in chapter 2 by the three categories above. Chapter 4 of the final CCP/EIS details the different management alternatives that were evaluated during our planning process. This final CCP does not repeat those discussions, but instead, focuses on future management direction for the refuge under alternative C, which was selected for implementation.





## Chapter 3



USFWS

*Federally endangered Jesup's milk-vetch*

## Affected Environment

### ■ Introduction

### Part I: The Connecticut River Watershed Environment

- Land Use: Historic and Current
- Physical Environment
- Biological Environment
- Socioeconomic Environment

### Part II: General Refuge Information

- Refuge Administration and Facilities
- Urban Wildlife Conservation Initiative
- Land Acquisition History
- Conte Refuge General Public Use

### Part III: Description of Individual Refuge Divisions and Units

- Refuge Divisions
- Individual Refuge Units



## Introduction

This chapter describes the existing physical, ecological, socioeconomic, and historical environment of the refuge and larger Connecticut River watershed. The chapter is divided into three parts to describe the environment at different scales. Part I describes the entire watershed's environment. Part II provides more general refuge information, while part III provides more specific and information on the refuge's existing divisions and units.

Several appendixes include supporting documentation and descriptions used to compile this chapter. For example, appendix M describes resource plans we used as references. Consulting these individual plans will provide the reader more detailed information on a wide variety of resources of interest. Of particular note, we recommend readers consult the respective State Wildlife Action Plans for Connecticut, Massachusetts, Vermont, and New Hampshire. These plans provide a comprehensive description of each State's fish and wildlife, historic and current habitat trends, and species and habitats of elevated conservation concern (New Hampshire Game and Fish Department 2015, <http://www.wildlife.state.nh.us/wildlife/wap.html>; Connecticut Department of Environmental Protection Bureau of Natural Resources 2015, [http://www.ct.gov/deep/cwp/view.asp?a=2723&q=325886&deepNav\\_GID=1719](http://www.ct.gov/deep/cwp/view.asp?a=2723&q=325886&deepNav_GID=1719); Vermont Fish and Wildlife Department 2015, <http://www.vtfishandwildlife.com/cms/One.aspx?portalId=73163&pageId=480706>; and, Massachusetts Department of Fish and Game 2015, <http://www.mass.gov/eea/agencies/dfg/dfw/wildlife-habitat-conservation/state-wildlife-conservation-strategy.html>).

As we noted in chapter 2, the amount of information about the watershed is impressive, and new plans and information are being produced at a rapid pace. We highlight below the information we think is most important to relate about the watershed and refuge resources; it is based on information that was available during preparation of this final document. To the extent practicable, we provide updates from the final CCP/EIS in this final CCP.

## Part I: The Connecticut River Watershed Environment

### Land Use: Historic and Current

As noted in chapter 1, our project analysis area is the entire 7.2 million-acre Connecticut River watershed, located in the Northeastern U.S. (map 1.1). It covers portions of four states: New Hampshire, Vermont, Connecticut, and Massachusetts (a very small portion also occurs in Maine and Canada). Of the watershed's total acreage, 13 percent (13%) lies in Connecticut, 24 percent (24%) in Massachusetts, 28 percent (28%) in New Hampshire, and 35 percent (35%) in Vermont. The watershed also includes more than 20,000 miles of tributaries and streams.

Both historic and current land uses in the watershed have been, and continue to be, largely influenced by its diverse geography and the changing needs of society. The next two sections describe the land use history of the Connecticut River from its earliest settlement by humans to the current day. We also direct readers to some interesting facts about the watershed on the CRWC Website (CRWC 2013; <http://www.ctriver.org/river-resources/about-our-rivers/watershed-facts/>; accessed August 2016).

**Cultural and Historic Resources Overview for Connecticut River Watershed**  
Starting with the earliest human occupation of the Connecticut River watershed more than 11,000 years ago, the river has provided focus for settlement, cultural exchange, and travel. People have been influenced by the environment and the types of natural resources that were available. In turn, they affected the ecology

of the watershed through their activities and land use (Waller and Cherau 2011, T. Binzen, personal communication 2013).

According to archaeological evidence, the first inhabitants were Paleoindian explorers who entered a sparsely vegetated landscape dominated by lakes of glacial meltwater. These people were highly mobile. They exchanged stone materials over great distances, and preferred to live on sandy plains of glacial outwash (Waller and Cherau 2011, T. Binzen, personal communication 2013).

Over the ensuing millennia, the climate changed within the watershed and the types of vegetation and animal species evolved as well. The Native American inhabitants formed societies that occupied different topographic zones within the watershed, adjusting to shifts in climate and ecology. After 7,000 years ago, tools for fishing become more common in the archaeological record. Native settlement tended to focus in upland areas. After 3,000 years ago, the vegetation regime in the watershed became similar to what is seen today. Along the coast, sea levels stabilized and systems of estuaries took the form that can be recognized today. Native Americans reoriented their settlement systems to the valley floors and coastal areas. Vast seasonal runs of diadromous fish drew people to gather at waterfalls and rapids along the Connecticut River and its tributaries. In addition to hunting and fishing, horticulture played an increasing role in Native American subsistence, and settlements became larger and more permanent (Waller and Cherau 2011, T. Binzen, personal communication 2013).

The native peoples of the watershed belonged to the Algonquian culture, sharing a common language and social structure and following an annual subsistence cycle. Landscapes they inhabited were highly variable, from the mountainous headwaters in the north, to the broad verdant plains of the central valley, down to the southern tidal area. Through time, the river formed a common chain and a route for travel, exchange, and communication (Waller and Cherau 2011, T. Binzen, personal communication 2013).

When the first European explorers arrived on the lower Connecticut River in the early 17<sup>th</sup> century, they encountered large Native populations, including members of the following tribes: Western Abenaki in the upper Connecticut River valley; Squakheag in New Hampshire; Norwottuck, Agawam, Woronoco, and Pocumtuck in the middle valley; and Wangunk in Connecticut. Dutch and English traders competed for influence with tribes, incrementally working their way further up the river to centers of trade in present-day Hartford and Springfield. Competition between tribes increased as the fur trade made control of headwater areas more important (Waller and Cherau 2011, T. Binzen, personal communication 2013).

Between 1620 and 1700, colonial settlement was rapid in the lower watershed. Within the Connecticut River watershed in the Connecticut and Massachusetts Bay colonies, the establishment of townships followed a common pattern. Proprietors were granted tracts of land which they were expected to “improve” by felling trees, building farmsteads, and cultivating cropland. The soils of the lower valley were highly favorable for this enterprise. Simple industries such as sawmills, grist mills, and tanneries were ubiquitous on the streams and smaller tributaries. As late as 1700, however, the northern frontier of colonial settlement was not far above Springfield. The watershed from that point north to the French colonies of Canada was unfamiliar to the colonial settlers. In the aftermath of regional conflicts in the early and middle 1700s (including Queen Anne’s War and the French and Indian War), the Native American inhabitants of the lands north of the frontier were decimated by disease and conflict, and colonial settlement

expanded progressively northward (Waller and Cherau 2011, T. Binzen, personal communication 2013).

During the Industrial Revolution in the 1800s, forms of land use transformed the ecology of the Connecticut River watershed. Agriculture, population growth, and a profusion of new industries characterized the southern portion of the watershed. The establishment of the planned industrial city of Holyoke, Massachusetts, was emblematic of transformations in the central and northern watershed. By the 20th century, the availability of electrical power meant that industrial enterprises could be established away from the watercourses on which they had previously depended (Waller and Cherau 2011, T. Binzen, personal communication 2013).

### **Forests and Farmland**

The landscape of eastern North America was completely transformed by logging, land clearance, and agriculture during the 18th and 19th centuries (Torrey and Allen 1906; Fisher 1933; Raup 1966; Cronon 1983; Whitney 1996). In central New England, 50 to 80 percent (50-80%) of the forested uplands were converted to pasture, hay fields, and tilled land by the mid-1800s and supported thriving agricultural activity based upon livestock and crop production (Bidwell and Falconer 1941; Black and Brisner 1952). In the late 1800s and early 1900s, urban manufacturing jobs and homesteading opportunities in the fertile Midwestern United States lured the population from eastern farms and triggered broad-scale reforestation. By the 1940s, 60 to 85 percent (60-85%) of the land in New England supported forests (Baldwin 1942).

Historical and ecological data from north-central Massachusetts suggest that widespread and intensive human disturbance, namely in the form of land clearing by European settlers, led to a shift in forest composition. Prior to European settlement, there was regional variation in forest composition, where oak, chestnut, and hickory communities were common at low elevations and hemlock, beech, sugar maple, and yellow birch communities were common at higher elevations. After European settlement, forest composition changed markedly in response to human land practices, leading to a more homogenous and broad-scale forest composition, and the rates of vegetation change remained high, reflecting continuing disturbance on the landscape (Fuller et al. 1998). One author suggests that the dynamic equilibrium in the ecology of upland oaks, notably white oak, which existed for thousands of years, had been destroyed in the few centuries following European settlement due to land clearing, extensive clear-cutting, catastrophic fires, chestnut blight, fire suppression, and intensive deer browsing (Abrams 2003).

Agriculture and forestry are the two main land use industries in the upper portion of the watershed, often characterized by dairy farms along the main stem and a few of the tributaries and expansive pastures for livestock. A majority of the land along the river is zoned for limited residential use, but there are commercial and industrial sites. New England Power Company owns 117 miles of river frontage and manages it for timber, wildlife, and recreation (NHDES 1991).

Forests are no longer owned principally by large corporations. Between 1980 and 2005, ownership of almost 24 million acres changed hands in New England's Northern Forest Region, a distinct region of 26 million acres. Ownership shifted from industrial forest ownership to various new financial and non-profit investors (e.g., timber investment management organizations, real estate investment trusts, and conservation organizations). By 2005, financial investors owned about one-third of the large forest tracts and industry owned only 15.5 percent (15.5%; or, 1.8 million acres, mostly in a single ownership). Despite the rapid turnover of

timberland in the last decade, most forest blocks have remained intact, although there is a trend toward more forest owners with associated smaller parcel sizes (Hagan et al. 2005).

It is useful to understand broad patterns in land use for the watershed and how those patterns affect natural environments. Of all America's forests under pressure from development, New England's are shrinking the fastest. Connecticut and Massachusetts will lose the highest percentages of forest among all states by mid-century (Carpenter 2007). Although the region's forests made a remarkable comeback, since the early 20th century, these forests are being displaced and fragmented by ever-encroaching home development with larger homes and lot sizes. In a study released by Harvard Forest researchers titled *Wildlands and Woodlands*, following almost 200 years of natural reforestation, forest cover is declining in all six New England states (Foster et al. 2010). The authors of this report recommend conserving 70 percent (70%) of New England as "working and wild forestland," a target they say is critical to protecting vital natural benefits that would be costly, and in some cases impossible, to replace.

One example of land use trends in the watershed, described in the recent report *Losing Ground: Beyond the Footprint*, is that between 1971 and 1999 the land considered developed increased from 17 to 24 percent (17-24 %) in Massachusetts, while "wildlife habitat," which is defined as forest, wetlands, and open water, declined from 70 to 64 percent (70-64%). Massachusetts Audubon estimates that Massachusetts is losing 40 acres a day to development (DeNormandi 2009). Similarly, by 2050, 61 percent (61%) of Connecticut will be urbanized, according to a report in the *Journal of Forestry* (Nowak and Walton 2005) compiled by Forest Service researchers.

Potential future shifts in fuel and power production will also have an effect on the watershed's forests and rivers. The 4 states in the watershed are part of a 10-state agreement to limit greenhouse gas emissions (Carter, Ledyard, and Milburn LLP 2007). The 10 states have capped CO<sub>2</sub> emissions from the power generation sector, and agreed to a 10 percent (10%) reduction in these emissions by 2018. In order to meet that goal, the states are considering all viable alternative energy options such as wood biomass production mills, solar and wind-driven electrical generation, and hydropower. These alternative energy sources will influence the watershed forests and rivers due to the removal of trees and other vegetation to support biomass plants or to construct solar- and wind-farms and the use of water to cool biomass plant operations and to run hydropower generators.

Agricultural land uses continue to be a mainstay in the watershed. "Traditional" agriculture, such as dairy, apple orchards, and maple sugar production, is still prominent, although there has been some adaptation to fewer, larger dairies and organic dairies. "Niche" agriculture has become popular in the region over the last 10 years. For example, there has been an increase in farm stands, pick-your-own produce farms, community supported agriculture (CSA), community involved in sustaining agriculture (CISA), organic crop and grain production, farm cooperatives with local food markets and restaurants, organic meat production, farmers' markets, selling compost in bulk, and collecting and selling wild mushrooms (Taylor 2009). Tilled agricultural land is largely restricted to the valleys and lower slopes where prime soils occur. Dairy farms tend to be concentrated in the upper watershed, particularly in northern Vermont (Clay et al. 2006).

Agriculture is an ever-changing and dynamic industry. Farmland throughout the watershed is under pressure from the high value of land for development; between 1982 and 1997 the watershed lost 19 percent (19%) of its farmland and, between 1997 and 2002, lost another 7.5 percent (7.5%). Additionally, only 11 percent (11%) of prime farmland and 16 percent (16%) of non-prime farmland are protected (Clay et al. 2006). The profitability of farm businesses is a high-risk endeavor, making farmland conservation an immense challenge. Prominent challenges include: an aging farm community, reduction in the number of farm owners, land values rising faster than the income it can generate, loss of farmland, and the economic inability to permanently protect farmland (Clay et al. 2006).

### Conserved Lands Network in the Watershed

The Connecticut River watershed has an extensive network of conserved lands equaling 1.5 million acres or about 22 percent (22%) of the watershed. See “Map 1.2. Conserved Lands in the Connecticut River Watershed” on page 1-4.” Conserved lands in the watershed are permanently protected from development through deed or easement restrictions, but in some cases may allow or require land uses such as farming and forestry. Our source of data for existing conserved lands was obtained by TNC (2011).

Within the watershed, many agencies, organizations, and private individuals own and maintain conserved lands for a variety of different purposes. Those include: water supply, flood protection, timber production, agricultural use, recreational use, and fish and wildlife habitat. Some owners place a restriction on development simply for aesthetic reasons.

Table 3.1 and map 1.2 show estimated acres in the watershed held by various agencies and organizations. It is important to note that there are likely small parcels held by municipalities, small land trusts, or private landowners that are not in the database yet, and more are being added all the time.

**Table 3.1. Conserved Lands in the Connecticut River Watershed by State and Ownership.** For each state, the total acreage by each ownership class is shown, along with the proportion of land in that class in each state. For example, 18% of Connecticut’s conserved land within the Connecticut River Watershed is privately owned. In the “Totals” line, the percentages represent the contribution of all lands in each state to the grand total.

Ownership	Connecticut		Massachusetts		Vermont		New Hampshire		Totals	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Federal	686	<1	11,497	2	217,795	35	227,089	36	457,067	25
State	77,013	53	284,006	57	157,106	30	116,140	18	634,265	35
Local <sup>1</sup>	41,583	28	77,830	16	25,119	5	27,416	4	171,948	10
Private	26,724	18	126,787	25	114,040	22	264,577	42	532,128	30
Unknown <sup>2</sup>	740	1	73	<1	2541	<1	61	<1	3,415	<1
<b>Totals</b>	<b>146,746</b>	<b>8</b>	<b>500,193</b>	<b>28</b>	<b>516,601</b>	<b>29</b>	<b>635,283</b>	<b>35</b>	<b>1,797,823</b>	

Sources: The conserved lands layer (2014) was obtained from The Nature Conservancy, and utilizes Gap Status codes 1, 2, 3, and 39. Other base layers were obtained from ESRI.

Refuge lands information provided by the Service.

<sup>1</sup> Local lands includes approximately 22,159 acres held to protect water supplies.

<sup>2</sup> Ownership could not be determined from the data available.

Some generalizations are possible with respect to conserved land ownership in the watershed. Most federal lands are held by the Service or Forest Service. State-owned land is typically secured as State forest, park or wildlife management areas. Water supplies may be held by both State and local or municipal governments (for example, the Quabbin Reservoir is owned by the Commonwealth of Massachusetts). In the southern half of the watershed Federal land ownership is very small, while in the northern half of the watershed, local and municipal ownership is more rare.

## Physical Environment

The watershed is part of several different regions based on topography and character: the Great North Woods of New Hampshire (<http://www.visitnh.gov/information/about-the-regions/great-north-woods.aspx>; accessed August 2016), the Northeast Kingdom of Vermont (<http://www.nekchamber.com/>; accessed August 2016), the Upper Valley of Vermont and New Hampshire (<http://uppervalleynhvt.com/>, accessed January 2017), the Pioneer Valley of Massachusetts (<http://www.valleyvisitor.com/>; accessed August 2016), and the Tidelands of southern Connecticut (<http://www.ctrivergateway.org/>; accessed August 2016).

Traversing these regions the river changes course in response to elevation, gradient, and other physical features. The area of the watershed in the Northeast Kingdom includes mountains with elevations exceeding 3,000 feet. Here the river is a narrow, swift, cold-water stream that falls some 900 feet in 30 miles, the sharpest drop within the river's profile. There are three artificial impoundments within this northernmost section of the river: Second Connecticut Lake, First Connecticut Lake, and Lake Francis. Spruce-fir forests dominate this rural area.

As the river leaves the Northeast Kingdom, it travels from Pittsburg, New Hampshire, to Moore Reservoir near Littleton, New Hampshire. This stretch is characterized by elevations of 2,000 feet or less. Here the river is wider, slower, more meandering, while making its second greatest fall, dropping some 400 feet between Gilman, Vermont, and East Ryegate, Vermont. The width and slower flow here can be attributed in part to the presence of five dams.

Moving into the Pioneer Valley region, from approximately Moore Reservoir to Turners Falls, Massachusetts, the river flows through hilly and rolling country, with elevations of up to 2,000 feet and gradually drops 365 feet. This section of the river contains six dams. Farmland and dairies characterize this rolling landscape.

Continuing through the Pioneer Valley and into the Tobacco Valley of Connecticut—from Turners Falls, Massachusetts, to Middletown, Connecticut—the river is characterized by a wide elongated valley floor less than 500 feet above sea level, with adjacent uplands to the east and west that rise sharply in elevation. The river has an extensive floodplain and a gradual fall. There are two dams in this stretch of the river: one at Holyoke, Massachusetts, and one in Enfield, Connecticut. The Enfield Dam, built in 1827, has been in disrepair for many years and has naturally breached (Frisman 2002). These rich valley lands encompass some of the most valuable farmlands in the watershed and attracted settlement early in America's history.

South of Middletown, Connecticut, the area can be characterized as a plateau with a few hilly or mountainous elevations rising to 660 feet. Lands along the river are fairly steep and little valley floor exists. The river here is free-flowing and tidal, flowing through the most urbanized section of the watershed.

Moving into the Tidelands area, from Chester, Connecticut, south to Long Island Sound, the river continues its decrease in elevation, transitioning from uplands to tidal coves, extensive tidal marshes, meadowlands, and large estuarine islands.



The mouth of the river is defined by sandy beaches and sheltered bays, as well as a number of offshore rocks, shoals, and shifting sandbars. Although this river delta and coastal plain landscape is highly urbanized, the Connecticut River is one of the few large rivers in the U.S. that does not have a major city at its mouth.

### **Geomorphology— History of Geological and Climatic Processes**

The Connecticut River valley's current diversity in topography and natural communities is a product of millions of years of geologic, glacial, climatic, and erosive dynamics. Uplift and glaciation were the predominant geologic and climatic events that shaped the current landscape. The Connecticut River began in a rift valley formed as the supercontinent Pangaea broke apart 180 million years ago along the deep ocean mid-Atlantic Ridge, which also formed the Atlantic Ocean. This was followed by valley layers tilting during earthquakes to form the basalt "traprock" ridges—the Holyoke Range and Mount Tom in Massachusetts, and Connecticut's Metacomet Ridge that were more resistant to the subsequent glacial scouring that wore down adjacent sedimentary rock. Over millennia, sedimentary sandstones and conglomerates filled the valley, and eons of flooding events have deposited deep, accumulated layers of terraced silt loams through which the river flows today (Freeman 2007, Sinton et al. 2007).

The Laurentide glacier reached its maximum southern extent about 18,000 to 21,000 years ago, depositing enormous amounts of glacial till and outwash gravels to form a massive terminal moraine. When the glacier melted back to the Hartford, Connecticut area, deposits blocked the whole valley, forming an earthen dam. Dammed meltwater formed glacial Lake Hitchcock, which stretched from Rocky Hill, Connecticut, to St. Johnsbury, Vermont, and existed for more than 4,000 years. As rivers drained into Lake Hitchcock, the heavy sand particles were deposited in deltas that formed sandplains in Windsor, Connecticut, Westfield, Massachusetts, Montague, Massachusetts, as well as a few other scattered locations. The finer clay particles that settled in the lake's bottom today support many wetland areas, and the rich sediments from the lake also provide for the productive agricultural lands in the Pioneer and Tobacco Valley regions (Zimmerman et al. 2007, Becker and Wunsch 2009).

When the dam forming Hitchcock Lake finally breached, the Connecticut River receded to approximately its current location and started to erode the Hitchcock sediments. Over time, the river has changed its course in places and left some abandoned channels (oxbow lakes) creating ecologically important floodplain areas. Some of the scenic, narrow valley segments we see today became established where the sediments were more difficult to erode, leading to the creation of waterfalls and rapids (Zimmerman et al. 2007, Becker and Wunsch 2009).

### **Hydrology and Water Quality**

The movement of water through the watershed, its quantity and quality, and the impacts from human activities all play important roles in the management of the river system and the fish and wildlife populations that depend upon it. Many aquatic plants and animals are sensitive to stream flow and water pollution. The health of a river system and its watershed is reflected in the species it is able to support. Groundwater typically originates in upland recharge areas and moves to lower discharge points. Because groundwater percolates down through the soil, our land uses affect its quality and quantity (CRWC 2008).

The main stem of the Connecticut River is 410 miles long, draining well over 7 million acres of diverse rural and urban lands. It is the largest riverine ecosystem in New England. The Connecticut River and its watershed are largely defined by the occurrence, distribution, movement and properties of water, and its relationship with the environment through the hydrologic or water cycle. Like

Bald eagle



Steve Maslowski/USFWS.

its land, the water is in high demand and is critical for many uses in households, businesses and industries; irrigation of farms; conservation of parklands, fish and wildlife habitat; and for production of electric power (USGS 2013a, USFWS 1994).

Under the National Watershed Boundary System, the watershed is classified as a subregional hydrologic unit (i.e., hydrologic unit code (HUC) 0108) within the Northeastern Region, one of 21 national hydrologic regions (Mulligan 2009). Within this subregion, there are 10 watersheds officially recognized by the USGS and NRCS. The main stem of the Connecticut River receives water from 36 major tributaries, 26 of which drain 100 square miles or more (table 3.2; map 3.1).

**Table 3.2. The Connecticut River’s Major Tributaries.**

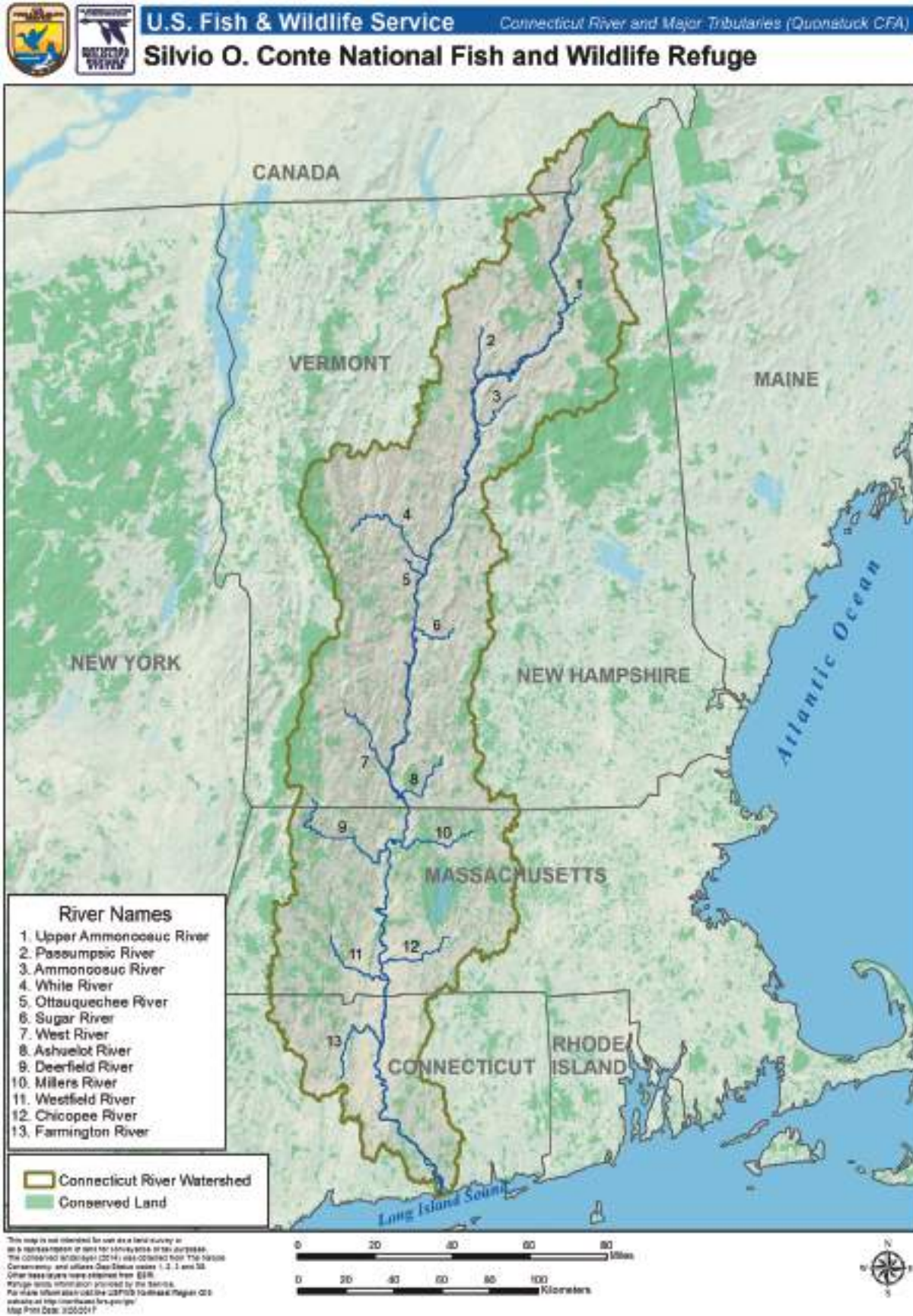
River - State	River Miles (upstream of Long Island Sound)	Length (in miles)	Drainage Area (in square miles)	Fall (in feet)
Lieutenant - CT	3	5	12	33
Eightmile - CT	9	11	62	300
Salmon - CT	18	20	152	520
Hockanum - CT	50	22	82	510
Farmington - CT	57	47	602	350
Scantic - CT	59	35	113	900
Westfield - MA	75	57	517	1,780
Chicopee - MA	80	17	721	260
Manhan - MA	92	18	106	900
Sawmill - MA	114	12	30	660
Deerfield - MA/VT	119	73	664	2,900

River - State	River Miles (upstream of Long Island Sound)	Length (in miles)	Drainage Area (in square miles)	Fall (in feet)
Falls - MA	122	12	36	400
Millers - MA	126	45	392	900
Ashuelot - NH	140	64	421	1,475
West - VT	149	53	423	1,780
Cold - NH	172	15	110	1,000
Saxtons - VT	173	20	78	1,565
Williams - VT	176	24	118	1,330
Black - VT	183	40	204	1,055
Sugar - NH	195	27	275	800
Ottawaquechee - VT	210	38	222	1,485
Mascoma - NH	214	34	194	1,015
White - VT	215	58	712	2,170
Ompompanoosuc - VT	225	20	136	800
Ammonoosuc - NH	226	56	402	4,560
Waits - VT	247	24	146	1,950
Wells - VT	266	16	100	680
Stevens - VT	277	7	49	435
Passumpsic - VT	280	23	507	245
John's - NH	303	9	76	200
Israel's - NH	312	21	135	1,445
Upper Ammonoosuc - NH	325	40	254	1,345
Paul Stream - VT	340	14	58	940
Nulhegan - VT	345	16	151	285
Mohawk - NH	359	11	92	850
Headwater Areas - VT/NH	372	29	304	875

The average annual runoff for the watershed as a whole is about 23 inches or about one half of the average annual precipitation (Federal Power Commission 1976). Daily flow at the mouth of the Connecticut averages nearly 16,000 cubic feet per second (cfs), similar to Hudson and Delaware Rivers. However, the flow has ranged as high as 282,000 cfs and as low as 971cfs. In the spring, daily flows average over 24,000 cfs, but drop to less than 5,000 cfs in late summer. Mean monthly river discharges are highest during April and May and lowest during August and September (USFWS 1994).

Water temperatures in many of the streams within the watershed closely follow seasonal air temperatures. Summer water temperatures in the mid-Connecticut River main stem average between 70° Fahrenheit to 80°F with temperature peaks sometimes reaching 90°F in July and August (USFWS 2010c). Minimum water temperatures occur from December through March with ice often forming on water surfaces and temperatures ranging from the low to mid-30°F (USFWS 1995b).

Map 3.1. The Connecticut River and Its Major Tributaries.



The Upper Connecticut River watershed is mountainous, steep, and rugged. Streams, brooks, and rivers are fresh, and often descend quickly through this northern terrain, being fed through rainfall, snowmelt, and groundwater. Streamflow at the headwaters in New Hampshire can be just a trickle, often barely 1cfs. Streamflow increases southward as the area of land being drained increases and is about 10,000 cfs at the northern Massachusetts border. As a drowned river valley, the lower river is strongly influenced by waters of Long Island Sound. The Connecticut River discharges nearly 70 percent (70%) of the freshwater input into the Sound, thus exerting a major influence on this northeast estuary. The lower 60 miles of the Connecticut River from Long Island Sound to the Scantic River, 8 miles above Hartford, Connecticut, mix with sea water and are tidally influenced. The range of tide height during periods of low flow is from one foot at Hartford to 3.5 feet at the river's mouth. The heavier saltwater moves under the overlying freshwater in a wedge and its "intrusion" upriver is dependent upon the amount of surface freshwater runoff, wind direction, and tide conditions (USFWS 1994).

The amount of salinity greatly affects the distribution of plants, animals, and habitat types in the lower river. For plants, the most significant salinity conditions for submerged and emergent plants are those that exist during the warm growing season. At the beginning of the growing season in early May, when river flows are at their peak, there is no detectable salt in the surface waters of the river estuary, regardless of the stage of the tide. However, as the summer season progresses, and the river flow decreases, the penetration of salt water and tidal influence increases, as does water temperature (USFWS 1994).

Fish and wildlife are adapted to natural, seasonal hydrologic events. Natural hydrology is greatly disrupted by artificial capture, holding, and release of river water for water supply, irrigation, snowmaking, flood risk reduction, electric power generation, and recreation. There are more than 2,700 dams of various sizes in the watershed and 18 main stem dams that impound over half the river's length (see chapter 2, map 2.2. Locations of Dams Throughout the Connecticut River Watershed). Less conspicuous than dams are the 44,000 road culverts that can fragment aquatic ecosystems and impede the natural movement of water, fish, and other aquatic organisms (TNC 2010).

There are 38 flood risk reduction projects operated by the USACE and almost 1,000 small dams on the tributaries that were built to power mills in the 1700s and 1800s. Flows, especially during low-flow periods, are highly regulated and restricted by dams in the watershed (Kapala and Brown 2009). Maintaining a natural flow regime in such a highly controlled river system presents a tremendous challenge. The State of Connecticut adopted new stream flow regulations in 2011 (State of CT 2012), and efforts are underway by TNC and the USACE to develop a hydrologic model to better understand flow dynamics and use demands, thereby helping to more effectively manage human use of the river (UMass-Amherst 2012).

Water diversions out of the watershed are an important ecological consideration because flow and volume requirements for aquatic resources in the Connecticut River can be significantly impacted. The Quabbin Reservoir located on the Swift River in the Chicopee River drainage, stores runoff from an 86-square-mile watershed for the greater Boston area. Flows in excess of 85 million gallons per day in the upper Ware River are diverted to either the Quabbin or Wachusett Reservoirs. Out of watershed water diversions, including water from the main stem Connecticut River and Millers River, have been considered as a source of potable water for Boston. Fortunately, however, aggressive water conservation steps taken in Boston by the Massachusetts Water Resources Authority prevented diversions from the Connecticut River (Postel 2013).

The Connecticut River has undergone a dramatic transformation in the last three decades. During this time, a number of public agencies and private organizations have worked diligently to implement policies and measures aimed at improving the river's quality. Ample data collected over the years indicate that the actual water quality conditions of the Connecticut River, as measured by empirical parameters, have improved. The water quality of rivers and streams in the Connecticut River watershed has likewise improved considerably, with all waters now designated at least Class B. State water quality agencies actively work with industries, municipalities and agricultural groups to meet water quality standards within the watershed. However, point and nonpoint pollution is still a concern within the watershed.

Some municipalities in the watershed still have combined sewer systems. These systems are designed to treat both sewage and stormwater (as found in Hartford, Connecticut, and Holyoke and Springfield, Massachusetts) and often are inadequate to handle large storms, causing pulse overflows of raw sewage and stormwater into the Connecticut River and its tributaries.

“Nonpoint source pollution” also occurs in the watershed from land runoff, precipitation, atmospheric deposition, drainage, or seepage. Unlike “point source” pollution, nonpoint source pollution can not be traced back to specific site (e.g., a specific industrial or sewage treatment plant). Another form of nonpoint source pollution is hydrologic modification. Although soil erosion and sediment transport are natural processes, they can be aggravated by a particular use or recreation activity and alter hydrological processes (e.g., removal of vegetation, shoreline erosion from excessive boat wakes) (USEPA 2012a). Common nonpoint pollutants include excess fertilizer, herbicides, and pesticides from agricultural, and residential lands; oils and toxic chemicals from urban and industrial areas; excess nutrients and bacteria from agricultural lands and livestock; and acids and other pollutants from abandoned mines and industrial areas.

The primary pollutants in the Connecticut River watershed are sediments, nutrients (e.g., nitrates and phosphorus), animal wastes, pesticides, salt, and various toxic chemicals (e.g., antifreeze, motor oil) (SCCD 2013). Most erosion within the watershed results from agricultural practices, construction, and fluctuating water levels within tributaries and the main stem river. Nutrient and sediment laden agricultural and urban runoff and landfill leachate contribute to pollution. Nutrient loads increase with increasing intensity of land use and with increasing population densities. Major sources of nutrients include atmospheric deposition, groundwater discharge, agricultural fertilizer and manure spread, urban nonpoint runoff from roads and impervious surfaces, and municipal wastewater discharge (USGS 1998).

Water quality in the watershed is affected by thermal pollution in certain locations. Thermal loading (i.e., increased water temperatures) resulting from impounding water behind dams and eliminating vegetative shading by clearing floodplain forests adversely affects indigenous wildlife, fish, and vegetation (Pace University 2000). The Vermont Yankee nuclear facility in Vernon, Vermont, uses water from the Connecticut River to cool the reactor, returning heated water to the river. The former Connecticut Yankee facility in Haddam, Connecticut, and



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Salmon River, Connecticut

the Rowe Yankee Nuclear Power Station in Rowe, Massachusetts, have been retired. Three fossil-fuel generating plants also use Connecticut River water for system cooling. Two of these are located in Massachusetts and one is in Connecticut.

The USGS sampled streambed sediments, fish tissues, surface water, and groundwater from a variety of sites in the Connecticut River watershed as part of its National Water Quality Assessment Program (USGS 1998). The most common contaminants in sediments were chromium, copper, lead, mercury, nickel, zinc, chlordane, DDT (dichloro-diphenyl-trichloroethane), PCBs (polychlorinated biphenyls), and PAHs (polycyclic aromatic hydrocarbons). The most commonly detected compounds in fish were chlordane, DDT, DDE (dichloro-diphenyl-dichloroethylene) and PCBs. The highest concentrations are in the southern urban basins in Massachusetts and Connecticut.

The concentrations of PCBs and organochlorine pesticides in the Connecticut River were among the highest found in the country, and exceeded aquatic life criteria at several sites. Although most of these compounds are presently banned, they are very stable and still persist in the environment from applications that occurred prior to the ban. In general, the more chlorine present in a PCB, as there are many forms, the longer it will take to degrade and the more potential harm it may cause organisms.

Not only do PCBs persist in the environment for a long time, they also tend to bio-accumulate and bio-magnify. Pollutants that bioaccumulate are taken up and stored by organisms over time. Bio-magnification occurs when the concentration of these pollutants increase as they are transferred through the food web (i.e., predators have greater concentrations of a particular pollutant than their prey) (EPA 2012). Because of this, there are broad restrictions on eating many fish species, especially bottom-dwelling catfish and carp, from the Connecticut River in Massachusetts and Connecticut due to high PCB levels (MDPH 2011; CDPH 2013). A USGS (1998) investigation also detected a wide variety of pesticides, but concentrations in streams and groundwater were relatively low. Nitrate concentrations in shallow groundwater wells under agricultural areas were usually greater than the national average, with 15 percent (15%) of these wells exceeding the drinking water standards (USGS 1998).

All four states recommend restricting the consumption of resident freshwater fish caught in the watershed due to elevated mercury levels from atmospheric contamination, notably for pregnant and nursing women and small children. Coal contains mercury, and airborne mercury is released in emissions from coal-fired power plants. Rates of mercury deposition are estimated to be higher in the northeastern U.S. relative to other parts of the country. This is widely attributed to the presence of coal-fired power plants in the region, and the airborne transport of mercury on the prevailing winds from power plants outside the region.

### **Soils**

Soil type and distribution in the Connecticut River watershed has an important influence on the distribution of plant communities and wildlife. Soil elements such as calcium, nitrogen, phosphorus, and potassium are the principle nutrients needed by plants. The valley is recognized for its highly diverse soils, including the rich agricultural soils in the lower valley regions of Massachusetts and Connecticut. The watershed contains 221,000 acres of “prime farmland” soils (Clay et al. 2006). As defined by the USDA, prime farmland is farmland that has the best combination of physical and chemical characteristics for producing

food, feed, forage, fiber, and oilseed products, and is also available for those uses (USDHHS 2011).

Due to the variety of bedrock in the watershed and the influence of glaciers, plant growth, climate variation, elevation, wind, and water-borne erosion over millennia, hundreds of soil types exist within four major orders of soils: entisols, histosols, inceptisols, and spodosols. Upland soils are generally well drained and often formed from glacial till. Many soils formed from alluvium on floodplains, and sandy and gravely outwash exist on stream and river terraces. Organic soils are frequent in lowlands and wetlands (Villars 2009).

The variety of soils in the watershed is too extensive to present in this chapter, but examples range from the well-drained, Turnbridge glacial till that supports forests and agriculture in the Green Mountains, to the Cabot glacial till that supports wetlands and agriculture in the Vermont Piedmont, and the Windsor sandy glacial outwash series that supports intensive agricultural development and sand and gravel extraction (Villars 2009, USDA 2013b).

State and county soil surveys are published by the National Cooperative Soil Survey, a joint effort of the USDA, other Federal agencies, State agencies and their agricultural experiment stations, and local agencies. NRCS has leadership for the Federal part of the National Cooperative Soil Survey. These surveys are comprehensive and provide useful information on soils and wildlife habitat (e.g., Connecticut Soil Survey 2014; <http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>; accessed August 2016). NRCS provides detailed soil surveys for soil conservation districts that are aligned with county boundaries. The NRCS “Web Soil Survey” provides access to the largest natural resource information system in the world, and the agency has soil maps and data available online for nearly all of the nation’s counties.

## **Climate**

### *Present Climate*

The climate and seasonality of the Connecticut River Valley play a large role in the terrestrial and aquatic habitats and species that inhabit the valley landscape. Climate indicates a region’s general, seasonal patterns of temperature, precipitation, humidity, wind, and air pressure. The current climate of the Connecticut River watershed is extremely varied and diverse for a variety of reasons. The watershed is influenced by the dynamic confluence of solar radiation, east-northeast moving continental air masses, the Hudson Bay’s polar vortex, jet stream, and moisture from the Atlantic and Gulf of Mexico colliding over the unique geomorphology of the valley.

Hardiness zones are one indicator of long-term climate trends. The USDA determines hardiness zones based on the average annual minimum temperature during a 30-year period. The valley covers seven USDA plant winter hardiness zones, ranging in total from 0°F near Long Island Sound to -35°F in northern New Hampshire. Although hardiness zones are useful guides about the types of plants and animals that may occur in a given area, plants and animals are also adapted to other environmental factors related to climate, such as precipitation, humidity, and wind. Their nesting, spawning, germination, leaf-fall, migrations, and hibernations are all driven by seasonal climate and available light (Maleski 2009, Koch 2009).

The climate varies considerably depending on elevation and distance from the coast. The watershed is subject to frequent, but generally short periods of heavy precipitation because it lies in the path of prevailing westerly winds and cyclonic storms or “nor’easters.” Serious blizzards occur, as witnessed in 1717,



1888, 1969, 1978, and the 1993 “Blizzard of the Century” that blanketed eastern North America. Ice storms occur with regularity. The valley is accustomed to major flood events, as occurred in 1913, 1927, and 1936. The central and lower portions of the valley are exposed to occasional coastal storms, some of tropical origin, that travel up the Atlantic seaboard. The greatest weather disaster ever to hit Long Island and New England was a category 3 hurricane referred to as the 163 mile per hour *Long Island Express* that roared up the Connecticut River valley in 1938 causing extensive damage. Watershed temperature extremes range from a recorded summer high of 105 °F in 1975 to a winter low of -50 °F in 1933. Average annual rainfall is over 40 inches. Average annual snowfall ranges from 40 inches in the lower valley to over 100 inches in the northern watershed (Maleski 2009, Koch 2009).

#### *Climate Change*

Climates are dynamic, although time frames for detectable changes typically are very long. Change is influenced by a number of major factors including the shape of the Earth’s orbit, orientation of the Earth’s tilt or axis, its wobble (precession) around its axis, variation in solar intensity, emissions from volcanic eruptions, and even continental plate tectonics. These climate change “drivers” often trigger additional changes or “feedbacks” within the climate system that can amplify or dampen the climate’s initial response (whether the response is warming or cooling). These drivers include glacial (cold) and interglacial (warm) periods, increases and decreases in the Earth’s solar reflectivity, and changes in global ocean currents. When changes in the Earth’s orbit become more elliptical, it triggers a cold glacial period, and conversely, when the orbit is more circular it promotes a warm (or interglacial) period. Increasing concentrations of carbon dioxide may amplify the warming by enhancing the greenhouse effect. When temperatures become cooler, CO<sub>2</sub> enters the ocean thus minimizing the greenhouse effect and contributes to additional cooling. During at least the last 650,000 years, CO<sub>2</sub> levels have tended to track the glacial cycles (IPCC 2013, Mithen 2003, and USEPA 2013).

There have been irregularities in the transition from the Last Glacial Maximum of 20,000 BC to the present with an abrupt warming around 13,000 BC and then an abrupt cooling around 10,000 BC. Even within the last 2,000 years, there have been irregularities including the warming period from about 900 to 1300 AD and the “Little Ice Age” from 1500 to 1850 AD. These changes can be explained by the interactions of the influences mentioned above. However, there is now sufficient evidence to unequivocally support the scientific consensus that manmade pollutants are warming the climate. Recent, historically unprecedented levels of greenhouse gases are being released into the atmosphere, largely from the combustion of fossil fuels, exacerbating the influences noted above, anthropogenically raising average global temperatures and causing changes in the global climate due to a stronger greenhouse effect. Predicted changes for the northeast, like less snow cover, more frequent large rain events, and more frequent fall droughts, could negatively affect native plants and wildlife (IPCC 2013, Mithen 2003, and USEPA 2013).

Between 1895 and 2011, temperatures in the Northeast increased by almost 2°F (0.16°F per decade), and precipitation increased by approximately five inches, or more than 10% (0.4 inches per decade). Coastal flooding has increased due to a rise in sea level of approximately 1 foot since 1900 (Horton et al. 2014). This increase has sped up in recent decades. Since 1970, the average annual temperature has increased 0.5°F per decade (Frumhoff et al. 2007). Winters have been warming even faster, by 1.3°F per decade from 1970 to 2000. If heavy reliance on fossil fuels continues and heat-trapping emissions remain high, average temperatures in the Northeast are projected to rise 8°F to 12°F above

historical levels in winter and 6°F to 14°F above historical levels in summer by 2100. This projection is reduced by roughly half, if present energy sources are rapidly replaced with more renewable sources that minimize the carbon footprint and energy-efficient technologies are implemented. On the higher-emissions trajectory, summers in New Hampshire may resemble those currently experienced in the Piedmont region of Virginia and North Carolina by 2100 (Frumhoff et al. 2007).

Climatic changes are expected to alter current precipitation patterns. Winter precipitation is projected to increase and to fall more as rain than snow. Rainfall intensity is expected to increase, with more frequent periods of heavy rainfall. More storms are expected to travel further up the eastern seaboard. Rising temperatures are expected to increase evaporation rates and reduce soil moisture, leading to more frequent short-term droughts in the summer and fall (Frumhoff et al. 2007, IPCC 2013). Data available from the northeast from 1900 to 2001 show an average growing season of 190 days in the early to mid-1990s, but this has since increased to a 200-day growing season (Koch 2009). Earlier emergence of plants in spring has the potential to disrupt phenological relationships of plants and animals. For example, insect emergence synchronized to flower blooming may occur before spring migrating birds arrive, thereby diminishing a critical food source (Horton et al. 2014).

Climate scientists caution that “continued warming, and more extensive climate-related changes to come could dramatically alter the region’s economy, landscape, character, and quality of life” (Frumhoff et al. 2007). Climate change is projected to alter the character of the region’s forests over the coming century. Northern hardwood and boreal spruce-fir forests, which now characterize New England forests, could retreat north, and be replaced with forest communities that are common today in southern New England and/or the Mid-Atlantic states. The impacts on wildlife and fish communities, as we know them today, could be

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profound. Such a shift could lead to losses of species that depend on northern forest types, like Bicknell's thrush, snowshoe hare, and Canada lynx. Northern hardwoods (American beech, yellow birch, and sugar maple) may persist, but the optimal climate zone may shift northward 350 to 500 miles. The long-term survival of fish, wildlife, and plant species that are closely adapted to their environment and are highly sensitive to climate change or have low adaptive capacity survival is at risk if they are unable to adapt to a changing climate and its effects on habitat. This is compounded by existing stressors such as invasive species and air and water pollution. There is an urgent need to manage preemptively to better enable species and habitats to adapt (Frumhoff et al. 2007, NFWPCAP 2012).

Analysis of breeding bird survey data over a 26-year period shows a northward range expansion (9 of 27 species studied), with an average shift of about 1.46 miles per year (2.35 kilometers per year). No significant shift to the south was observed (Burns 2008). Trout habitat may shrink 50 to 100 percent (50-100%) by next century; hemlock woolly adelgid will steadily move north thereby removing hemlocks and reducing shade that moderates stream temperatures, among other impacts; and the range and incidence of vector-borne illnesses such as Lyme disease will expand as insect vectors move north and winter temperatures increase. Changes in fall temperatures could affect the timing and vibrancy of the fall leaf colors, an important tourism feature of the region. "Southern" invasive species such as kudzu vine may expand its range northward (Frumhoff et al. 2007, Horton et al. 2014). Only a third of current national wildlife refuges in the Northeast Region will be in same biome by 2100 (Inkley 2008).

Greater winter rainfall and earlier snow melt may lead to higher flow levels and flooding during spring run-off (Hayhoe et al. 2007). In contrast, summer low-flow periods may extend impacting riparian habitats and in-stream fish, wildlife and invertebrate populations (Koch 2009). Aquatic and riparian species will need to adapt to these changes rapidly, or they may experience population declines. Replacement of some species by more southerly species is predicted. Warmer waters in Long Island Sound may exacerbate shellfish diseases, harmful algae blooms, and the duration and frequency of hypoxia and anoxia, as well as interfere with temperature-regulated fish migrations (Frumhoff et al. 2007).

If global temperatures rise as projected by high-emissions scenarios, glaciers and sea ice will melt, raising sea levels by 1 to 4 feet (Horton et al. 2007). Sea level could rise as much as 20 feet over the next few centuries if the major Greenland and West Antarctic ice sheets melt (Frumhoff et al. 2007). The extensive marshes in the lower Connecticut River are probably at risk, first from salt regime changes as the precipitation patterns change, and second, as they are submerged by rising sea levels. Many of these marshes are surrounded by suburban infrastructure or steep banks, and cannot therefore "emigrate" as might have occurred historically during periods of climatic fluctuations (Hoover et al. 2010, Pardo and Whelchel 2013, Ryan and Whelchel 2015).

### **Air Quality**

Local air quality affects our daily lives, and like the weather changes from day to day. Polluted air can impact wildlife and vegetation; cause acidification of water; degrade habitats; accelerate weathering of buildings and other facilities; and impair visibility. Ground-level ozone and airborne particles are two air pollutants that pose a threat to human health. Emissions from industrial facilities and electric utilities, motor vehicle exhaust, gasoline vapors, and chemical solvents

are some of the major sources of nitrogen oxides and volatile organic compounds, components of smog. The southern portion of the watershed supports a large urban environment that often contributes to poor air quality. Similarly, there is a constant concern for the effects of toxic air emissions on the health of wildlife and their habitats (USEPA 2012b, USFWS 2013c).

General air quality trends based upon state and county Air Quality Index (AQI) information (<https://www.epa.gov/outdoor-air-quality-data/>; accessed November 2016) show that air quality has improved in the Connecticut River valley since 1980. Air quality has historically been better in the less urbanized northern half of the watershed. The number of days rated Unhealthy or Very Unhealthy by the EPA has declined significantly since 1980, the earliest date of measurements in this dataset, and have become rare in recent years (Table 3.3).

**Table 3.3. Annual Number of Unhealthy or Very Unhealthy Days<sup>1</sup> by State Counties substantially within the Connecticut River Watershed (based upon Air Quality Index (AQI). Dashes (—) indicate no data reported for that location.**

State/County	1980	1985	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015
<b>Connecticut</b>												
Hartford	32	2	6	8	2	5	1	1	1	1	0	0
Middlesex	38	17	6	11	4	6	1	3	2	2	1	0
New Haven	35	18	15	12	6	8	0	6	7	3	0	3
<b>Massachusetts</b>												
Franklin	5	—	—	—	—	—	—	—	—	—	0	0
Hamden	15	22	9	8	1	6	1	2	0	0	0	0
Hampshire	—	13	16	7	2	7	1	0	0	0	0	0
<b>Vermont</b>												
Essex	—	—	—	—	—	—	—	—	—	—	—	—
Caledonia	—	—	—	—	—	—	—	—	—	—	—	—
Orange	—	—	—	—	—	—	—	—	—	—	—	—
Windham	—	5	0	0	—	0	—	0	0	0	0	0
Windsor	0	—	—	—	—	—	—	—	—	—	—	—
<b>New Hampshire</b>												
Cheshire	—	3	0	0	1	0	0	0	0	0	0	1
Coos	89	6	12	2	0	0	0	0	0	0	0	0
Grafton	—	—	—	—	0	0	0	0	0	0	0	0
Sullivan	—	—	0	0	1	0	—	—	—	—	—	—

<sup>1</sup> EPA calculates the AQI for five major air pollutants regulated by the Clean Air Act: ground-level ozone, particle pollution (also known as particulate matter), carbon monoxide, sulfur dioxide, and nitrogen dioxide. Air Quality Index is an indicator of overall air quality, because it takes into account all of the criteria air pollutants measured within a geographic area. The AQI is categorized into Good, Moderate, Unhealthy for Sensitive Groups, Unhealthy, and Very Unhealthy.

Ryan Hagerly/USFWS



Lady slippers

The Clean Air Act (CAA) of 1970, as amended, requires the EPA to set and regulate National Ambient Air Quality Standards (NAAQS) for six common air pollutants (42 USC Chapter 85). These six air pollutants are found all throughout the U.S., and include ozone, particulate matter, carbon monoxide, nitrogen oxides, sulfur dioxide, and lead, as well as other hazardous air pollutants, such as mercury (USEPA 2016a). Pursuant to the CAA, the Service has an affirmative responsibility to protect air quality related values on national wildlife refuges, with special emphasis on Class I Wilderness Areas (i.e., more than 5,000 acres formally designated as Wilderness prior to August, 1977). As noted earlier, there is no designated wilderness administered by the refuge; however, there are wilderness areas in the nearby White Mountain National Forest and the Green Mountain National Forest (note: the majority of these wilderness areas lie outside of the Connecticut River watershed). All other clean air regions are designated Class II areas with moderate pollution increases allowed (unless an area is redesignated by a state or Tribe).

Under the CAA, any area that violates national ambient air quality standards for any of the six criteria pollutants is designated as a “non-attainment area.” Activities that emit significant

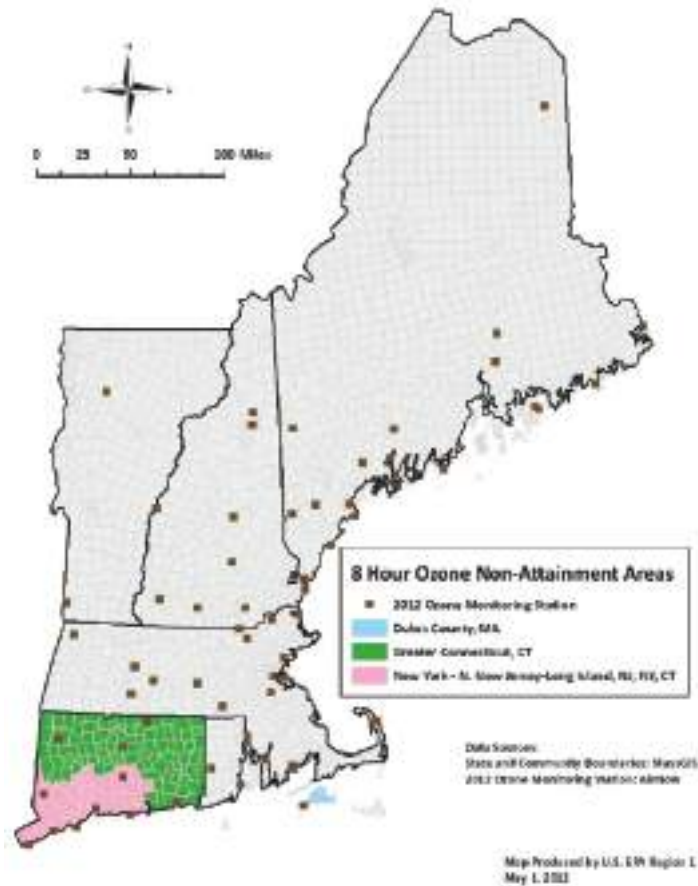
levels of criteria pollutants in a non-attainment or maintenance area are subject to control, and the Service and any other Federal agency must demonstrate that their actions (e.g., prescribed burning) will not impede the state implementation plans to attain or maintain the ambient air quality standard.

In 2008, the EPA set a NAAQS for ground-level ozone at 0.075 parts per million (ppm)<sup>1</sup>, averaged over eight hours. In New England, the states operate a network of 60 ozone monitoring stations during the ozone season (i.e., April 1 through September 30). Figure 3.1 below shows the 8-hour ozone non-attainment (failure to meet) areas for New England. The portions of Massachusetts within the Conte Refuge, and all of New Hampshire and Vermont, had met the 2008 standards as of 2012. However, all counties in Connecticut have been designated as non-attainment—marginal (USEPA 2012c). In 2015, EPA revised the primary and secondary ozone standard levels down to 0.070 ppm, averaged over eight hours (<https://www.gpo.gov/fdsys/pkg/FR-2015-10-26/pdf/2015-26594.pdf>; accessed November 2016). Measurements taken from 2012-2014 indicated that the portions of Connecticut that overlap the Conte Refuge continue to be in non-attainment, as is Hampshire County, Massachusetts, which entirely overlaps the Conte Refuge. The EPA projects that most of this area, with the exception of southwestern Connecticut, will be in compliance with the revised standards by 2025 (<https://>

<sup>1</sup>Based upon a required review of air quality standards every 5 years, EPA issued revisions to the ozone standard in 2008 to 0.075 ppm; however, EPA has not designated areas for this standard as nonattainment. In 2009, EPA announced reconsideration of 0.075 standard and is now considering ozone standards (<http://www.epa.gov/glo/actions.html>; accessed December 2014).

[ozoneairqualitystandards.epa.gov/OAR\\_OAQPS/OzoneSliderApp/index.html#](http://ozoneairqualitystandards.epa.gov/OAR_OAQPS/OzoneSliderApp/index.html#); accessed November 2016). States are required to develop implementation plans to attain and maintain the standards, and to specifically outline what actions they will take to meet the ozone standard (e.g., enhanced vehicle inspection programs) (USEPA 2016b).

Figure 3.1. 8 Hour Ozone Non-attainment Areas, 2012 (USEPA 2012c).



## Biological Environment

The Service is legislatively authorized and entrusted to protect and manage a number of natural resources; the most prominent of these “Federal trust” resources are migratory birds, migratory or “interjurisdictional” fish, wetlands, and threatened and endangered species. These resources are protected by Federal law. National Wildlife Refuges are legislatively created and also constitute a Federal trust resource. These Federal trust resources are, in effect, the Service’s legally explicit, manifest priorities. Of particular interest on Conte Refuge are those resources that were legislatively mandated in the Conte Refuge Act to be part of the refuge purposes (see chapter 1). The resources specifically mentioned in the enacting legislation are: Atlantic salmon, American shad, river herring, shortnose sturgeon, bald eagle, peregrine falcon, osprey, and American black ducks; native species of plants, fish, and wildlife and their ecosystems; endangered, threatened, and candidate species; and wetlands and other waters.

Through policy mandates, the Service is also responsible for assisting the conservation of priority State fish and wildlife resources, especially as they occur on national wildlife refuges and management is consistent with respective refuge

purposes. Species of greatest conservation need (GCN) have been identified in each of the Wildlife Action Plans (WAP) for Connecticut (Connecticut Department of Environmental Protection Bureau of Natural Resources 2015), Massachusetts (Massachusetts Department of Fish and Game 2015), Vermont (Vermont Fish and Wildlife Department 2015), and New Hampshire (New Hampshire Game and Fish Department 2015). Almost without exception, the GCN species include those already identified by the Service and are recognized by regional conservations partnerships (e.g., Joint Ventures) as a priority resources of concern. These species are also included in the *NatureServe*

rankings supported by natural heritage programs. The WAPs are comprehensive and readers are directed to those individual plans for further details.

Recognizing the size of this 7.2 million-acre watershed, the biological environment of the Connecticut River Valley is extremely diverse and expansive. The wide range of habitats that occur in the watershed support approximately 140 species of fish, 60 mammals, 250 birds, 20 reptiles, 20 amphibians, 1,500 invertebrates, and more than 3,000 plants (USFWS 1995a). Given these numbers, we are not able to provide an exhaustive review of the flora and fauna in the watershed. There are many sources for a more thorough discussion regarding the habitat needs and geographic distribution of mammals, birds, reptiles and amphibians, and fish and freshwater mussel species in New England.

For more information on birds, refer to the *Atlas of Breeding Birds in Connecticut* (Bevier 1994), the *Atlas of Breeding Birds of Vermont* (Laughlin and Kibbe editors 1985), *Atlas of Breeding Birds in New Hampshire* (1994), *Birds of Massachusetts* (Veit and Petersen 1993), *Online Breeding Bird Atlas of Massachusetts* (<http://www.massaudubon>

[.org/our-conservation-work/wildlife-research-conservation/statewide-bird-monitoring/breeding-bird-atlases/bba2](http://www.massaudubon.org/our-conservation-work/wildlife-research-conservation/statewide-bird-monitoring/breeding-bird-atlases/bba2); accessed August 2016). Other sources include DeGraaf et al. (2005), Bevier (1994), Veit and Peterson (1993).

There are numerous sources for New England taxa, including mussels (Nedeau 2008a, 2008b), amphibians, reptiles, mammals, and birds (Hammerson 2004, DeGraaf and Yamasaki 2001, DeGraaf and Rudis 1986), reptiles, and amphibians (Klemens 1993, Taylor 1993). There are also plant checklists developed by the various states' natural heritage programs (e.g., Dow Cullina et al. 2011 for Massachusetts).

The remainder of this section provides a summary of the general habitat types in the watershed, and highlights the fish, wildlife, and plant species that are a priority for conservation.

### General Habitat Types

Below we describe the general habitat types that occur within the watershed. These habitats types follow the Northeast Terrestrial Habitat Classification System (NETHC) developed by TNC (Gawler 2008). This classification system is also used by the NALCC. NETHC data suggests approximately 80 percent (80%) of the watershed is forested; 7 percent (7%) is in grassland, pasture, or croplands; 9 percent (9%) is developed; 4 percent (4%) is wetland (emergent, shrub-scrub or forested); 2 percent (2%) is shrub-scrub; and 2 percent (2%) is water.

*Black-throated blue warbler*



Bill Dyer



Steve Maslowski/USFWS.

*American black bear*

The remainder of our discussion on habitat types in this section is organized under subheadings that correspond to the general habitat types addressed in our management direction in chapter 4 and in appendix A.

#### *Forested Uplands and Wetlands*

##### **Spruce-fir/Conifer Swamp**

Spruce-fir habitats are associated with cool, moist sites. These habitats are found at both low elevations and montane sites where conditions are suitable. Both occur primarily in Vermont and New Hampshire (Sperduto and Nichols 2004, Thompson and Sorenson 2000). Dominant trees include red spruce, black spruce, and balsam fir. Sites range from well or moderately well drained upland forests to poorly or very poorly drained swamps. These forests are important for several priority species including the Bicknell's thrush (montane), bay-breasted warbler (montane and lowland), and Canada lynx.

Recognition of the importance of these habitats has led multiple agencies to protect and manage this forest type. The Green Mountain National Forest in Vermont and the White Mountain National Forest in New Hampshire both contain substantial acreages of high-elevation spruce-fir habitat. Lowland spruce-fir forests are managed within the Nulhegan Basin, Blueberry Swamp, and Pondicherry Divisions of the Conte Refuge.

##### Hardwood Forest

Hardwood forest communities represent a large matrix community throughout the watershed. They include deciduous-dominated forests, such as northeast interior dry-mesic oak, Central Appalachian dry oak-pine, North Atlantic coastal plain dry hardwood forest, and Laurentian-Acadian northern hardwood forests, as well as mixed wood communities, such as Laurentian-Acadian pine-hemlock-hardwood, Appalachian hemlock-northern hardwood, and northeast coastal interior pine-oak forests.

Deciduous-dominated communities are often associated with moist, loamy, fertile soils and are most common below 2,500 feet elevation on gentle to steep slopes. Soil permeability, aspect, geographic area, as well as other micro and macro conditions influences the growth, abundance, and diversity of deciduous species present, thus leading to a number of sub-community types. Tree species common to this habitat are sugar and red maple, American beech, yellow and white birch, quaking aspen, and to a lesser extent basswood, white ash, and black cherry. As this community transitions into the northern extent of the central hardwood community, oak (red, white, black) and hickory (shagbark, bitternut, and pignut) become more abundant, especially on well drained soils.

Mixed-wood forests are often along transitional zones between deciduous and coniferous dominated habitats, and thus are characterized by plant species and soil properties that stem from both. Most often these are found on either gently sloping benches or plateaus or at higher elevations (2,000 to 2,500 feet), where soils are typically shallow above a restricting pan layer. Localized site conditions and past disturbance creates a considerable amount of variability in species composition. Composition in the northern portion of the Connecticut River



watershed typically consists of sugar and red maple, yellow birch, red spruce, balsam fir, and aspen. Further south in the watershed red oak, red maple, eastern hemlock, and white pine become more abundant.

These forests are important for several priority species including wood thrush, American woodcock, and black-throated blue warbler. As with most large upland communities within the watershed, hardwood forests are not a resource of concern, although a variety of wildlife associated with this habitat are recognized as being in need of conservation efforts. Our understanding of the forest structure within the watershed comes exclusively from a reading of forest history in New England: a legacy of intensive past-use that altered the vegetation structure and composition, landscape patterns, and ongoing ecological dynamics (Cronon 1983; Whitney 1996; Bellemare et al. 2002; Hall et al. 2002). The CCP assumes the forests of the watershed are more homogeneous than those of three centuries earlier, and they include more sprouting and shade-intolerant species and fewer long-lived mature forest tree species (Goodburn and Lorimer 1998; Foster 2000; Cogbill 2002; Bellemare et al. 2002; Abrams 2003). Areas of the watershed also support forests with a simplified age structure where canopy layers, dead and dying trees, and down coarse woody material may be lacking. The list of threats to the health of forests is long, but the occurrence and spread of invasive species and over browsing by ungulates are common themes among the State WAPs.

#### Woodlands (Natural)

This habitat type includes Central Appalachian pine-oak rocky woodland, and alpine glade and woodlands—two habitats uncommon and interspersed throughout the watershed. This habitat type often occurs in isolated pockets within the larger forested landscape. It encompasses open or sparsely wooded hilltops and outcrops or rocky slopes. The vegetation is patchy, with woodland as well as open portions. Pine species are indicative and often are mixed with oak species. Some areas have a fairly well-developed heath shrub layer, others a grass layer. Conditions are dry and nutrient-poor, and many, if not most, sites have a history of fire (Gawler 2008). Woodlands are used by those species present in the surrounding forested landscape such as rufous sided towhee, ruffed grouse, pine warbler, white-throated sparrow, box turtle, white-tailed deer, and others.

#### Hardwood Swamps

Forested swamps occur in large and small patches within and around the larger upland formations throughout the watershed. They occur on terrain with little to no slope, in topographic depressions and sumps, and often in watershed headwater basins. Drainage is typically poor to very poor with seasonal fluctuations varying greatly in areas that stem from stream or lake flooding, and less so where ground water or surface runoff is the primary source. Soils vary from shallow to deep and can be predominately mineral, organic, or muck with occasionally a peat component (Gawler 2008). Hardwood forested swamps vary in their hydrological regimes—from wetlands having standing water for only a small part of the year, to wetlands which are quite wet and have seasonally flooded and/or saturated surfaces for a substantial part of the year.

Forested swamps provide important wildlife habitat; for example, forested wetlands tend to have more total birds as well as more bird species nesting in a given area than upland forested sites (Newton 1988).

Red maple swamps are the most common type of forested wetland in the watershed, reaching their greatest abundance in the southern part of the watershed. Red maple swamps occur in a wide range of settings and provide habitat for a large variety of wetland-dependent species including wood ducks, marbled salamanders, and beaver. Studies have demonstrated that red maple swamps constitute significant habitat for amphibians (Golet et al. 1993).

Hardwood swamps are larger and more common in the southern and central portion of the watershed. Hardwood swamps in the south are often dominated by red maple with a lesser component of swamp white oak, black and green ash, and black gum. Further north, red maple will typically continue to be the dominant species in hardwood swamps, but species such as black ash will become more abundant and warmer climate species such as black gum and green ash less abundant to non-existent in the far northern reaches. In the northern part of the watershed, in the conifer forest region, the wetter areas support spruce–fir and northern white cedar swamps.

#### Pine Barrens and Maritime Forest

Pine barrens occur on sandplains such as outwash plains and stabilized sand dunes. Pitch pine is the usual dominant, and cover may range from closed-canopy forest to (more typically) open woodlands. Red oak, white pine, and gray birch are common associates. A tall-shrub layer of scrub oak and/or dwarf chinkapin oak is commonly present, although portions of some barrens (or occasionally the entire barrens) lack the scrub oak component. A well-developed low-shrub layer is typical, with lowbush blueberry, black huckleberry, and sweet fern characteristic (Gawler 2008).

The Montague sandplains in Massachusetts are recognized as an IBA by Mass Audubon, and consists of a 1,500-acre state wildlife management area managed by the Massachusetts Department of Fisheries and Wildlife. The Plains are an excellent example of an uncommon pine barren that supports habitat for many rare plants and animals. The Montague Plains, located on a large sand delta, formed more than 10,000 years ago when melt water streams from the retreating glaciers emptied into Lake Hitchcock. Four species of grassland birds breed there including grasshopper sparrows.

The structure and species composition within maritime forests are influenced by proximity to marine environments, and include both upland and wetlands. They are subject to salt spray, high winds, dune deposition, sand shifting and blasting, and occasional over-wash during extreme disturbance events. Species range from deciduous hardwoods to pitch pine and Virginia pine (Gawler 2008).

These habitats are uncommon in the watershed, and are being impacted by invasive species and recreational activities. Species such as the golden-winged warbler and Northern harrier use these habitats.

#### Shrub Swamps and Floodplain Forests

*Shrub Swamps:* Shrub swamps are wetlands dominated by woody shrubs. They occur throughout the watershed and are highly variable depending on climate, past disturbance, hydrology, and mineral enrichment. These habitats are typically subject to seasonal flooding and saturated soils. They are often found in transitional zones between marshes and forested wetlands, along pond and lake margins, and along rivers and streams (Gawler 2008, Thompson and Sorenson 2000). They provide habitat for a number of state and Federal resources of concern including rusty blackbird, chestnut-sided warbler, gray catbird, least flycatcher and American woodcock. Concern over degradation of the ecosystems is widely acknowledged. Changes in hydrology from development and the introduction of invasive species are two of the most significant threats.

*Floodplain Forests:* Annual spring high water flows in the Connecticut River valley have created a substantial number of floodplains. In the past, “bulldozing” by ice and large trees floating down river during floods produced naturally disturbed scour areas adjacent to the river channel. However, in areas without constant scouring, floodplains host rich forest habitats. Connecticut River floodplain forests are usually dominated by silver maple,

Blueberries



Ken Sturm/USFWS

Eastern cottonwood, and black willow, with an understory of ostrich fern, wood nettle, and/or false nettle. Historically, American elm was an important constituent before eradication from Dutch elm disease. These riverside forests provide critical nursery habitats (e.g., shade, cover) for some fish and important migratory stopover habitat for many migrating songbirds including wood thrush, yellow warbler, Canada warbler, black-throated blue warbler, black-throated green warbler, black and white warbler, scarlet tanager, ovenbird, yellow-bellied sapsucker, rosebreasted grosbeak and veery (Smith College 2006). These are also important areas for wood duck and rusty blackbird during migration.

Although active flooding has limited development, many of these floodplain forests have been converted to agriculture, and others have been altered by a lack of seasonal flooding. Dams in the upper watershed have changed the flooding regime, reducing the frequency and intensity of large scouring events. Historic floodplains have been cut off by elevated railroad grades that follow the river course and/or by the dikes/levees built around urban areas (e.g., Northampton, West Springfield). Roads are commonly located adjacent to rivers/streams. In both situations, altered site hydrology is thought to negatively affect floodplain vegetation. Invasive plants pose serious threats to floodplain habitats because they often are well adapted to disturbed areas.

TNC collected data and used a number of models to look at floodplain remnants, identify the best quality remaining floodplains for conservation, and identify suitable restoration areas (Anderson et al. 2010). Additional research is underway to better understand the ecology and status of watershed floodplain forests (Marks et al. 2011).

#### *Non-Forested Uplands and Wetlands*

##### Rocky Outcrop

This habitat type includes the Northern Appalachian-Acadian rocky heath outcrop and Laurentian-Acadian calcareous rocky outcrop systems. These systems occur on ridges or summits of bedrock. Vegetation is often patchy; a mosaic of woodlands and open glades predominant. Species may include oaks and conifers, such as white pine and red spruce, and low heath shrubs. Exposure to the elements, bedrock type, and occasional fire are major factors in species composition and open areas (Gawler 2008).

##### Cliff and Talus

Cliff and talus systems occur below treeline at low to mid elevations. The vegetation is patchy and often sparse, punctuated with patches of small trees that may form woodlands in places (Gawler 2008). The type of rock, microclimate, and soil availability from higher elevation sources directly and indirectly influence vegetation within these systems (Thompson et al. 2000). Rock types may include limestone, dolomite, granite, schist, slate or shale which breakdown differently in the environment providing varying levels of nutrients, moisture, ground stabilization, and soil availability. Sun exposure, aspect, elevation, and moisture provide different microclimate conditions affecting vegetation type and growth. These systems provide unique niches for rare and uncommon plants, and habitat for snakes, including the rare

eastern timber rattlesnake, black rat snake and eastern garter snake. Exposed cliffs provide nesting habitat for turkey vultures, ravens, porcupines, and peregrine falcons: a refuge and state species of resource concern.



USFWS

*Peregrine falcon*

### Freshwater Marshes

Freshwater marshes are open wetlands found throughout the watershed. They are dominated by herbaceous vegetation such as sedges, grasses, and cattails with little or no woody vegetation present. Soils are typically a mixture of muck, mineral, and peat and can be seasonally flooded to permanently saturated. Freshwater marshes generally have water at or above the surface throughout the year and are further categorized through a number of factors such as surface water depth and vegetation (Gawler 2008, Thompson and Sorenson 2000).

Freshwater marshes are rich and very productive biological communities. They are identified as having high ecological and functional importance within the state wildlife action plans. Also within these plans, a common concern exists for the health and proliferation of these habitats. Development, invasive species, dredging, and sedimentation are a few of the threats that are damaging these ecosystems.

In the Connecticut River Valley, old oxbows form many of these marshes. Marshes may be shallow or deep, with water levels ranging from a few inches to several feet. Marshes support a variety of emergent plants such as cattails, grasses, and sedges. Some extremely rare plants grow in these freshwater marshes, including the federally endangered northeastern bulrush.

### Peatland

The most commonly recognized peatlands are bogs and fens. These communities occur throughout the watershed in kettle holes, along pond margins, in isolated valley bottoms, and stream headwaters. They are permanently saturated wetlands that can be open or wooded. The characteristic that distinguishes these from other wetlands is the presence of peat soils. Peat is the accumulation of partially decomposed organic material, which accumulates due to water levels being at or near the surface creating anaerobic conditions that slow or halt decomposition of plant material. Bogs typically have deeper peat buildup than fens and are highly acidic and nutrient poor. Fens often receive additional water from ground discharge or inlets, which introduces varied amounts of mineral nutrients (Gawler 2008, Thompson and Sorenson 2000).

Peatlands are ecologically sensitive communities that provide habitat for several rare plant and wildlife species. These communities are recognized by most state and Federal agencies, and non-governmental conservation organizations as areas that are critically important for conservation efforts.

*Bogs:* Bogs are poorly drained acidic wetlands, unconnected to the water table, which form a floating mat of vegetation. Bogs vary from small floating mats along the edges of ponds to peat filled watersheds that may be as deep as 100 feet. Bogs contain unique plant communities specifically adapted to survive on few nutrients. The dominant vegetation is sphagnum moss. Other characteristic plants in bogs include tamarack, black spruce, sweet gale, orchids, and leatherleaf (TNC 1985). Due to their uniqueness and their extreme sensitivity to disturbances, bogs are given the highest priority for protection under New Hampshire State law RSA 483–A.

*Fens:* Fens (calcareous wetlands) are mineral rich with a hydrologic connection to the ground water table. These wetlands support a lush and diverse flora and a number of rare plants (Dowhan and Craig 1976). These calcium rich, low acidic wetlands host various orchids and sedges, particularly calcium loving species such as chestnut colored sedge. Besides protecting these wetlands, it is important to protect the surrounding aquifers as well, so that alkaline rich springs continue to flow through the calcareous wetlands.

### Pasture/Hay/Grassland

In the Connecticut River watershed, pasture, hay, and grasslands are primarily the result of agricultural production activities. Although, historically there was natural grasslands in the region, most likely in major river valley and along the coast, very little natural grassland remains today (Dettmers and Rosenberg 2000). Today, little historic natural grassland remains. Although agricultural lands are not native wildlife habitat; they can serve the needs of many species. Forage lands or pasture, hay fields, open vegetable patches, and sod fields can be valuable to many species of birds, mammals, reptiles and amphibians. Some examples of species include Eastern American toad, Northern leopard frogs, spotted turtles, Eastern hognose snake, turkey vultures, Canada geese, horned lark, American or water pipit, northern harrier, red-tailed hawk, American kestrel, American woodcock, mourning dove, Northern shrike, Northern rough-winged swallow, field sparrow, and Eastern meadowlark, least shrew, Eastern cottontail, Eastern pipistrelle bat, woodchuck, meadow vole, red fox, and striped skunk (DeGraf and Yamasaki 2001).

Currently, agricultural lands occupy roughly 8.5 to 12 percent (8.5-12%) of the watershed's land base, of which one-half to one-third, approximately 229,000 acres, is prime agricultural land. Most of the quality agricultural lands are in the broad Connecticut River Valley of Connecticut and Massachusetts although there is a large, agriculturally based grassland complex in northern New Hampshire. Current estimates suggest that of the overall cropped lands (approximately 229,000 acres), 69 percent (69%) is managed for forage, 6 percent (6%) in vegetable crops, and 3 percent (3%) in Christmas tree farms. The remaining includes corn, tobacco, potatoes, orchards, nurseries, sod, and "miscellaneous other" which is dominated by maple syrup production (Clay et al. 2006).

However, the amount of these habitats are currently declining in the Northeast. During European settlement millions of hectares of forests were cleared for agriculture in the eastern U.S. creating habitat for grassland dependent birds. As agricultural activities declined, open areas dominated by herbaceous vegetation began to convert back to forests, causing a drastic decline in grassland species in the region. Naturally occurring grassland ecosystems were not uncommon in the eastern U.S., but, were found closer to the coast rather than inland (Brennan et al. 2005). These grassland ecosystems have since been impacted by development and fragmentation.

Some level of grassland conservation and, where appropriate, restoration, is warranted based on the historic evidence and the desirability of retaining grassland species (often state-listed) in each state. The Partners in Flight plan for the Southern New England Physiographic region set a broad level goal of protecting 25,000 to 38,000 acres of grassland, to produce 250 breeding pairs of upland sandpipers, 800 pairs of grasshopper sparrows, and 15,000 pairs of bobolinks. In Connecticut, Connecticut Audubon recommended a 5,000-acre network of natural grasslands in patches at least 500 acres in size, 3,500-acre late harvest working hayfields (greater than 25 acre blocks), and giving priority to currently existing grasslands (Comins et al. 2005).

Considerable work has been done to identify grasslands suitable for conservation in New England. However, many potentially suitable lands, such as pastures and hayfields, are increasingly being converted into residential developments. The highest quality habitats for grassland birds in the watershed typically are in conservation areas or airports which delay mowing until the middle of July to allow the ground-nesting birds to fledge their young. The Northeast Grassland Bird Working Group is currently identifying important grassland focus areas within the watershed and for the northeast generally. Some initial work for New Hampshire illustrates four large focus areas occurring near the Connecticut River Valley. In the Massachusetts portion of the watershed there are four

large functional grasslands: Westover Air Reserve Base (approximately 1,600 acres), Barnes Municipal Airport/Air Reserve Base (approximately 500 acres), Massachusetts Audubon Society's Arcadia Sanctuary (approximately 750 acres); and the Fort River farmland area where the Service purchased land that is now the Fort River Division. There are other large areas currently in row crops with grassland potential, such as the Meadows in Northampton, the Honeypot in Hadley, or the area around the Hatfield oxbow in Hadley. Smaller airports in Turners Falls and the Orange Municipal Airport have been managed for grassland birds in the past.

The CTDEEP started a new Grasslands Habitat Conservation Initiative in 2006 aimed at conserving grassland habitat in order to protect critical nesting and breeding grounds for bird and other species (CTDEEP 2006). This initiative was selected as the first major statewide action to be addressed under Connecticut's WAP. Grasslands are a priority identified in this strategy because this habitat is important for 80 bird species in Connecticut, 13 of which are listed under the Connecticut ESA, and several mammal, amphibian, and reptile species and many invertebrate species. In support of the Grassland Habitat Conservation Initiative, the DEEP has committed \$3.2 million for the acquisition of grassland habitat and has set aside an additional \$4.5 million for future acquisitions.

Grasslands in New Hampshire are generally in hay fields, croplands, airports, capped landfills, and military installations. New Hampshire has over 232,000 acres (94,000 hectares) of grassland complexes at least 10 hectare in size, mostly occurring in Grafton County (20 percent (20%)) followed by Merrimack and Coos Counties (13 percent (13%) and 12 percent (12%), respectively). A number of programs exist that protect critical grasslands and farmland from development, including New Hampshire's Land and Community Heritage Investment Program (LCHIP), conservation easements through the New Hampshire Department of Agriculture, and Current Use Advisory Board within the Department of Revenue Administration, for the protection of agriculture and wildlife resources via reduced taxes. At the local level, many municipalities have passed open space bonds to help protect natural resources of local and statewide importance. At the Federal level, the NRCS administers the Farmland Protection Program through the USDA which provides funds to help purchase development rights to keep farmland in agriculture. New Hampshire Fish and Game also recognizes the importance of grassland habitats (NHFG 2006).

#### Old Fields, Shrublands, Young Forest

Old fields and shrublands are typically agricultural lands that are no longer in production. Young forests are generally the result of a recent forest harvest, or from natural disturbances such as, wind, ice, or fire. Beaver flowages are another way these habitats are created and probably contributed 3 to 4 percent (3-4%) to the amount of these habitat types in the Northeast historically (Gotie and Jenks 1982). Utility rights-of-way provide a relatively large and dependable amount of shrublands and early successional forest.

Vegetation may range from herbaceous dominance to a mixture of shrubs and herbaceous species, to shrub dominance. Vegetative composition is influenced by past disturbances (e.g., mowed, plowed, grazed, harvested), soil type and saturation, and seed availability. In the absence of disturbance, this upland habitat tends to be ephemeral, typically succeeding to forest.

The decline of these habitats is a consequence of historic and current land uses (Lorimer 2001, Trani et al. 2001, Brooks 2003). Prior to European colonization, the Northeast was predominately forested with seedling-sapling areas likely comprising only 3 percent (3%) of inland forests (Lorimer and White 2003).

European settlement resulted in widespread clearing of forests for agriculture, timber, and fuelwood (Whitney 1996). Later, as more lands were settled in the Midwest, fossil fuels replaced fuelwood as the primary energy source, and better economic and social opportunities became available in the industrialized cities, the agricultural fields of the northeast were abandoned (Whitney 1996; Lorimer 2001). A period of relatively abundant grassland and shrubland habitat resulted during the early part of the 20th century (Lorimer 2001). Since that time, the amount of these habitats has generally declined, especially in southern New England.

Birds dependent on habitats such as old fields, shrublands, and young forest are experiencing steep population declines over the last decade in the Northeast (ACJV 2008). These include: American woodcock, chestnut-sided warbler, blue-winged warbler, brown thrasher, Eastern towhee, and field sparrow. Other species of conservation concern that rely on these habitats include New England cottontail and snowshoe hare, the hare being the main prey for Canada lynx, a federally listed threatened species.

Conservation of this habitat type has been identified as high priorities for conservation by the Service, state wildlife agencies, and other conservation partners. This urgency has led state, Federal, and non-governmental partners to implement a six-state collaborative shrublands restoration and protection effort. Conservation activities are already in progress, including assistance by numerous agencies and organizations to restore shrublands on private lands, and restoration on existing state and Federal secured lands, including shrubland management on existing national wildlife refuges. This partnership effort has identified a need for additional secured acreage and management capability to meet population and habitat goals.

#### *Inland Aquatic Habitats*

##### Open Water

Open water habitats include rivers, streams, ponds, lakes and associated transitional habitats influenced by fluctuating water levels. Diadromous and indigenous fish, freshwater mussels, mayflies, dragonflies, and amphibians rely on these communities for some stage of their life cycle. These habitats also provide foraging opportunities for other species including waterfowl, herons, egrets, mink, and otter.

*Rivers and Streams:* Many of the rivers and streams within the watershed are influenced by man-made dams and roads. The watershed has 38 flood risk reduction dam projects operated by the USACE, and almost 1,000 small dams on the tributaries that were built to power mills in the 1700s and 1800s. Flows, especially during low flow periods, are highly regulated and restricted by the numerous dams on the river system (Kapala and Brown 2009). Unrestricted free flowing streams, those that flow freely without restrictions from dams and roads, are considered one of 13 imperiled habitats in the State of Connecticut (Metzler and Wagner 1998). According to the Connecticut WAP, nearly all the State's streams have been influenced by dams, and the regulation of discharges and diversions. Segments of Hollenbeck River (South Canaan to Cornwall), Moore Brook (Salisbury), Eight-Mile River (East Haddam, Salem, Lyme), Moodus River (East Haddam), and Natchaug River (Eastford, Chaplin, Mansfield, Windham) provide examples of unrestricted free-flowing stream habitat (CTDEEP Bureau of Natural Resources 2005). The Fort River is the longest free-flowing tributary of the Connecticut River in Massachusetts (town of Amherst 2013). The White River in southern Vermont and several of its tributaries are free-flowing. Waterpower and flood risk reduction dams, land development and the introduction of nonnative

species are affecting water temperatures, migration routes, and the structure and diversity of plant and wildlife communities.



Bill Thompson

Ruddy turnstone

Many fish species rely on specific river and stream habitats within the watershed. Many diadromous fish, such as American shad, blueback herring, and sea lamprey, as well as resident fishes, such as hogchoker, and mummichog use head-of-tide habitat as staging areas critical for spawning and migration. Head-of-tide is the farthest point on a river where the tide from an ocean or bay influences water levels. There is generally a defined maximum point, but may vary due to storm, seasonal and annual precipitation, snow melt, and subsequent water flows. Tides tend to extend farther upriver during summer low-flow periods. The head-of-tide for various rivers within the watershed may be many miles upstream from the Atlantic Ocean, but concentrated toward the southern portion of its region, generally south of Hartford, Connecticut. There are few head-of-tide areas that are truly pristine, as most of these habitats are

adjacent to developed urban areas ([http://library.fws.gov/pubs5/ramsar/web\\_link/area.htm#Salinity Distribution](http://library.fws.gov/pubs5/ramsar/web_link/area.htm#Salinity_Distribution); accessed August 2016).

Other species are sensitive to the warmer temperatures in the southern portion of the watershed. Species such as Eastern brook trout, slimy sculpin, white sucker, common shiner, longnose dace, and blacknose dace rely on cold water habitats. These streams are fed by small headwater streams, surface springs, or seeps, and flow rapidly over gravel or cobble substrate. Upland forest communities are often adjacent to the channel, where shade from the forest canopy help to maintain suitable and stable water temperatures (CTDEEP 2005).

Cold water streams are found throughout the watershed, though a higher concentration is found in the northern and central portions of the region due to higher elevations. Cold water streams are sensitive areas that are impacted by development and forest fragmentation (CTDEEP 2005).

*Pond and Lakes:* Ponds and lakes are large inland bodies of still water located in basins or low areas, and are often fed or drained by a river or stream. They provide habitat for a diversity of aquatic dependent species, as well as foraging habitat for birds and mammals, including osprey, bald eagles, waterfowl, herons, mink, and otter. Lakes and ponds within the watershed include those created during the glacial period, and man-made reservoirs that provide drinking water, energy production, recreational opportunities and flood risk reduction.

#### *Coastal Non-forested Uplands*

##### Dunes and Maritime Grasslands

These habitats include the Atlantic coastal plain northern dune and maritime grassland, and heathland and grassland. These systems occur along the coast of Connecticut, and are dominated by grasses and shrubs. The dune and maritime grassland communities are predominately herbaceous, with shrublands, resulting from succession from grasslands, occurring in limited areas. Both upland and non-flooded wetland vegetation are also included in this system. Small patches of natural woodland may also be present. Dominant ecological processes are those associated with the maritime environment, including frequent salt spray, saltwater overwash, and sand movement (Gawler 2008).



The coastal plain heathland and grassland communities may occur as heathlands, grasslands, or support a patchwork of grass and shrub vegetation. This system is related to dune grasslands but occurs on sandplains, not dunes, and lacks significant amounts of American beachgrass. In the absence of disturbance (fire, grazing, mowing), coverage by pitch pine and scrub oak can increase, creating vegetation similar to a pitch pine-scrub oak barren; or in some cases, a tall-shrub community can develop in the absence of fire (Gawler 2008).

Coastal dune communities are fragile habitats that support priority species in need of protection from human development and disturbances. Barrier beaches protect salt marsh from storms and provide nesting and feeding habitat for piping plovers, least terns, and American oystercatchers. The most challenging issues facing dune habitat are recreational activities, oil spills, and rising sea level resulting from climate change.

#### Rocky Coast and Islands

This system encompasses coastal non-forested uplands in the watershed, and can be found at the mouth of the Connecticut River, and inland as far as the Whalebone Cove CFA in Connecticut. It is often a narrow zone between the high tide line and the upland forest; this zone becomes wider with increasing maritime influence. The substrate is rock, sometimes with a shallow soil layer, and tree growth is prevented by extreme exposure to wind, salt spray, and fog. Slope varies from flat rock to cliffs. Cover is patchy shrubs, dwarf-shrubs and sparse non-woody vegetation, sometimes with a few stunted trees (Gawler 2008).

#### *Coastal Wetlands and Aquatic Habitats*

##### Salt marsh

The name Connecticut is the French corruption of the Algonquin word *quinetucket* and means long tidal river. The second largest group of wetlands in the watershed is estuarine wetlands or tidal wetlands which are located in the lower part of the main stem of the Connecticut River. Estuarine wetlands are influenced by both tidal and freshwater flows. The lower part of the Connecticut River is considered the most pristine large river tidal marsh system in the Northeast (USFWS 1994). The wetlands at the mouth of the Connecticut River are intertidal marshes vegetated by grasses such as smooth cordgrass, saltmeadow cordgrass or hay grass, salt or spike grass, saltmeadow rush or black grass, and other salt tolerant plants. Salt marshes are among the most productive ecosystems in the world.

Further upstream, the Connecticut River has extensive, high-quality freshwater and brackish tidal wetland systems which provide habitat for several federally listed species, species at risk and globally rare species, including wintering bald eagles, shortnose sturgeon, and Puritan tiger beetles. This area also provides significant American black duck habitat for breeding, wintering, and migration. It serves as an important movement corridor for migratory birds, especially waterfowl, rails, many species of neotropical migrants, and raptors. Within this group of wetlands, wild rice marshes are considered rare and valuable and function as significant resting and feeding areas for waterfowl, shorebirds, and especially the sora rail.

The lower Connecticut River tidal wetlands complex has been designated a Wetland of International Importance by the multi-national Convention on Wetlands of International Importance (aka Ramsar Convention). The Ramsar project area contains 20,570 acres and consists of 20 discrete major wetland complexes (USFWS 1994). The Ramsar designation is used for wetland complexes that have international significance in terms of ecology, botany, zoology, limnology, or hydrology. The lower Connecticut River tidal wetlands complex is considered the best example of this type in the northeastern U.S.

Tidal wetlands provide foraging habitat for a variety of shorebirds, including willet, various species of sandpipers, ruddy turnstone, red knot, and whimbrel. These wetlands also support migrating and wintering waterfowl, various marsh birds, sparrows, bald eagles and osprey. Its tidal marshes and mudflats support significant concentrations of waterfowl and shorebirds, as well as nesting habitat for globally significant species such as the salt marsh sharp-tailed sparrow (ACJV 2005). This habitat is also important as nursery areas for a variety of aquatic species.

*Plant Communities*

Many different plant communities exist in the watershed, including common types of wetlands, forests, and grasslands, as well as a number of rare communities. There are roughly 3,000 plant species in the watershed. There are many rare natural plant communities that are tracked by the state natural heritage programs. Wetland plant communities are diverse and widely occurring. Upland forests are the dominant land cover type and are increasing as abandoned agricultural lands revert to forest cover. A number of non-forested, or open plant communities occur in the watershed such as grasslands, shrublands, and unique or rare uplands types.

Natural communities were used as the basis for the habitat types discussed below. Natural communities are defined as recurring assemblages of interacting plants, animals, their physical environment, and the natural processes that affect them (Sperduto and Nichols 2004, Thompson and Sorenson 2000).

Wetland Plant Communities

Restoring and maintaining the integrity of wetlands and other waters is one of the purposes in the Conte Refuge Act. The watershed contains many diverse types of wetlands whose plant and soil characteristics reflect the geomorphology and hydrology of the area. Descriptions of wetlands, in general, are grouped into easily recognized types: coastal/tidal (estuarine); rivers and streams (riverine); lakes and large ponds (lacustrine); and vegetated freshwater wetlands (palustrine). Each of these types contains a number of subtypes.

According to the Service’s National Wetlands Inventory (NWI), the watershed contains approximately 320,000 acres of wetlands (table 3.4), which represents 4.5 percent (4.5%) of the land in the watershed (USFWS 2016). The NWI figures should be considered conservative (i.e. more likely to overcount wetlands than undercount them) because mapping followed a standardized, nationwide process. NWI maps do not identify farmed wetlands, except cranberry bogs.

**Table 3.4. Estimated Amount of Wetlands in Connecticut River Watershed by State.**

State	Acres of Wetland Type in Each State within the Connecticut River watershed <sup>1</sup>				Total Wetland Acres in watersheds for Each State
	Palustrine Wetlands	Lacustrine Wetlands	Riverine Wetlands	Estuarine Wetlands	
Connecticut	60,932	1,304	658	2,733	65,627
Massachusetts	109,202	2,466	2,730	0	114,398
Vermont	65,434	299	1,392	0	67,125
New Hampshire	66,097	481	6,925	0	73,503
Wetland Type Totals	301,665	4,550	11,705	2,733	320,653

<sup>1</sup>Source is National Wetlands Inventory (USFWS 2016)

### Trends in Wetlands Plant Communities

Unfortunately, significant portion of the wetlands in the watershed have already been destroyed or degraded. Although the conversion and loss rates have been reduced due to the increased effectiveness of state and Federal regulations, incremental losses continue to occur due to exempted filling and those permits which are granted under the Section 404 provisions of the Federal Clean Water Act. Some states also regulate activities affecting wetlands that are not covered by the Clean Water Act, Section 404 program. A net loss of wetlands in both quantity and functional quality is anticipated to continue, although at lower rates than occurred historically.

*Connecticut:* Palustrine wetlands are by far the most common wetland type in the State, followed by estuarine wetlands; together, they constitute about 99 percent (99%), by area, of the State's wetlands. The combined area of lacustrine and riverine wetlands makes up the remaining 1 percent of wetland acreage. Palustrine forested wetlands constitute 54 percent (54%) of the State's wetlands and consist primarily of red maple swamps with some evergreen forested wetlands (Metzler and Tiner 1992, USGS 1996).

Although Connecticut has a strong wetland regulatory program, experts estimated that 1,200 to 1,500 acres of inland wetland will be filled each year. Commercial development and highway/road construction are the most significant causes of wetland loss. Also, there are losses due to golf courses and home construction. Another serious threat to wetlands is the discharge of materials (i.e., direct discharges of industrial and municipal waste and indirect discharges of urban and agricultural runoff) into waters and wetlands which degrades water quality and functional value for wildlife habitat. The most threatened wetlands are located close to urban areas. Large acreage of floodplain wetlands have been filled and/or diked for industrial and commercial development along the Connecticut River in Hartford and East Hartford. With a substantial increase in development activity and land values, impacts to wetlands are not likely to decrease in the near future. (USGS 1996, Metzler and Tiner 1992).

There is some disagreement on the original acreage of wetlands within Connecticut. Some estimate that the state has lost 74 percent (74%) of its original wetlands, while others believe losses in the range of 30 to 50 percent (30-50%) are more realistic. The CTDEEP estimates losses of 40 to 50 percent (40-50%) for freshwater wetlands and 65 percent (65%) for coastal wetlands (Metzler and Tiner 1992, USGS 1996).

Tiner et al. (1989) completed a wetland trend analysis for central Connecticut comparing 1980 aerial photos with 1985 to 1986 photos. The study area covered 780 square miles and contained 28,177 acres of wetland (6 percent (6%) of the area). Vegetated wetlands were the most abundant type (91 percent (91%)). A total of 117 acres of vegetated wetlands were converted to non-wetlands and 28 acres were made into ponds. Palustrine emergent wetlands (59 acres) and forested wetlands (53 acres) experienced the biggest losses.

In 2013 the Service updated and enhanced the 1980s inventory and completed an assessment of wetland trends between 1990 and 2010. The method of analysis was a comparison of digital imagery covering the entire state, from 1990 and from 2010. (Tiner et al. 2013). The researchers concluded that between 1990 and 2010, Connecticut experienced a net gain of 425 acres in wetlands, due to pond construction across the state. Despite this gain, the state had a net loss of 273 acres of freshwater

vegetated wetlands plus a net loss of about 28 acres of estuarine wetlands. The new ponds are artificial or created wetlands, while marshes, swamps, and bogs are natural wetlands that developed over the past 12,000 years. Forested wetlands experienced the heaviest losses with roughly 314 acres converted to other wetlands (201 acres) or nonwetland (113 acres). Residential development was the most common source of loss of forested wetlands.

*Massachusetts:* Historically, Massachusetts wetlands may have extended across as much as 16.5 percent (16.5%) of the state. This estimate is based on an estimate of hydric (wet) soils, which can persist after wetland vegetation is lost. The NWI estimate of Massachusetts wetlands as shown in Table 3.4 above comprises only about 2 percent (2%) of the state. This implies that Massachusetts has lost a large majority of its original wetlands. Palustrine wetlands are the most common wetland type in the State, followed by estuarine and marine



John White /USFWS

*River otter*

wetlands; all together, they constitute about 99 percent (99%), by area, of the State's wetlands. The combined area of lacustrine and riverine wetlands makes up the remaining less than 1 percent (1%) of wetland acreage.

A 1978 U.S. Soil Conservation Service (now National Resources Conservation Service) report estimated an annual statewide wetland loss rate of 0.4 percent (0.4%; lower than the U.S. average loss rate of 0.5 to 1.0 percent (0.5-1.0%) in the mid 1970s). In recent years the rate of loss has slowed dramatically. The 0.4% loss rate from 1978, applied conservatively to the existing acreage, would imply a loss of hundreds of acres of wetlands annually. Instead, approximately 1,250 acres of wetlands were lost or altered between 1991 and 2005 (<http://www.mass.gov/eea/agencies/massdep/water/watersheds/wetlands-loss-maps-qa.html>, accessed November 2016).

*Vermont:* Recent estimates of the area covered by wetlands in Vermont range from 4 to 6 percent (4-6%) of the State's total area. Many of the State's wetlands are small; about 80 percent are less than 10 acres. The largest wetlands are in the broad valleys of northeastern Vermont and in the flood plains and deltas of rivers that discharge into Lake Champlain. In the Connecticut River Valley, timber harvesting and the clearing and draining of wetlands for crops and grazing resulted in the degradation or loss of many wetlands during the 1800s and early 1900s. Prior to 1990, annual wetland losses were approximately 200 acres (USGS 1996, VT DFPR 2012). Since 1995, the rate of regulated wetland loss in Vermont has been 20 acres annually. In addition, there is likely a similar amount of unregulated wetlands that are lost each year (<http://vnrc.org/programs/water/wetlands/>, accessed November 2016).

Overall, the state has lost as much as 35 percent (35%) of its original wetland acreage. Approximately half of the wetlands lost have been

palustrine emergent marshes. In Vermont, road construction, residential and commercial development, as well as the draining of wetlands for agricultural production, account for the majority of the loss. (Parsons 1988, VT DFPR 2012, USGS 1996). *New Hampshire*: The New Hampshire Wetlands Priority Conservation Plan (State of New Hampshire Office of State Planning 1989) lists agriculture as the major cause of freshwater wetland losses. Development in and near wetlands due to urbanization is also a major cause of wetland loss and degradation (USGS 1996). Wetlands have been drained for timber cutting, and ditched and drained for hay, grain, forage, and vegetable crops. Inland wetlands have been lost to road and highway construction, building construction, and peat and mineral/gravel mining. Moreover, the quality of many existing wetlands has been reduced by adverse environmental impacts, developmental pressures, and improper land use management practices (State of New Hampshire Office of State Planning 1989, USGS 1996).

A study of New Hampshire's wetlands from 1997 to 2012 shows a decline in the average acreage of wetlands lost annually. From 2007 to 2012, losses averaged 59 acres per year. This compares to an average wetland lost of 111 acres for the period 1997-2007. The cumulative loss recorded from 1997-2012 is just over 1,600 acres from projects permitted by the State. During this same time period, more than 28,000 acres of wetlands and upland habitat have been protected through wetland mitigation and conservation.

#### *Special Designation Areas*

Refuge lands often have areas subject to special management. Special management status may arise from legislation, administrative decision making, or the actions of other agencies and organizations. The influence that special designations have on the management of refuge lands and waters varies considerably. Authority for designation of some special management area types (e.g., Research Natural Areas) on refuges lies solely with the Service. Wilderness designations are passed only by Congress (USFWS 2013b).

#### *Wilderness Areas*

Wilderness is set aside by Congress to be part of the NWPS. There are over 109 million acres of wilderness across the U.S. managed by several agencies: National Park Service, Bureau of Land Management, Forest Service, and Fish and Wildlife Service. The Service manages over 20 million acres of wilderness. Generally, this designation means that special rules direct management to maintain or achieve an area's wilderness character. For example, motorized and mechanized equipment for transport, management, or recreation are not allowed. The Wilderness Act of 1964 defines wilderness in this way: "A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammelled by man, where man himself is a visitor who does not remain .... retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable...has outstanding opportunities for solitude or a primitive and unconfined type of recreation; ...is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value. The refuge does not, to date, include any areas designated as wilderness. The White Mountain National Forest contains approximately 148,000 acres of congressionally designated wilderness, and the Green Mountain National Forest includes about 58,600 acres of designated wilderness. However, much of these wilderness areas are outside of the Connecticut River watershed.

#### *Wetlands of International Importance*

The lower Connecticut River tidal wetlands complex has been designated a Wetland of International Importance by the Convention on Wetlands of International Importance (Ramsar Convention of 1971). The Ramsar project area contains 20,570 acres and consists of 20 discrete major wetland complexes (USFWS 1994). The Ramsar designation is used for wetland complexes that have international significance in terms of ecology, botany, zoology, limnology, or hydrology. The lower Connecticut River tidal wetlands complex is considered the best example of this type anywhere in the northeastern U.S.

#### *Wild and Scenic Rivers*

The Wild and Scenic Rivers Act, October 2, 1968, stated that: “It is hereby declared to be the policy of the United States that certain selected rivers of the Nation which, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations. The Congress declares that the established national policy of dams and other construction at appropriate sections of the rivers of the United States needs to be complemented by a policy that would preserve other selected rivers or sections thereof in their free-flowing condition to protect the water quality of such rivers and to fulfill other vital national conservation purposes.”

Protection of a designated river is provided through voluntary stewardship by landowners and river users and through regulation and programs of Federal, state, local, or tribal governments. Not all land within boundaries is, or will be, publicly owned, and the Act limits how much land the Federal government is allowed to acquire. The Act purposefully strives to balance dam and other construction at appropriate sections of rivers with permanent protection for some of the countries most outstanding free-flowing rivers. For example, it prohibits Federal support for actions such as the construction of dams or other instream activities. Designation neither prohibits development nor gives the Federal government control over private property. The act specifically:

- Prohibits dams and other federally assisted water resources projects that would adversely affect river values.
- Protects outstanding natural, cultural, or recreational values.
- Ensures water quality is maintained.
- Requires the creation of a comprehensive river management plan that addresses resource protection, development of lands and facilities, user capacities, and other management practices necessary to achieve purposes of the act as of 2012.

The NWSRS protects 12,709 miles of 208 rivers in 40 states and the Commonwealth of Puerto Rico; this is a little more than one quarter of one percent (1%) of the nation’s rivers (<http://www.rivers.gov/national-system.php>; accessed August 2016). Connecticut River tributaries have been designated under the act: 14 miles of the West Branch of the Farmington River in Connecticut; 25.3 miles of the Eightmile River in Connecticut, and 78 miles of the Westfield River in Massachusetts (NWSRS 2013). In recent years, local partners have been controlling invasive plants along these stretches. A study has been completed for the Lower Farmington and Salmon Brook system in Connecticut recommending its designation.

#### *Research Natural Areas*

The Service administratively designates Research Natural Areas (RNAs) on refuges. RNAs are part of a national network of reserved areas under various ownerships, often the Forest Service, National Park Service, Bureau of Land Management, and Fish and Wildlife Service. Research natural areas are intended to represent the full array of North American ecosystems with their biological communities, habitats, natural phenomena, and geological and hydrological formations. In research natural areas, as in designated wilderness, natural processes are allowed to predominate without human intervention. Under certain circumstances, deliberate manipulation may be used to maintain the unique features for which the research natural area was established. Activities such as hiking, bird watching, hunting, fishing, wildlife observation, and photography are permissible, but not mandated. Research natural areas may be closed to all public use if such use is determined to be incompatible with primary refuge purposes (USFWS 2013d).

There are no RNAs on the refuge. The nearby White Mountain National Forest contains 1,995 acres in three RNA units, all of which are outside of the watershed: Alpine Gardens (tundra), Nancy Brook (old growth spruce-fir), and The Bowl (old-growth spruce-hardwood). The Green Mountain National Forest contains one 290-acre unit known as the Cape (mesic northern hardwood) (USDA 2012).

#### *National Natural Landmarks*

The National Natural Landmarks (NNL) Program recognizes and encourages the conservation of outstanding examples of our country's natural history. It is the only natural areas program of national scope that identifies and recognizes the best examples of biological and geological features in both public and private ownership.

NNLs are designated by the Secretary of the Interior, with the owners concurrence. To date, nearly 600 sites have been designated. The National Park Service administers the program, and if requested, assists with the conservation of these important sites. There are 14 designated landmarks in or intersecting the watershed; 5 in New Hampshire, 2 in Vermont; 3 in Massachusetts, and 4 in Connecticut. Two NNLs occur on the refuge. The Pondicherry NNL, lies entirely within the refuge's Pondicherry Division in New Hampshire. We will expand the existing 304-acre Pondicherry NNL by 694 acres (see the "General Refuge Management Direction" section in chapter 4). At 505 acres, the Fannie Stebbins NNL overlays the refuge's 98-acre Fannie Stebbins Unit in Massachusetts.

#### *National Trails*

The National Trails System Act (P.L. 90-543, as amended through P.L. 109-418, December 21, 2006) was passed: "In order to provide for the ever-increasing outdoor recreation needs of an expanding population and in order to promote the preservation of, public access to, travel within, and enjoyment and appreciation of the open-air, outdoor areas and historic resources of the Nation, trails should be established primarily, near the urban areas of the Nation, and secondarily, within scenic areas and along historic travel routes of the Nation which are often more remotely located. The purpose of this Act is to provide the means for attaining these objectives by instituting a national system of recreation, scenic and historic trails, by designating the Appalachian Trail and the Pacific Crest Trail as the initial components of that system, and by prescribing the methods by which, and standards according to which, additional components may be added to the system." The Appalachian Trail is a National Trail that passes through the watershed. The Little Cherry Pond and Mud Pond trails on the refuge's Pondicherry Division were established as a National Recreational Trail in 2006 and 2013, respectively. The Little Cherry Pond Trail is a one-mile loop that winds through six different forest communities with a view of the pond from its shore.

The Mud Pond Trail is a 0.6-mile universally accessible trail with 900 feet of raised boardwalk and rest stops that offer views of the boreal forest and wetland communities. Visitors walk through a forest to a beautiful pond and a boreal forest fen where three carnivorous plant species reside.

#### *Important Bird Areas*

The IBA of the National Audubon Society is a global effort to identify and conserve areas that are vital to birds and other biodiversity. By working with Audubon chapters, landowners, public agencies, community groups, and other non-profits, National Audubon endeavors to interest and activate a broad network of supporters to ensure that all IBAs are properly managed and conserved (Audubon 2013). IBAs are sites that provide essential habitat for one or more species of bird. IBAs include sites for breeding, wintering, and/or migration. IBAs may be a few acres or thousands of acres, but usually are discrete sites that stand out from the surrounding landscape. IBAs may include public or private lands, or both, and they may be protected or unprotected.

To qualify as an IBA, sites must satisfy at least one of the following:

- (1) Species of conservation concern (e.g., threatened and endangered species).
- (2) Species with restricted ranges (i.e., species vulnerable because they are not widely distributed).
- (3) Species that are vulnerable because their populations are concentrated in one general habitat type or biome.
- (4) Species, or groups of similar species (such as waterfowl or shorebirds), that are vulnerable because they occur at high densities due to their tendency to congregate (Audubon 2013).

There are 11 recognized IBAs areas in the Connecticut River watershed. More information on each IBA can be found at each state's Audubon website (<http://nhbirdrecords.org/bird-conservation/nh-iba-program/about-new-hampshires-important-bird-area-iba-program/>; <http://ct.audubon.org/conservation/important-bird-areas>; <http://vt.audubon.org/conservation/important-bird-areas-vermont>; <http://www.massaudubon.org/our-conservation-work/wildlife-research-conservation/statewide-bird-monitoring/massachusetts-important-bird-areas-iba/important-bird-area-sites>; all accessed August 2016).

- (1) Pondicherry Basin IBA, which includes the Pondicherry Division, is a low elevation wetland complex featuring black spruce, tamarack, balsam fir, balsam poplar, red maple and a variety of wetland plant communities. The IBA supports populations of species such as Rusty Blackbird, Yellow-bellied Flycatcher, Lincoln's Sparrow, and several warblers. Emergent wetlands provide habitat for Virginia rail, American bittern, and the occasional sora or pied-billed grebe. Other forest types at higher elevations support hardwood species like veery and early successional species like American woodcock and chestnut-sided warbler. Extensive grasslands associated with an airport within the IBA boundary are used by bobolinks and northern harriers. The area is also home to seven species of breeding waterfowl, and as such is one of the more diverse assemblages of this group in New Hampshire.
- (2) The Lower Connecticut Valley IBA stretches from the northern Massachusetts border up river to the vicinity of Claremont, New Hampshire. This area is used by a wide variety of waterfowl in migration and winter and supports nesting



pairs of bald eagles. Important habitats include floodplain forests, emergent wetlands, and agricultural fields. The IBA boundary is defined as roughly 200 feet above the average river level, which covers an area roughly corresponding to the lower river terrace.

- (3) The Northwest Park IBA in Windsor, Connecticut, is located along the Farmington River and has successional habitat with forest, wetland, shrub, and fields. Of the 128 bird species recorded, 59 are considered high-conservation priorities. The majority of these are associated with actively managed early successional forest, grasslands, and shublands, including the State-endangered grasshopper sparrow (Davison 2007).
- (4) The Station 43 Marsh IBA in South Windsor, Connecticut, consists of a pond and associated fresh water wetland complex. It is situated in the Connecticut River floodplain in a large undeveloped block of several thousand acres of farmland, shrubland and floodplain forest on both sides of the river. Over 200 bird species have been recorded on the IBA with 9 of those listed as State-endangered, 7 as State-threatened, and 10 of special concern (Morrison 2006).
- (5) Herricks Cove IBA consists of two parcels of about equal size in the town of Rockingham, Vermont. Herricks Cove is located where the Williams River enters the Connecticut River north of Bellows Falls. It consists primarily of agricultural lands bordered by wetlands to the west and floodplain forest to the south. The location along the Connecticut River and the diversity of habitats make this IBA ideal stopover habitat for migrating birds. At least 221 species have been recorded there including several priority marsh birds (e.g., pied-billed grebe, American bittern, sora, and Virginia rails) (<http://netapp.audubon.org/iba/Reports/1754>; accessed August 2016).
- (6) The Nulhegan Basin IBA is Vermont's largest IBA comprising a mosaic of forest and wetland habitat types. The predominance of boreal habitats is typical of forest found further to the north and as such supports a number of species rarely found in Vermont. The largest population of the State-endangered spruce grouse is found in the IBA. The common loon, another State endangered species inhabits several ponds. Other State priority species include the gray jay, boreal chickadee, black-backed woodpecker, Cape May, bay-breasted, palm, and Tennessee warblers (<http://netapp.audubon.org/iba/Reports/1780>; accessed August 2016).
- (7) Barton Cove–Poet's Seat IBA in Gill and Greenfield, Massachusetts includes the large impoundment of the Connecticut River main stem behind the Turners Falls dam and a wooded ridge on the west side of the river. Bald eagle pairs have been present during nesting season since 1989, with several successful nestings. The cove is an important feature for waterfowl including ducks, loons, and grebes. The Rocky Mountain Ridge (e.g. Poet's Seat area) in Greenfield, Massachusetts, is important for breeding and wintering birds.
- (8) The Mount Holyoke/Mount Tom/East Mountain Range IBA in Amherst, Granby, and South Hadley (Amherst, Belchertown, Easthampton, Granby, Hadley, Holyoke, South Hadley, West Springfield, Westfield) is a forested area near the main stem, and includes the Mount Tom Unit of the refuge. It is primarily oak-conifer forest with lesser amounts of northern hardwoods, pitch pine/scrub oak, shrubland, grassland, and wetlands. This area is prime migratory habitat and supports nesting peregrine falcons. The ranges are a migration route for large concentrations of broad-winged, sharp-shinned and Coopers hawks, and American kestrel, as well as several other species including the northern goshawk, red-shouldered hawk, merlin, peregrine

falcon, osprey, and bald eagle. It is also an important nesting habitat for many important species including the whip-poor-will, Louisiana waterthrush, worm-eating, black-and-white, blackburnian, black-throated blue, and cerulean warblers.

- (9) Longmeadow Flats IBA is a floodplain area along the main stem of the river in Longmeadow, Massachusetts, ownership is divided among the Fannie Stebbins Wildlife Refuge, the town of Longmeadow, and private landowners. At least eight State-endangered, threatened, or special concern species use this site on a regular basis including peregrine falcons, bald eagles, American and least bitterns, blackpoll warblers, Northern parula, and pied-billed grebes.
- (10) Montague Sandplains IBA is a pitch pine/scrub oak area in Montague, Massachusetts, owned by the Massachusetts Division of Fisheries and Wildlife and the town of Montague. The sandplains support State-threatened vesper and grasshopper sparrows, as well as numerous other important bird species.
- (11) The Quabbin River watershed IBA is in the area surrounding the Quabbin Reservoir in several towns. It is a large reservoir that hosts wintering bald eagles, surrounded by thousands of acres of watershed forests managed by the Massachusetts Department of Conservation and Recreation. Three State-listed species are documented breeders: common loon, bald eagle, and pied-billed grebe. Thirty-five Partners in Flight priority bird species have been documented as breeding in this IBA including several forest-interior and early successional species.

#### *American Heritage River*

The entire 410-mile length of the Connecticut River is designated an American Heritage River. It stands at the heart of this region's human settlement and commerce; at the core of its history and culture; and represents the essence of its environmental quality and economic vitality. The American Heritage Rivers is an innovative non-regulatory partnership-based initiative designed to help river communities that seek Federal assistance and other resources to meet some tough challenges.

The Federal role is solely to support community-based efforts to preserve, protect, and restore these rivers and their communities. Without any new regulations on private property owners, state, local and tribal governments, the American Heritage Rivers initiative is about making more efficient and effective use of existing Federal resources, cutting red-tape, and lending a helping hand.

#### **Federally Endangered, Threatened, and Proposed Species**

Twenty-two federally listed endangered, threatened, or proposed species occur within the watershed. A brief description of each follows.

*Canada Lynx—Threatened:* Lynx were historically found from Alaska to the Canadian Maritime Provinces, extending south in the Rocky Mountains, around the Great Lakes, and into New England. Today the species is secure in Alaska and Canada, but imperiled or extirpated in the continental United States. Lynx occur in boreal and montane landscapes dominated by coniferous or mixed forest with thick undergrowth interspersed with more open habitats and young forests that support their principal prey, snowshoe hare.

Lynx are relatively rare in the contiguous U.S. because of habitats that are inherently unable to support cyclic, high-density snowshoe hare populations and are thus unable to sustain cyclic lynx populations (USFWS 2009b). The principal factor affecting softwood forest types favored by lynx is timber harvest on non-Federal lands, however the influence of current forest practices on lynx is not known.

Lynx have been confirmed breeding in northeastern Vermont and New Hampshire. A family group was detected in the winters of 2012 and 2013 within the refuge’s Nulhegan Basin Division. Lynx may also use habitats within the refuge’s Pondicherry and Blueberry Swamp Divisions, though evidence of lynx at these divisions has not been detected. The Upper Connecticut River Valley is included as a peripheral recovery area in the Recovery Outline for this species, an interim document in advance of a Recovery Plan (USFWS 2005).

*Piping plover—Threatened:* The piping plover is a threatened shorebird which breeds along the sandy coastal beaches of eastern North America. Historically, it was severely reduced in numbers by hunting, although now the major threats are habitat degradation, human or human-related disturbances during the nesting season, and nest predation (USFWS 1996). The only suitable habitat for this species within the watershed is a one-mile long sand spit at the mouth of the Connecticut River known as Griswold Point. Owned by TNC, this beach provides nesting habitat for several nesting pairs.

Piping plovers also breed in several other nearby areas along the Long Island Sound in Connecticut, including the Stewart B. McKinney Refuge, but these areas are outside of the Connecticut River watershed. Over the last decade, up to two breeding pairs have attempted nesting at the Milford Point Unit of the Stewart B. McKinney Refuge, with very limited success (Long Island Sound Study 2011; <http://longislandsoundstudy.net/wp-content/uploads/2010/07/From-the-Shore-111.pdf>; accessed August 2016).

*Atlantic sturgeon—Endangered:* In 2012, five distinct population segments of Atlantic sturgeon were listed as either threatened or endangered under the ESA: the Gulf of Maine, New York Bight, Chesapeake Bay, Carolina, and South Atlantic distinct population segments (NOAA 2014). Atlantic sturgeons living in the Connecticut River are part of the New York Bight distinct population segment and are listed as endangered (77 FR 5880, 2/16/2012). According to the Connecticut River Coordinator’s program, the Connecticut River population is considered extirpated. Currently, only a small amount of migrating individuals are found in the mouth of the Connecticut River and, therefore, it is likely no spawning activity is occurring in the river (CRCO 2010).

The Atlantic sturgeon is an anadromous fish, meaning they spend part of their lives in saltwater and part in freshwater (NOAA Fisheries 2012). Adult Atlantic sturgeons spawn in large, deep freshwater rivers. For spawning, they require clean, cold, moderately flowing water. Juvenile and non-spawning adults live in shallow, nearshore coastal waters, and estuaries.

The major historical threat to Atlantic sturgeons was overharvest, but in 1998 the Atlantic States Marine Fisheries Commission (ASMFC) put in place a coast-wide moratorium on Atlantic sturgeon harvest. Current threats include “by-catch” from commercial fisheries targeting other species, habitat degradation from

*Atlantic sturgeon*



Duane Raver/USFWS

dredging, dams, water withdrawals, and development; ship strikes; and barriers to movement, including locks and dams (NOAA Fisheries 2012). ASMFC's Atlantic Sturgeon Fishery Management Plan and its amendments outline measures to help preserve existing sturgeon habitat, restore and improve degraded habitat, and monitor by-catch and species recovery (ASMFC 1998). The plan also describes protocols for breeding and stocking captive-reared sturgeon.

*Shortnose sturgeon—Endangered:* The shortnose sturgeon was first listed as endangered in 1967. The National Marine Fisheries Service (NOAA Fisheries) published a shortnose sturgeon recovery plan in 1998. Although it has disappeared from some rivers, it is still found in many rivers from Florida to New

*Shortnose sturgeon*



Duane Ravery/USFWS

Brunswick. The Connecticut River population is considered one of 19 separate distinct population segments of this species in need of recovery.

Although it inhabits the Connecticut River from Turners Falls, Massachusetts, to Long Island Sound, the Holyoke dam separates the shortnose sturgeon into two populations. The total upriver population estimates ranged from 297 to 714 adult sturgeon (with less than 100 of those spawning in a given year), while the downriver population (which cannot reach the upstream spawning area) was estimated at around 875 adults. Recent evidence indicates that no successful reproduction occurs in the population below the Holyoke dam. This downstream population is sustained by the influx of out-migrating sturgeon from the upstream group. Spawning in the Connecticut occurs from the last week of April to mid-May, as the spring flows wane, in specific rubble/boulder substrate. Not all females spawn every year, and a percentage of adult females with tumors are unable to spawn (B. Kynard, pers. obs.). Breeding adults migrate north to their spawning grounds in the fall and stay there until spring. Most fish stay in freshwater all year, concentrating in decreased flow areas where they seek out freshwater mussels, a major prey item. Shortnose sturgeons forage day and night, and have a summer home range of about 10 kilometers. They overwinter in deep holes, usually within their summer range. Some adults from the downriver population spend several weeks in low salinity river reaches below Hartford in May and June, presumably feeding, and then return to the fresher upriver areas (NOAA 1998, NMFS 1998). The primary impediment to sturgeon recovery is the presence of dams that obstruct migration and modify the historic flow regimes that cued the fish to spawning at appropriate times and places. There is also mortality associated with accidental by-catch by fishermen (NOAA 1998).

*Dwarf wedgemussel—Endangered:* This freshwater mussel is an inhabitant of muddy sand, and sand or gravel bottoms of rivers and streams. It once occurred throughout the Atlantic coastal plain from North Carolina to New Brunswick, but has been lost from a majority of known sites. Primary threats include habitat loss and habitat fragmentation, and altered natural river processes; specifically, these threats include loss of riparian buffers, loss of floodplains, altered channel processes and sediment transport, altered hydrology, bank erosion, and dams. Pollutants from industrial and agricultural activities and other sources

substantially impact mussel populations which are sensitive to pesticides, chlorine, potassium, zinc, copper, and cadmium (Nedeau 2009a, USFWS 1993a).

This mussel once occurred along much of the Connecticut River and many of its tributaries, but is no longer found in the main stem in Connecticut and Massachusetts (USFWS 1993a). The species was rediscovered in the upper Connecticut River in 1995, including 68 sites in the main stem and 77 sites in tributaries. It occurs along a 16-mile main stem reach of the river between Orford and Haverhill (New Hampshire) in an area referred to as the Middle Macrosite, and along a 21-mile reach from Dalton to Northumberland (New Hampshire) in an area referred to as the Northern Macrosite (Nedeau 2009a). Small populations also exist in the Farmington River in the vicinity of Simsbury; Fort River, Mill River near Northampton, Massachusetts; a different Mill River in Deerfield and Whately, Massachusetts; and Ashuelot River near Keene, New Hampshire (Susi von Oettingen, 2010, pers. comm., USFWS). The Recovery Plan for this species was last issued in 1993 (USFWS 1993a).

*Puritan tiger beetle*—*Threatened*: The Puritan tiger beetle is an inhabitant of sandy riverine beaches along the Connecticut River and sandy bluffs along Chesapeake Bay in Maryland. The Puritan tiger beetle has declined along the Connecticut River due to inundation and disturbance of its shoreline habitat from dam construction, riverbank stabilization and human recreational activities. Of 11 known historic populations along the Connecticut River, 2 remain (USFWS 1993b). One occurs in Northampton, Massachusetts, on a river beach owned by the City of Northampton and the Massachusetts Division of Fisheries and Wildlife. The numbers of adult beetles in this population decreased in the late 1980s, dropping below 50 adult beetles. The refuge and its partners have been making a concerted effort there since 1996 to protect and augment this population. The last year the beetles were reintroduced to the Northampton site was in 2006. In 2005 the number of adult beetles rose to 200, but unfortunately declined to only 2 adults in 2014. The other population is near Cromwell, Connecticut, and comprises 350 to 500 individuals at three sites in close proximity. The refuge's Deadman's Swamp Unit protects one of these sites and supports adult beetles, although no larvae have been found there to date. The Recovery Plan for this species was issued in 1993 (USFWS 1993b).

*Puritan tiger beetles*



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In 2015, the Service awarded \$220,000 in funding, under the Cooperative Recovery Initiative (CRI), to Conte Refuge and partners to conduct a habitat enhancement and population stabilization project for the Puritan tiger beetle populations in the watershed. CRI is a strategic, cross-programmatic approach to recover federally listed species on refuges and surrounding lands. The goals and objectives of the Puritan tiger beetle project are to:

- Secure the existing metapopulation in Connecticut.
- Establish two metapopulations in New England to meet recovery criteria.
- Restore riverine beach habitat.
- Establish a captive rearing lab at the Richard Cronin Aquatic Resource Center in Sunderland, Massachusetts.

Project activities planned include debris removal and control vegetative encroachment using mechanical and herbicide treatments, collecting adult tiger beetles for the captive rearing program, rearing beetles from eggs to larvae in enough quantities to allow for translocating captive reared beetles into restored habitats. Other species benefitting from this project include the tide water mucket, yellow lampmussel, cobra clubtail, midland clubtail, hairy necked tiger beetle, and sandbar willow.

*Jesup's milk-vetch—Endangered:* This plant exists only in the Connecticut River watershed and is confined to calcareous bedrock outcrops which are ice scoured annually (USFWS 1989). The only three known sites occur along a 16-mile stretch of the Connecticut River in the towns of Plainfield and Claremont, New Hampshire, and Hartland, Vermont. Habitat alteration and botanical collecting have been the major impacts to this plant. Trampling by humans also poses a threat due to canoe and kayak portaging near one site. An invasive plant, black swallow-wort, has expanded into the area from the nearby railroad tracks and threatens to displace the milk-vetch. The Recovery Plan for this species was issued in 1989 (USFWS 1989). Partners have worked to control the black swallow-wort.

*Small whorled pogonia—Threatened:* This threatened plant, also known as the green five-leaf orchid, inhabits upland sites in deciduous or mixed deciduous and coniferous forests in second or third growth forests. It is rare but widely occurring at about 85 sites in 15 states and Canada (USFWS 1992). There are only two known sites within the Connecticut River watershed, one in Connecticut and one in Massachusetts. Both are extremely small. Destruction of habitat from commercial and residential development has been a primary threat. Plant collectors decimated the only known population in Connecticut several years ago after its location was published in a newspaper. The species was originally listed as endangered in 1982 but that status was changed to threatened in 1994. A 5-year review of the listing of this plant species was initiated on March 6, 2012 (<https://www.gpo.gov/fdsys/pkg/FR-2012-03-06/pdf/2012-5212.pdf>; accessed August 2016). The Recovery Plan for this species was issued in 1992 (USFWS 1992).

*Northeastern bulrush—Endangered:* This plant is found in alluvial meadows and small headwater or coastal plain ponds characterized by seasonally variable water levels. Approximately 113 populations are known from 7 eastern states, with most of the populations occurring in Pennsylvania and Vermont (USFWS 2008b). Within the Connecticut River watershed, 2 sites are known in Massachusetts, 9 in New Hampshire, and 22 in Vermont. Habitat alterations that make conditions consistently wetter or drier are the major threat to this species (USFWS 2006b). Other threats include agricultural runoff, logging roads, fire roads, off-road vehicle use, and unauthorized collection. The refuge's Putney Mountain Unit in southern Vermont was purchased to protect a population of this plant. The Recovery Plan for this species was issued in 1993 (USFWS 1993c), and the Service completed a 5-year status review for the species in the fall of 2008 (USFWS 2008b).

*Rufa red knot—Threatened:* In December 2014, the Service listed the *rufa* red knot as federally threatened (79 FR 73706-73748). The “*rufa*” subspecies of red knot winters near the tip of South America and begins its long journey north to Arctic breeding grounds in mid-February, when they spend time at a number of coastal habitats along eastern North America, particularly Delaware Bay beginning in mid-May. The species has been recorded during migration along the coasts of Connecticut, Massachusetts, and New Hampshire. Major threats to the subspecies include loss of breeding and nonbreeding habitat, predation during breeding, reduced prey availability, and mismatches in the time of the species migrations and the availability of food and favorable weather conditions (USFWS 2011b).

Northern long-eared bat



Al Hicks/NYDEC

*Northern long-eared bat—Threatened:* In April 2015, the Service listed the northern long-eared bat as federally threatened. The northern long-eared bat occurs in 39 states in the eastern and north central U.S. This medium-sized bat is currently being decimated by white-nosed syndrome, a fungal disease that affects certain types of bats. These bats are especially susceptible to the disease in their wintering hibernacula; namely, caves and mines. They typically use large caves or mines for hibernacula, with large passages and entrances, constant, cooler temperatures, and high humidity with minimal air currents. Within hibernacula, surveyors find them in small crevices or cracks, often with only the nose and ears visible. In the Northeastern U.S., northern long-eared bat populations have dropped by 99 percent (99%) from pre-white-nosed syndrome numbers. As white-nose syndrome continues to expand throughout the remainder of the species range, scientists expect high losses will continue.

During summer, the bats roost singly or in colonies underneath bark, in cavities, or in crevices of reproductive females may also roost in cooler places, like caves and mines. This bat seems opportunistic in selecting roosts, using tree species based on suitability to retain bark or provide cavities or crevices. Potential roosts may include live trees and/or snags greater than or equal to 3 inches diameter-at-breast height that have exfoliating bark, cracks, crevices, and/or cavities. It has also been found, rarely, roosting in structures like barns and sheds. Breeding begins in late summer or early fall when males begin swarming near hibernacula.

Potential habitat for the species exists throughout the watershed. For more information on this species, visit: <https://ecos.fws.gov/ecp0/profile/speciesProfile.action?spcode=A0JE> (accessed August 2016).

*Indiana Bat—Endangered:* The Indiana bat recovery plan was drafted in 2007. Human disturbance and vandalism pose significant threats during hibernation, and loss and degradation of forested habitat impact summer roost sites. Permanent protection of hibernacula, conservation and management of summer habitat and public outreach are recovery criteria for this species. The western boundaries of two CFAs in Vermont are located within the Northeast Indiana Bat Recovery Unit (RU). The RUs serve to protect summer habitats, and aid in the conservation of natural variation across populations (USFWS 2007). Permanent protection through land acquisition, and management of potential summer roost and maternity sites within these CFAs will aid in the recovery of this species.

*Roseate Tern—Endangered:* The recovery plan for the northeastern population of roseate terns was updated in 1998. These terns occupy sandy beaches and tidal mudflats at the mouth of the Connecticut River during migration. Loss of nest habitat and predation are threats to this species. Land protection of migration habitat will provide undisturbed stop-over areas.

*Northern Bog Turtle—Threatened:* The northern population of the bog turtle was listed as a threatened species on November 4, 1997. These turtles prefer open-canopy wetlands, such as herbaceous sedge meadows and fens, which periodically flood and often bordered by wooded areas. Threats to its survival include the loss, degradation, and fragmentation of its habitat, compounded by the take of long-lived adult animals from wild populations for illegal wildlife trade. The protection of known bog turtle populations and their habitats, as well as the management of these habitats to maintain suitability (U.S. Fish and Wildlife Service 2001) are a few of the recovery actions which the refuge could

undertake for this species. At this time, the bog turtle occurs in the Farmington River CPA.

*Bicknell's Thrush—Under Review:* Bicknell's Thrush was petitioned in 2010, and in 2012 the USFWS announced a "90-day finding" that the Bicknell's thrush may warrant protection as an endangered species. Bicknell's Thrush is a rare and geographically restricted habitat specialist of balsam fir-dominated forests in the northeastern U.S. and southeastern Canada. In its US breeding range, the Bicknell's thrush is found in high-elevation spruce-fir forest, regularly breeding only at elevations above 700 m. This species occurs in the White Mountains in New Hampshire and in Vermont's Green Mountains. These areas are on the outskirts of the Connecticut River Watershed.

Across its breeding range, bicknell's thrush appear to be declining, with some populations reported to be decreasing by 7-19% annually. Threats to this species include recreational development, telecommunication construction, wind power development, acidic precipitation, mercury deposition, and climatic warming (Mollie Matteson 2010).

*Brook floater — Under Review:* The brook floater is a mussel species that occurs in rivers in the eastern part of the U.S. Significant declines have been noted in Massachusetts, New York, Pennsylvania, New Jersey, Rhode Island, Virginia, North Carolina, and South Carolina. Few known sites remain that hold healthy, viable populations. Species experts have determined that the brook floater occupies less than 50% of its historic range, primarily due to habitat destruction and land use practices that impact water quality. Populations are known to occur in Vermont and New Hampshire. Permanent conservation of lands adjacent to rivers with known occurrences of brook floater will protect and potentially improve water quality at these sites.

*Cobblestone tiger beetle—Under Review:* The cobblestone tiger beetle is restricted to the open, cobbled, and sparsely vegetated areas of river islands and banks of free-flowing rivers (Allen and Acciavatti, 2002). Threats to this species include hydrologic alterations that impact habitat suitability, invasive plants, water pollution and river bank stabilization projects. This tiger beetle occurs in the Quonotuck CFA and West River CPA. The refuge can support this species by permanently protecting known populations and their habitats, as well as adjacent lands, to improve water quality and provide suitable habitat through management efforts.

*Tri-colored bat—Under Review:* Tri-colored bat was once the most common bat species found in eastern forests. This species hibernates in caves during the winter, and roosts within forested habitats during the summer. Potential habitat for the species exists throughout the watershed. The species has been documented occurring in at least three of the CPAs/CFAs: Ompompanoosuc River, Ottauquechee River, and White River CFAs. Permanent protection of winter and summer habitats, as well as the management of roosting areas will benefit this species.

*Monarch butterfly—Under Review:* The monarch butterfly was petitioned for federal listing in 2014. This species is widely distributed across North America and is categorized into geographically distinct populations based on migration patterns. The monarch requires habitat that provides milkweed as host plants for breeding and flowering plants for foraging. This species has experienced dramatic declines which may be contributed to habitat loss, pesticide use and impacts from climate change. The refuge can support this species by protecting, creating and restoring high quality habitat.



*Regal fritillary butterfly*—*Under Review*: Regal fritillary is a rare butterfly that may be extirpated from much of the Northeast. This species requires habitat that provides various species of violets as host plants for breeding and flowering plants for foraging. Habitat loss, fragmentation, and degradation, and pesticide use are listed as threats to the survival of this species. The refuge can support this butterfly by protecting and creating suitable open habitat.

*Yellow banded bumble bee*—*Under Review*: Yellow banded bumble bee was petitioned for federal protection in 2015. According to recent studies, this species has declined by over 30% in range and persistence over its entire range; in some areas this species has been extirpated. This species forages on a diversity of plants within a wide variety of habitats including woodlands, farmlands, meadows, grasslands and wetlands. Threats to this important pollinator include disease, pesticide use and habitat loss (Hatfield et al. 2015). The refuge can support this species by protecting, creating and restoring high quality habitat for extant populations.

*Wood Turtle*—*Under Review*: Wood turtle was petitioned for federal protection in 2012. Wood turtles require riparian habitats, using aquatic and terrestrial habitats at different times of the year. This species is long lived, and thought to be experiencing population declines exceeding 50% over the past 100 years. Much of this decline is due to habitat degradation, fragmentation and destruction (van Dijk and Harding, J. 2016). Wood turtle occur in the Fort River, Quonotuck and Nulhegan Basin CFAs. Protection and management of riparian habitats will benefit populations.

### Birds

The Connecticut River watershed serves as one of the major “north-south” migration corridors within the expansive Atlantic Flyway, flanked by the Atlantic coastal corridor to the east and the Champlain Valley corridor to the west (Browne 2009). Hundreds of species of migratory and resident birds inhabit the Connecticut River watershed. These species encompass 17 taxonomic orders and 46 families of birds ranging from the well-known Canada goose and American robin to the rare golden-winged warbler and Fox sparrow. Twenty-seven species of ducks, geese, and swans; 15 species of shorebirds; and 24 other water-dependent species such as rails, grebes, and herons use the watershed for breeding, wintering, or migration (USFWS 1995a).

The watershed is also host to 181 passerine and raptor species. Of these, 88 are neotropical migrants that breed in the watershed, 77 are residents that breed and winter here, and 16 are winter residents that migrate to the watershed from the north. Certain species such as mourning dove, American robin, red-tailed hawk, American crow, cedar waxwing, and American goldfinch have both migratory and resident populations (DeGraaf and Yamasaki 2001).

The Atlantic Coast Joint Venture (ACJV) has established habitat objectives within Waterfowl Focus Areas for supporting the full suite of waterfowl occurring within the Joint Venture boundaries. Three of these Focus Areas exist within the Connecticut River watershed: 1) the Connecticut River and Tidal Wetlands Complex Focus Area along the lower Connecticut River in the state of Connecticut; 2) the Connecticut River Focus Area, which runs along the Connecticut River in New Hampshire and Vermont from the Massachusetts boarder to the river’s origin; and 3) Lake Memphremagog Focus Area in northern Vermont.

A study of spring stopover habitat use by neotropical migrant birds within the Connecticut River Valley, conducted by Smith College through funding by the Conte NFWR and R5 Migratory Bird Program, provides indications of the

Ospreys



Bob Weiss/USFWS

importance of the Connecticut River watershed to migrating birds (<http://www.science.smith.edu/stopoverbirds/>; accessed August 2016). Results demonstrated that spring migrant birds using the Eastern Flyway reach the southern portions of the Connecticut River watershed in large numbers, then disperse throughout the watershed and beyond as they continue north. Almost half (47 percent (47%)) of the birds counted within the defined count circles were at sites along the main stem of the Connecticut River. This trend was more pronounced during the early periods of spring migration along the Connecticut and Massachusetts portions of the River. Forested wetlands and shrub swamps are likely to be particularly valuable habitats along the main stem of the river because they provide more food and protection earlier in the spring migratory period due to warmer air and water temperatures and earlier tree leaf-out. Overall density of birds observed decreased by about half from south to north, as birds dispersed away from the main stem of the river as they moved north. The mouth and lower main stem of the Connecticut River may serve as a landscape feature used by many Eastern Flyway migrants to orient north after reaching the southern New England coast.

For a complete list of birds in the watershed, please visit: [http://www.fws.gov/refuge/Silvio\\_O\\_Conte/about/library.html](http://www.fws.gov/refuge/Silvio_O_Conte/about/library.html) (accessed August 2016).

Six landbird species are identified as Watch List species—those of highest conservation concern at the continental scale—in the 2016 Partners in Flight Landbird Conservation Plan (see Table C.1) (Rosenberg et al. 2003a, 2003b). We summarize studies on birds conducted on individual refuge divisions and units in Part III of this chapter.

Below, we provide some general information on different bird groups (e.g., waterfowl, raptors, etc.) in the watershed.

#### *Waterfowl*

The lower Connecticut River has abundant waterfowl year-round and has some of the highest and most significant concentrations of black duck in the Northeastern U.S. (Dreyer and Caplis 2001). The freshwater and tidal wetlands along the Connecticut River, particularly in the lower portion of the watershed, provide important stopover habitat during both spring and fall migrations of waterfowl, such as American black duck. The habitats most important to black duck are the tidal wetlands along the main stem, as well as the tidal wetlands and bays along the coast. In the winter, the river provides relatively ice-free open water habitat providing access to submerged aquatic vegetation, invertebrates and high calorie wetland vegetation. Many waterfowl also nest along the river, including mallards, black duck, Canada goose, green-winged teal, and gadwall. The lower Connecticut River (from Salmon River to the mouth) has been designated a Ramsar Wetland of International Significance, as well as an ACJV waterfowl focus area.

Further north in the watershed, many migrating ducks use flooded agricultural fields, floodplains, emergent wetlands, shrub swamps and backwater areas along the Connecticut River for stopover habitat. In fact, the Connecticut River is a waterfowl focus area under the ACJV for New Hampshire and Vermont, highlighting the importance of the river habitats to breeding and migrating waterfowl (ACJV 2005, NHRFG 2006). Species such as Canada geese, teal, mergansers, American black ducks, mallards, wood duck, and some sea ducks use the river corridor during spring and fall migration. The river provides prime breeding habitat for American black duck, wood duck, mallard, common merganser, and Canada geese. Other species nest along the river, but are less common.

Wood ducks are ubiquitous nesters in the watershed requiring large tree cavities which are associated with freshwater forested or shrub wetlands. They especially

favor beaver ponds with heavy forest cover. Black ducks are a species of special management concern as previously described and are specifically mentioned in the Conte Refuge Act.

#### *Forest, Shrubland, and Grassland Birds*

According to the national species richness maps produced by the Breeding Bird Survey (Price et al. 1995), the watershed has a very high richness of nesting flycatchers and thrushes, and the northern watershed has the highest richness of nesting warblers, distinguishing it as nationally significant for this taxon. Within the watershed, the White Mountains to the east, Green Mountains to the west and the Berkshire Hills to the west provide the northern hardwood/spruce forest breeding habitat required by neo tropical migrants and residents. Species dependent on this type of habitat include the black throated blue warbler, black throated green warbler, American redstart, least flycatcher, veery, pileated woodpecker, and Northern goshawk.

A number of birds associated with old fields, pastures, and grasslands are declining in New England and are of special concern (Askins 2002, Vickery 1992). Grassland birds comprise one of the most imperiled groups of birds in the U.S., although the responsibility for recovering them belongs to bird conservation regions (BCRs) that include their core ranges in the Midwest. Grassland-dependent species, such as upland sandpiper, savannah sparrow, vesper sparrow, grasshopper sparrow, and bobolink, are declining across the Northeast as meadows succeed to forest stands or are replaced by development (Askins 2002). According to USGS Breeding Bird Survey, continental declines of grassland birds have been steeper, more consistent, and more geographically widespread than those of any other ecological group of birds (Sauer et al. 2001). The Wildlife Management Institute has estimated that natural grasslands have declined by 99 percent (99%) in the Northeast. The remaining grasslands are mostly agricultural and are under increasing pressure to be converted into residential developments.

Grassland-dependent birds in the watershed include: upland sandpiper which requires large contiguous grassland area with a mixture of tall and short grasses—minimum 150 acres and even fields as large as 300 acres or more (Vickery et al. 1994, Carter 1992); sedge wren (prefers wet fields); savannah sparrow (generalist—minimum 20 to 40 acres); vesper sparrow (areas with thin grasses and bare ground—minimum 30 acres); grasshopper sparrow (dry areas with bunch grasses and bare ground—minimum 30 acres); bobolink (prefers thick grass in old fields—minimum 5 to 10 acres); and Eastern meadowlark (old fields with dead grass layer—minimum 15 to 20 acres) (Jones and Vickery 1997).

Westover Air Force Reserve Base in Chicopee, Massachusetts, supports the largest populations of two State-listed bird species in the six state New England region: the upland sandpiper, State-listed as endangered, and the grasshopper sparrow, State-listed as threatened (U.S. Air Force 2015). The Connecticut River valley in Massachusetts provides the greatest potential for grassland habitat restoration in the watershed, as it has the greatest abundance of prime grassland habitat in the watershed and the river serves as an important migration corridor for birds (CT DEEP 2006). As New England becomes increasingly forested and urbanized, habitat for these species will continue to decline.

Neotropical migrants were surveyed in four sub-watersheds of the Connecticut River including the Farmington River watershed in Connecticut, the Deerfield River watershed in Massachusetts, the Ashuelot River watershed in New Hampshire, and the White River watershed in Vermont. The goal was to determine the importance of the Connecticut River watershed to neotropical migrants, and the habitat types used most often during migration. Twelve

transects were established in each sub-watershed at specific geographic locations, and each transect was surveyed 6 different times throughout the spring each year, for 3 years (1996-1998). This survey effort was part of a study conducted by Smith College and Manomet Center for Conservation Sciences.

#### *Waterbirds*

The Connecticut River valley is inhabited by six species of colonial nesting heron: great blue heron, great egrets, black-crowned night herons, yellow-crowned night herons, snowy egrets, and little blue heron. Great blue herons forage in almost every type of shallow, open wetland including fresh, brackish, and saltwater wetlands. They are colonial tree nesters in wetlands, and many colonies can be found in the watershed; breeding is increasing. Great egrets are uncommon local breeders, common migrants and summer residents, and are generally increasing. Black-crowned night herons, another colonial nester, are locally common breeders; this species has experienced declines in the watershed and is restricted to the seacoast. Yellow-crowned night herons as well as little blue herons are rare breeders, both tending to use wooded wetlands and marshes. Double-crested cormorant are colonial nesters and their populations are increasing; there are one or two reports of them nesting near the Connecticut River (Bevier 1994).

The common loon nests on small and large ponds and lakes from Quabbin Reservoir north and winters along the coast.

#### *Secretive Marsh Birds*

Virginia, clapper, and sora rails are all fairly common nesters in the marshes along the river. King rail are rare and found almost exclusively in high salt marshes at the mouth of the Connecticut River. Freshwater tidal marshes with wild rice are important stopover areas for sora rails in the fall (Dreyer and Caplis 2001). Least and American bitterns are relatively uncommon across the watershed, although the latter is known to breed at the Pondicherry Division. American bitterns have declined of late due to loss of freshwater wetlands. Least bittern are rare local breeders preferring tall dense freshwater marshes (DeGraaf and Yamasaki 2001).

#### *Shorebirds*

During migration, mud flats along the main stem of the Connecticut River and sandy areas around the mouth of the river provide essential foraging habitat to several species of shorebirds such as the willet, solitary sandpiper, lesser yellowlegs, and federally endangered roseate terns. The mouth of the river also provides nesting areas for piping plovers, least terns, and common terns. The spotted sandpiper is common, frequenting shorelines along rivers, streams, lakes and ponds. Upland sandpipers rely on expansive grassland habitats and are generally rare in the watershed, most often seen at large airports. The American woodcock is found throughout the watershed in early successional forests, and locally is a common breeder. Declining early successional forests pose a challenge to this species (DeGraaf and Yamasaki 2001).

#### *Raptors*

The Connecticut River valley is a major corridor for raptor migration. Mount Tom in Massachusetts, Mount Monadnock in New Hampshire, and Putney Mountain in Vermont, are well known sites to observe raptor migrants in the fall. On certain days when strong fronts follow periods of harsh weather, thousands of broad winged hawks can be observed. At least a dozen other raptor species including red-tailed hawks, sharp shinned hawks, American kestrels, merlins, red-shouldered hawks, and osprey are common migrants. Many of these species and other raptors nest throughout the watershed.

## Fish

The watershed supports a diversity of fishery resources. Cold, cool and warm-water species are in general abundance throughout the watershed. The watershed did not historically support as diverse a group of fishes as it does presently; many of the species considered resident were introduced (e.g., smallmouth bass, brown trout). The main stem and many of its tributaries were impounded following early European settlement through extensive dam construction in all four basin states. Prior to environmental regulations, many industries in the river corridors discharged pollutants directly into the water. Many lakes, ponds, and wetlands were similarly degraded. The creation of reservoirs and subsequent degradation of aquatic habitats resulted in native species declines and provided opportunities for exotic species establishment.

There are 142 fish species found within the watershed: 33 native freshwater; 35 nonnative freshwater; 11 diadromous fish (migrate between salt- and freshwater for breeding purposes); 15 amphidromous (migration between fresh water and the sea for other than breeding purposes); and 48 saltwater ([http://www.fws.gov/refuge/Silvio\\_O\\_Conte/about/library.html](http://www.fws.gov/refuge/Silvio_O_Conte/about/library.html); accessed August 2016). Indigenous freshwater fish are, with few exceptions, generally found throughout the watershed. Diadromous fish are primarily found in the lower reaches of the watershed, south of Bellows Falls, Vermont, with higher numbers and more species near the mouth of the main stem. Saltwater species generally occur within Long Island Sound and amphidromous species are found in the lower reach of the Connecticut River and its tributaries.

The northern reaches of the river provide habitat for lake and Eastern brook trout and land-locked Atlantic salmon. The mid-section of the river supports chain pickerel, largemouth and smallmouth bass, Northern pike and walleye, and a variety of panfish such as bluegill and seasonal foraging migrations of striped bass, occur up to many first dam barriers including Holyoke Dam. Common carp, white suckers, American eel, and catfish such as the introduced channel catfish and native brown bullhead are present in many areas. The native population of Atlantic salmon in the watershed was extirpated; efforts to reestablish the population through hatchery stock persisted for decades, however the Service recently terminated the program due to poor success. The American shad population, with less precise habitat requirements, has experienced recent declines along the East Coast, in spite of habitat restoration efforts that are complicated by among other factors, fish passage issues.

### *Migratory Fish*

Atlantic salmon, American shad, shortnose sturgeon, and river herring (i.e., alewife and blueback herring) are all specifically mentioned in the purposes of the Conte Refuge Act. In addition, each is a trust responsibility of the Service via the Magnuson Stevens Fishery Conservation and Management Act, the Anadromous Fish Conservation Act, the Atlantic Coastal Fisheries Cooperative Management Act, and the Atlantic Striped Bass Conservation Act (<http://www.fws.gov/laws/lawsdigest/fishcon.html>; <http://www.fws.gov/laws/lawsdigest/anadrom.html>; <http://www.fws.gov/laws/lawsdigest/atlstri.html>; all accessed August 2016).

### Atlantic Salmon

Based on historical accounts from Native Americans and early European settlers, there used to be large Atlantic salmon runs in the Connecticut River. However, the salmon population declined rapidly as Europeans colonized American and constructed dams for power. The first dam across the main stem Connecticut River was constructed in 1798 near the present site of Turners Falls, Massachusetts. This and other dams blocked salmon migrations to their breeding areas in the northern portion of the river. Dams were also constructed along the lower basin tributaries. Additionally, unregulated harvest of salmon

depleted the population. By the early 1800s, salmon had disappeared from the Connecticut River.

There have been several attempts to restore Atlantic salmon to the Connecticut River. An interagency State/Federal program to restore salmon to the Connecticut River was initiated in the 1860s. Although the effort resulted in the return of hundreds of adult salmon for several years in the 1870s and 1880s, the program eventually failed due to both uncontrolled harvest of fish in Connecticut waters and the failure to construct effective fish passage at dams in Massachusetts.

Another attempt began in 1967 when the Service, Connecticut, Massachusetts, New Hampshire, Vermont, and the National Marine Fisheries Service signed a statement of intent to restore anadromous fish, including Atlantic salmon, to the Connecticut River. The Service discontinued the Atlantic salmon portion of this program in 2012 due to reviews of scientific literature, low numbers of adults returning to the river since the 1990s, and severe damage to the White River National Fish Hatchery from flooding in fall 2011. Following the Service's announcement, Massachusetts decided it would no longer culture salmon at its Roger Reed State Hatchery. As of 2014, Vermont and New Hampshire have no plans for future stocking of any anadromous Atlantic salmon. However, Connecticut is continuing to operate an "Atlantic Salmon Legacy Program." The purpose of this program is to maintain Atlantic Salmon in the Salmon River and Farmington River, from spring fry stocking, with objectives that include school education programs and providing broodstock fisheries in out-of-basin waters. Atlantic salmon remain a priority refuge resource of concern due to its inclusion in the enacting legislation.

#### Other Diadromous Fish Species

Prior to extensive dam construction, migratory fish returning to the Connecticut River formerly consisted of larger numbers of American shad, alewife, blueback herring, American eel, and lesser numbers of Atlantic sturgeon, shortnose sturgeon, rainbow smelt, striped bass, and sea lamprey. Gizzard shad is a relative newcomer to the watershed; it has expanded its range northward to the Connecticut River, where it was first observed at the mouth in 1980. Migratory fish life histories are described by Scarola (1987) and Scott and Grossman (1973).

American shad are broadcast spawners using the river and larger tributaries for reproduction. Blueback herring spawn in the river and tributaries while alewives seek the smaller tributaries and coves for spawning. Alewife spawning habitat is mainly south of Longmeadow, Massachusetts, and alewives rarely are found as far north as Holyoke. Rainbow smelt historically spawn in the lower basin tributaries but are now considered extirpated. Historically, American shad and blueback herring were known to occur up Bellows Falls, Vermont, with American eel continuing further upstream than even Atlantic salmon, to the Connecticut Lakes in Pittsborough, New Hampshire. Currently, American shad can ascend the river to Bellows Falls, Vermont, only after successfully passing the fish lift at Holyoke Dam, two fish ladders at Turners Falls Dam, and a fish ladder at Vernon Dam.

Migratory fish populations were impacted by overharvesting, pollution, and dam construction that blocked migration routes. Recognition of the impact to the migratory fish populations was quickly apparent to the inhabitants of the river valley upon completion of the dams. Two early attempts (in 1873 and 1940) to provide fish passage at the Holyoke Dam (built in 1849) in Massachusetts failed. In 1955 an elevator-type fishway was constructed, allowing a portion of the population of American shad and blueback herring to migrate upriver of the dam. The Enfield Dam in Connecticut, built in 1880, was a partial fish barrier until the late 1970s, when it began to disintegrate after being breached in several places.



M. Poole

*Dragonfly*

The enactment of the Anadromous Fish Conservation Act in 1965 provided the states and Federal agencies with the means to initiate anadromous fish enhancement and restoration programs within the watershed. This Federal legislation led to the four basin state fish and wildlife agencies, the U. S. Fish and Wildlife Service and the predecessor to the National Marine Fisheries Service, creating the “Policy Committee for Fisheries Management of the Connecticut River Basin.” The Committee was focused on establishing a coordinated anadromous fish restoration effort at the watershed scale. Both American shad and Atlantic salmon garnered the most interest at that early time and later led to the Congressional Act of 1983 that created the Connecticut River Atlantic Salmon Commission (CRASC), that provided additional formalization of these

efforts (for the agency partner) that included more work than salmon restoration alone. This included negotiations with power companies on fish passage plans for restoration. Outside of the Connecticut river basin agency efforts, ongoing coordinated management for East Coast diadromous species (i.e., shad and river herring) occurs through the Atlantic States Marine Fisheries Commission, which has additional federal acts to support coordinated actions. The CRASC Commissioners (agency Directors) and its Technical Committee, remain very active on all aspects of restoration, management, restoration, planning, and research for all diadromous fish species (<http://www.fws.gov/r5crc>; accessed August 2016).

American shad in the Connecticut River have been the focus of many studies, research, monitoring, dating back to the 1950s. Measures of abundance include commercial and recreational landings largely as determined by the State of Connecticut, and more recently by fishway passage counts. Although Holyoke Dam has provided upstream passage for many decades, it was really in 1976, following fish lift improvements, and the demise of the Enfield Dam that provided noted increases in shad counts at that location. Additional fish lift improvement occurred in 2004 following relicensing and downstream passage measures also occurred for both adults and juveniles to aid the population’s restoration. The average number of shad passed at Holyoke Dam from 1976 to 2014 is 306,000, with a high of 721,000 (1992) and a low of 145,000 (1978) (<http://www.fws.gov/r5crc>, accessed August 2016). Since 2012, shad counts have been well above the long-term average at Holyoke, even as other East Coast rivers continue to experience all-time low levels of abundance. Fish passage, both up and downstream, for both adults and juveniles, remains one of the highest priority factors influencing this population’s full restoration, with much work ahead, but much progress achieved. In fact, a new shad passage record was set at the Vernon Dam fishway in 2014 with over 39,000 shad passed, the highest number since the fishways start-up in 1981.

Connecticut River shortnose sturgeon were one of the first species to be identified for inclusion under the Endangered Species Act when first passed by Congress. Research in recent decades by both the University of Massachusetts Amherst, the Conte Anadromous Fish Research Center, and the Connecticut DEEP have shown the population to be stable to growing (slowly) with published research indicating that spawning is limited to an area downstream of the Turners Falls Dam (which is believed to be the upstream extent of their range). The population is fragmented by the Holyoke Dam which has initiated construction of new downstream passage protection measures for this species, for adults and juveniles in summer 2014. Upon completion, upstream passage of sturgeon will be permitted (currently prohibited pending safe downstream measures), allowing the potential for sturgeon downstream of that dam to contribute to the recovery of the population.

Blueback herring and sea lamprey use tributaries to the Connecticut River for spawning and nursery habitat often up to the first barrier encountered, typically not far upstream from the main stem. Blueback herring is a prolific fish that can ascend the river as far as American shad on the main stem and in tributaries beyond first barriers that have working fishways. Over the past two decades river herring populations have experienced dramatic decline in abundance similar to what has been seen with American shad throughout the Northeast. Currently, river herring have special status and harvest closures in place as state, federal, private entities try to determine causal factors and measure to reverse trends and improve status. Fishway counts for bluebacks and alewife in the Connecticut River have plummeted from the 1980s and 1990s, requiring annual inriver field sampling to obtain data on these species.

Sea lamprey can presently migrate into the Vernon Pool passing through the Vernon Dam fishway located in southern Vermont and New Hampshire, although their historic upstream range is unclear, their migration abilities make them capable of reaching quite far into the basin. Sea lamprey in some abundance may use the subsequent Bellows Falls Dam fishway, to access habitat upstream, with some lamprey utilizing the next and most upstream main stem upstream fishway at Wilder Dam. Other species including American eel may also use these fishways and are under study as part of these upstream dams' relicensing process. Alewife, similar in appearance to the blueback herring, generally occur in the lower reaches of the Connecticut River. Alewives currently migrate upriver as far as the vicinity of the former Enfield Dam. Together, blueback herring and alewives are referred to as "river herring." A February 2015 report prepared by the CRASC, Technical Subcommittee for River Herring, identifies river herring restoration status and plans in the Connecticut River basin (CRASC 2015). This 2015 report supplements the existing CRASC plan, "Management Plan for River Herring in the Connecticut River Basin" (CRASC 2004).

Gizzard shad is another diadromous fish occurring in the lower reaches of the Connecticut River. They were first observed in the main stem in 1985, and have been observed in limited numbers in the Holyoke Dam fish lift in Massachusetts. Gizzard shad may occur in greater abundance below the Holyoke Dam.

Striped bass are not known to spawn in the Connecticut River, but rather migrate to the system following river herring, a favorite forage due to size and schooling behavior. This seasonal feeding migration (Chesapeake Bay, Hudson and Delaware river origin) lasts generally for the run of river herring which concludes with river herring "adult outmigrants" (following spawning) leaving in mid to late June. The successful restoration of the migratory stock of striped bass in the early 1990s led to the development of a popular striped bass fishery in the river upstream to Holyoke Dam and lower reaches of larger tributaries.

The American eel, which is petitioned for federally threatened status under the ESA, is another important migratory fish in the Connecticut River. Life history information for the American eel is presented in Stone et al. (1994), Scott and Grossman (1973), Bigelow and Schroeder (1953). American eel are ubiquitous throughout the watershed with abundance decreasing from south to north. It is rarely observed above the confluence with the White River in Vermont.

The Service initiated a status review for American eel in 2004 at the request of the Atlantic States Marine Fisheries Commission, representing 15 states from Maine to Florida, along with a formal listing petition filed by others shortly thereafter. The Service determined in 2005 that substantial biological information existed to warrant a more thorough examination and began a comprehensive review of all the available scientific and commercial



information. The Service examined all available information about the American eel population from Greenland south along the coast to Brazil and as far inland as the Great Lakes and the Mississippi River drainage. While the eel population has declined in some areas, the species' overall population was not considered in danger of extinction or likely to become so in the foreseeable future, thus formally concluding that protecting the eel as an endangered or threatened species under the ESA was not warranted. However, in 2011 in response to another petition, the Service published a finding that the petition presented substantial scientific or commercial information indicating that listing this species may be warranted (76 FR 60432-60444).

#### *Amphidromous Fish*

Amphidromous fish (fish that migrate between freshwater and the ocean during some stage of their lives other than breeding) use the estuary of the Connecticut River and the marine environment of Long Island Sound. Fifteen amphidromous fish species occur in this classification. The most commonly recognized species in this category are: white perch, mullets, and killifishes.

#### *Resident Fish*

Resident fish are defined by two categories: indigenous (native) and nonindigenous (introduced). Species distribution is strongly correlated to temperature regimes. Cool and cold-water fishes (e.g., trout, sculpin, and burbot (cusk)) are found in the northern part of the watershed and in mountainous tributary streams. Smallmouth bass, chain pickerel, brown bullhead (horned pout), and white perch are found in the central and southern part of the watershed and the lower reaches of the main tributaries and the impounded areas of the main stem where warm waters occur. Forage fishes are abundant in the main stem of the river and in the larger tributaries. They include blacknose dace, spottail shiner, fallfish, white sucker, and common shiner. There are 33 native species in addition to the diadromous fish discussed previously.

One resident fish of conservation concern is the brook trout. In 2005, a group of public and private entities formed the Eastern Brook Trout Joint Venture (EBTJV) to address the decline of native brook trout and restore fishable populations. The group spearheaded a range-wide population and threats assessment to the species and its habitat in the eastern U.S. The long-term goals of the EBTJV are to develop a comprehensive restoration and education strategy to improve aquatic habitat, raise education awareness, and raise Federal, state, and local funds for brook trout conservation.

Although not currently threatened with extinction across the entire range, brook trout were extirpated from 21 percent (21%) and greatly reduced in 27 percent (27%) of sub-watersheds in a study by Hudy et al. (2005). Large portions of Maine, New Hampshire, New York and smaller portions of Vermont, Massachusetts, and West Virginia need increased monitoring. Most of the Connecticut River sub-watersheds still support brook trout to varying degrees. More subwatersheds in Vermont and New Hampshire have self-sustaining populations, whereas streams in Connecticut and Massachusetts have experienced more widespread declines due to habitat loss and degradation. The most important factors impacting brook trout across their range are increased water temperature, agriculture, urbanization, exotic fish species, and degraded riparian habitat.

In Connecticut, brook trout populations tend to be small and fragmented. The only sub-watershed in the State considered "intact" by the EBTJV is in the Litchfield Hills area which is outside the Connecticut River watershed. Intact means at least 50 percent (50%) of this subwatershed has a self-sustaining

population. Within the watershed in Massachusetts, there is one intact sub-watershed located along the New Hampshire border east of the Connecticut River. Vermont has the most sub-watersheds designated as intact. A substantial portion of that is in the Northeast Kingdom, where the Nulhegan Basin Division is located. Although only qualitative information is available for most of New Hampshire, there are intact sub-watersheds near the Pondicherry and Blueberry Swamp divisions, and within the Ashuelot River area (EBTJV 2006).

### Mammals

The watershed hosts a diverse assemblage of mammal species, from the widespread white-tailed deer to the rare and largely unfamiliar pygmy shrew found in a variety of forested habitats in the northern third of the watershed. Sixty-one mammal species occur in the watershed today. A number of species have been extirpated over the last hundred years due primarily to habitat loss and/or unregulated hunting/trapping. These include the eastern cougar, gray wolf, wolverine, Eastern elk, and woodland caribou. Two species have immigrated into the watershed in the last century: coyote and Virginia opossum (DeGraaf and Yamasaki 2001).



Craig Lewis/USFWS

*White tailed deer*

Most mammals within the watershed are forest inhabitants and include species such as near ubiquitous eastern chipmunks, gray squirrels, raccoon, and deer mouse, to the more solitary porcupine, black bear, bobcat, and Canada lynx, a federally listed species. Although heavily forested, the watershed holds a wide variety of wetland habitats (see above) which support a number of species well suited or limited to riparian and/or wetland habitats such as river otter, beaver, muskrat, and mink. Other species that commonly use wetland habitats include, water shrew, star-nosed mole, Eastern pipistrelle bat, meadow vole, Southern and Northern bog lemming, meadow jumping mouse, gray fox, raccoon, American marten, and ermine (DeGraaf and Yamasaki 2001).

The rocky and steep topography in the northern portion of the watershed provides natural caves and manmade mines for hibernating bats. Millions of North American bats have been killed by white-nose syndrome, a fungal disease discovered in a cave in New York State in 2006. Winter surveys have shown 100 percent (100%) mortality in bat populations using hibernacula in Vermont (Bennett *pers.com.* 2013). This disease may be blamed as the principle cause for some bat species' extinction. Little brown, tricolored, and eastern small-footed bats have been decimated by this disease, and have been petitioned for listing under the ESA. As mentioned above, the northern long-eared bat is listed as federally threatened.

Another mammal of particular concern in the watershed is the New England cottontail. The range of this once widespread rabbit has declined by about 86 percent (86%) since 1960 (Fuller and Tur 2012). The primary cause is loss of early successional forest and shrubland habitat. Other factors include high predation rates due to small, fragmented habitat patches, and gradual displacement by introduced eastern cottontails which use a wider variety of habitats and appear to be less susceptible to predation.

Recent surveys have revealed that the New England cottontail still occurs in scattered areas of Rhode Island, New Hampshire, southern Maine, western Connecticut, and in parts of Massachusetts (western Hampden County, southeastern Berkshire County, and Plymouth County). In the watershed, it has only been found in Hartland, New Hartford, East Haddam, and Lyme, Connecticut and in Hampden and Berkshire Counties in Massachusetts. Given this conservation urgency, a rangewide New England Cottontail Initiative was established and a Conservation Strategy was approved in 2012. This initiative involves collaboration from multiple agencies, including the Service, state wildlife agencies, universities, NRCS, TNC, and Wildlife Management Institute, to

address cottontail conservation on a landscape scale (USFWS 2011a, Fuller and Tur 2012). The Conservation Strategy, titled “A Conservation Strategy for the New England Cottontail” provides management goals and strategies for this species (Fuller et al. 2012) and recognizes the importance of conserving and actively managing habitats to the species’ future. Forty-nine focus areas were identified as locations to manage and restore habitat for New England cottontail. Three of these focus areas are within the refuge acquisition boundary. Early successional forest management and protection of adjacent natural shrubland habitat will meet the conservation goals set for the New England cottontail.

The Service considered listing this species and published a summary for this petitioned candidate that summarizes the status of the New England cottontail (*Federal Register* 77(225):70009-70010). However, a determination was made by the Service in 2015 to not list the cottontail as a federally threatened species, was in part, due to the established conservation partnership dedicated to conserving and protecting shrubland habitat.

For a complete list of mammals found in the watershed, visit: [http://www.fws.gov/refuge/Silvio\\_O\\_Conte/about/library.html](http://www.fws.gov/refuge/Silvio_O_Conte/about/library.html) (accessed August 2016).

### Reptiles and Amphibians

There are 23 species of amphibians and 25 species of reptiles in the watershed. Reptiles include species such as wood turtle, Eastern box turtle, spotted turtle, musk turtle, common snapping turtle, painted turtle, Northern red-bellied slider, Northern black racer, Eastern timber rattler, Eastern ribbon snake, Eastern milksnake, and Eastern hog-nosed snake. Amphibians include species such as Northern leopard frog, wood frog, Eastern American toad, spotted salamander, red-backed salamander, marbled salamander, and Jefferson salamander. The painted turtle is probably the most ubiquitous turtle frequently seen basking in ponds, oxbows, and other quiet shallow bodies of water. The Northern diamondback terrapin, an estuarine species, is restricted to the tidal creeks and bays at the mouth of the Connecticut River. It may nest on some of the sandy spoil islands. The Eastern box turtle is the only completely terrestrial turtle within the watershed and is a resident of woodlands, field edges, and well-drained forest bottomlands (USFWS 2013e).

For a complete list of amphibians and reptiles found in the watershed, visit: [http://www.fws.gov/refuge/Silvio\\_O\\_Conte/about/library.html](http://www.fws.gov/refuge/Silvio_O_Conte/about/library.html) (accessed August 2016).

Redback  
salamander



USFWS

The redback salamander, probably the most widespread and abundant salamander within the watershed, is a small woodland salamander with a completely terrestrial life history. It inhabits deciduous or mixed conifer-deciduous forests residing beneath wet leaf litter, within or beneath logs or other retreats. The common mudpuppy salamander is the only aquatic species within the watershed and occurs primarily in the main stem Connecticut River and immediate tributaries from Massachusetts to central Connecticut. The Northern spring peeper is a diminutive woodland frog widely distributed throughout the watershed. It is the earliest frog to call in the spring, breeding in a variety of wetlands including woodland swamps and ponds, vernal pools, and roadside ditches.

Amphibians and reptiles have only recently become fauna of management concern by conservation agencies and organizations, but are now a prominent part of wildlife and natural heritage programs (Mitchell et al. 2006). All of the state wildlife action plans provide information on species of herpetofauna that are of greatest conservation need (GCN). These species in total embrace a broad range of habitats within the Connecticut River watershed. Examples of GCN species listed by watershed states include the blue-spotted salamander, Eastern

spadefoot toad, wood turtle, Eastern box turtle, spotted turtle, Eastern ribbon snake, Jefferson salamander, marbled salamander, Northern leopard frog, and Fowler's toad. Suitable habitats include tidal wetlands, freshwater bogs, vernal pools, interior forests, grasslands, shrublands, streams, and rivers (NHFG 2005, Connecticut Department of Energy and Environmental Protection 2005, Vermont Fish and Wildlife Department 2005, Massachusetts Department of Fish and Game 2006).

One of the most seriously declining vertebrate species in New England is the Eastern timber rattlesnake. Although this species is classified as "Least Concern" on the Red List of Threatened Species by the International Union for the Conservation of Nature, it is listed as State-endangered in all watershed states ([http://www.masnakes.org/snakes/timber\\_rattle/](http://www.masnakes.org/snakes/timber_rattle/); <http://www.ct.gov/deep/cwp/view.asp?a=2723&q=326068>; <http://www.wildlife.state.nh.us/wildlife/profiles/timber-rattlesnake.html>; <http://www.vtfishandwildlife.com/cms/One.aspx?portalId=73163&pageId=149312>; all accessed online August 2016). The species ranges widely in the United States, though its overall population is decreasing. It is declining or extirpated in all northeastern states, with a few surviving populations in Massachusetts and Connecticut, one in New Hampshire, and two in Vermont. This rattlesnake is an inhabitant of deciduous forests, but it also requires rock ledges or outcroppings with southerly exposures for winter denning. Major threats to the species include habitat loss and fragmentation (i.e. from development) leading to population isolation, and direct mortality caused by humans (i.e. from collecting hunting, and vehicles) (Hammerson 2007).

The Eastern spadefoot toad is listed as "threatened" in Massachusetts and is most common on Cape Cod and in the Connecticut River Valley. Spadefoots breed only after very heavy or prolong rain events. When they do breed it may be as early as April or as late as September. This burrowing frog is associated with sandy, well drained soils and open forest or sparse shrub or fields (MA NAAMP 2009).

### **Invertebrates**

Invertebrates are the most diverse and abundant group of animals within the watershed and encompass many large groups of animals such as single-celled protozoa, freshwater sponges, flatworms, snails, freshwater clams, worms, insects, arachnids, and crustaceans. These range from familiar insects such as butterflies, dragonflies, bees, and beetles to more obscure invertebrates such as clam shrimp and bryozoans. Perhaps the rarest invertebrate species in the watershed is Faxon's clam shrimp (also known as Agassiz's clam shrimp. This crustacean is less than one-half inch long and enclosed by a chitinous clam-like shell. This species only occurs in three locations in Massachusetts (one in the Connecticut River watershed); it has also been recorded in Florida and Europe.

There are also several rare tiger beetles in the watershed. As mentioned under the section on federally listed species, several populations of threatened Puritan tiger beetle occur along the Connecticut River in Massachusetts and Connecticut. The cobblestone tiger beetle, currently petitioned for Federal listing, lives in riparian cobble bars and sandy beaches along rivers. Isolated populations of cobblestone tiger beetles occur along the Connecticut River in Massachusetts, Vermont, and New Hampshire, as well as in the White River in Vermont (NHWAP 2005).

Extensive information on invertebrates is presented in the State WAPs (NHFG 2005, Connecticut Department of Energy and Environmental Protection 2005, Vermont Fish and Wildlife Department 2005, Massachusetts Department of

Fish and Game 2006). These plans identify many invertebrates of GCN such as the precious underwing moth and boreal turrel snail, both endangered in Massachusetts and listed as “special concern” in Connecticut.

The role of invertebrates in the watershed cannot be underestimated. There are numerous species of invertebrates such as stoneflies, mayflies, and caddis flies that process stream detritus in their larval stage and serve as prey for fish (larvae) and birds and bats (adults). Trout are well known for their reliance on aquatic insect larvae such as mayfly, stonefly, caddis fly, midges, ants, and worms. Some species are common, while others are recognized as rare by individual states. Many species of invertebrates are excellent indicators of environmental health. Muskrats thrive on clams and mussels, and salamanders and frogs rely on aquatic insect larvae, snails, beetles, spiders, and earthworms.

Many invertebrates spend part or all of their lives in an aquatic environment. Most infamous are the various mosquitoes and black flies whose larvae grow in still waters and moving waters, respectively. Although their adult bloodsucking forms are seen as a nuisance, the larvae are important in the aquatic food chain, and winged adults are food for many birds such as cedar waxwings, swifts, and flycatchers, and all bats in the watershed such as little brown and hoary bats. Certain native and nonnative mosquitos, however, serve as vectors for serious diseases such as West Nile virus, which is well established in the watershed.

### *Mussels*

The U.S. has the greatest diversity of freshwater mussels in the world, but of the nearly 300 species residing in North America, researchers believe that only 23.6 percent (23.6%) of the species are stable—the rest being either endangered, threatened, undetermined (5 percent (5%)) or of special concern, and 35 species are extinct or believed to be extinct (Williams et al. 1993, Nedeau 2008a). An extensive discussion of freshwater mussels for the watershed is provided in “Freshwater Mussels and the Connecticut River watershed” (Nedeau 2008a); much of the discussion on their critical ecological role was derived from this reference. As noted earlier, there are 12 species in the watershed, 8 of which are endangered, threatened, or of conservation concern by managing agencies and/or organizations. These include the federally endangered dwarf wedgemussel, the rare brook floater, and triangle floater. The yellow lampmussel is another rare species. The Tidewater mucket was documented from the Connecticut River in Massachusetts in 2005 and also occurs in Connecticut. The Eastern pearlshell and the Eastern pond mussel are both uncommon. The only relatively common mussels are the Eastern elliptio and alewife floater, the former having many cool and warm-water host fish species, and the latter being somewhat restricted to alosids (i.e., American shad, blueback herring, alewife). The Eastern elliptio is the most widely distributed of the mussels in the watershed, and the alewife floater is moderately well

*Federally endangered dwarf wedgemussel*



Susi Von Oettingen/USFWS

distributed, as are the Eastern pearlshell, triangle floater, creeper, and Eastern lampmussel (Nedeau 2008a).

As filter-feeders, freshwater mussels are recognized for being excellent indicators of watershed health, and they play an essential and significant role in the food web, improving water quality, nutrient cycling, and habitat quality. They are unique in their reproductive cycle in that their larvae, or glochidia, must attach to the gills or tail of fish, or as is sometimes the case in creepers, amphibians may be the host (Nedeau 2008a). As a group, they inhabit a wide range of riverine and stream habitats; however, individual species often have strict habitat requirements. Eight of the native species have broad distributions, four occur in the southern portion of the watershed (Nedeau 2008a), and nine species have been found within a 1-mile stretch of the Farmington, Fort, and Salmon rivers (Nedeau 2005a, 2005b, 2008b). Other rivers with high occurrence include the Mill River in Massachusetts and Eight Mile River in Connecticut. Of 47 recognized tributaries, seven contain between nine and 11 mussel species, 18 contain six, and 19 contain less than five. Each state has tributaries containing no mussels, such as the Mohawk River in New Hampshire and Fall River in Massachusetts (Nedeau 2008a).

*Zebra mussel on native mussel*



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Threats to freshwater mussels include dams and other aquatic blockages, destruction of riparian habitat, dredging, intensive agriculture and urbanization, stream flow alterations, and all aspects of water pollution: eutrophication, organic and heavy metal contaminants, acid rain, turbidity, power plant and urban source thermal pollution, anoxia and hypoxia, pH, pesticides, endocrine disruptors. Invasive fish, including the nonnative smallmouth bass, often displace native host fish, disrupting mussel breeding behavior, and mussels also are threatened by the invasive zebra mussel and quagga mussel, although these mussels are not currently in the watershed (Nedeau 2008a).

### *Pollinators*

The health of the watershed and its habitats is greatly affected by pollinators, and quality habitats such as those found on national wildlife refuges are essential to pollinators. Pollinators (insects, birds, bats) are essential to our environment, including that of the watershed. The ecological service they provide is necessary for the reproduction of nearly 70 percent (70%) of the world's flowering plants, including more than two-thirds of the world's crop species. The U.S. alone grows more than one hundred crops that either need or benefit from pollinators, and the economic value of these native pollinators is estimated at \$3 billion per year. Fruits and seeds derived from insect pollination are a major part of the diet of about 25 percent (25%) of all birds, and of mammals ranging from red-backed voles to black bears.

Four previously abundant species of native *Bombus* bumblebee have declined by 96 percent (96%) in the U.S., and their ranges collapsed by 87 percent (87%) (Cameron et al. 2011). A good example of an important wild pollinator is the rusty-patched bumble bee, once commonly distributed throughout the east and upper Midwest that has steeply declined in recent years. This bumble bee is an excellent pollinator of wildflowers, cranberries, and other important crops, including plum, apple, alfalfa, and onion seed. In many places, the essential service of pollination is at risk from habitat loss, pesticide use, and introduced diseases (The Xerces Society 2013).

### **Rare Plants**

The New England Plant Conservation Program (NEPCoP), a collaboration between the New England Wild Flower Society and the state botanists in

the natural heritage programs examined the status of all the rare plants in New England. They most recently published their findings in the 2012 *Flora Conservanda* (available online at: <http://www.newfs.org/conservesaving-imperiled-plants/flora-conservanda>; accessed August 2016). NEPCoP then commissioned and published conservation plans for about 120 species of the rarest plants. The refuge supported the development of conservation plans for the following six rare plants that had most of their occurrences in the watershed.

*Yellow corydalis*

This plant is at the northeastern limit of its range in Connecticut and occurs in only four populations in five towns in the south-central part of the State. It is listed in *Flora Conservanda* as a “regionally rare” species and by the State of Connecticut as threatened. It is restricted to a narrow belt of open outcrops and sparsely wooded summits along trap-rock ridges. Property supporting one of the populations is owned by a conservation organization, and another population is under the jurisdiction of two towns. The final two are privately owned. Trampling and damage from all-terrain vehicles is a threat at three of the four sites. Competition from invasive plant species and climate change are potential threats (Farnsworth 2001).

*Garber’s Sedge and Sticky False Asphodel*

These two plants are considered together because they inhabit similar habitats. They often co-occur along calcareous river shores and riverside seeps, on sites that are regularly inundated and ice-scoured. Garber’s sedge is considered a “globally rare species occurring in New England,” while the more common sticky false asphodel is “locally rare.” The watershed contains 11 occurrences of the former and 8 occurrences of the latter (they co-occur at six sites). Most of the sites are on the main stem of the Connecticut River in New Hampshire and Vermont, although there are two occurrences along the White River and one on the Passumpsic (Brumback 2001).

*Many-fruited false-loosestrife*

This perennial is a “regionally rare” species. It is listed as endangered in Vermont (two sites) and threatened in Massachusetts (seven sites in the Connecticut River watershed). The species occurs on floodplain and pond shore habitats. It is threatened by invasive plant species, recreational activities, and hydrological changes (Ramstetter and Mott-White 2001).

*Musk flower*

Also a “regionally rare” species, it is found at only three sites in Vermont, three in New Hampshire, and three sites in Massachusetts. It grows in wet, cool soils along brooks, springs, and wet seeps. Most occurrences contain only small numbers of plants, and invasive species are present at several of the sites (Ewing 2001).

*Toothcup*

Another “regionally rare” species, this plant is at the northern edge of its range with seven populations (four in the watershed) documented in Massachusetts and three in Connecticut. Toothcup inhabits exposed gravel or cobble shores of lakes, ponds and reservoirs that have wide fluctuations in water levels. It occupies the zone between low and high water, and does not compete well with other plants. Of 26 historic sites, the plant has only been observed at five since 1990. Invasive species, sedimentation, and habitat succession are all threats (Mattrick 2001).

**Invasive Species**

Introduced species that multiply in large numbers, displace native species, and cause ecological damage (i.e., loss of rare species and plant communities, loss of habitat value, change in soils, changes in fire regimes), economic damage (e.g., weeds, forest pests, zebra mussels), or impact human health (e.g., giant

hogweed) are called invasive species. Since our Nation's founding, the U.S. has experienced the introduction of more than 30,000 species of plants, animals, fungi, and viruses, most introduced directly or indirectly by humans. Although many are valuable crops and livestock, others are serious pests that have claimed the habitats of native species, forcing many of them to extinction, causing crop damage and human and animal disease. Economic damage is estimated to be \$123 billion annually, and more than 40 percent (40%) of Federal endangered and threatened species are at risk due to the impacts associated with introduced species (Hall 1999).

Invasive species have been introduced, purposefully or accidentally, into the watershed from other countries or other regions of this country. Often these exotic species establish in natural ecosystems, becoming naturalized, but without noticeably affecting natives or their habitats. However, some outcompete and displace native species, especially if there are no natural population control mechanisms (e.g., habitat competition, predation, disease, and parasitism) in their new location. In fact, introduced species frequently have been introduced specifically because they were easy to establish, hardy, and disease resistant. In addition to the initial introductions, human activities that relocate surface soil layers and disturb existing stands of invasive plants or that result in generally disturbed soils, contribute excessive nutrients, and remove native plant cover, can favor the spread of exotics.

#### *Invasive Exotic Fish*

Nonindigenous fish species are found throughout the length of the Connecticut River and its tributaries. There are more introduced fish species (35) in the watershed than native species (33). Many species were introduced to provide additional recreational fisheries, specifically, trout, bass, pike, and sunfish. Native species populations often suffered from exploitation, habitat loss, and water quality degradation. Land management practices including unregulated timber harvest, some agricultural practices, dam installation, and industrial discharges resulted in altered habitat and water quality conditions that were better suited for hardier nonindigenous species. The distributions and populations of fish are better known than those of any other aquatic species. State and Federal agencies work together to avoid the loss of native fish species as a result of the purposeful or accidental introduction of nonnative plant and animal species.

#### *Invasive Plants*

Invasive, exotic plants like Oriental bittersweet, Japanese stiltgrass, purple loosestrife, garlic mustard, glossy buckthorn, water chestnut, and shrub honeysuckles can substantially degrade native plant communities in the watershed. Since the last ice age, the native plants and animals have co-evolved, and developed intricate interdependences. While there are an estimated 4,000 introduced plants in the U.S., only 400 are considered potentially invasive. Many of the alien plants, such as dandelion, naturalize and blend in with the native plants. A few others have a remarkable competitive advantage, and can overcome the native vegetation reducing their biomass and in turn impacting the wildlife dependent on them. Some introduced plant species can alter the soil chemistry and produce chemicals that inhibit or prevent other species from growing in close proximity; others elevate erosion potential; some are so attractive to pollinators that native plants are avoided; others impact habitat suitability (UVPLC 2002).

Based on figures for Massachusetts, 950 of the 2,700 (or 35 percent (35%)) of plants in that State have been introduced (Bickford and Dymon 1990). In Massachusetts alone, at least 66 species are considered invasive, likely invasive, or potentially invasive, including Norway maple, autumn olive, mile-a-minute vine, burning bush and garlic-mustard (Somers et al. 2006). Although common



reed and purple loosestrife degrade wetlands throughout the watershed, these plants are much more widespread in Connecticut, affecting a large number of wetlands. In general, the southern watershed has more and larger, well-established invasive plant populations, likely due to the warmer climate and larger human populations that cause the soil disturbance known to benefit invasive plant establishment.

Another plant affecting both wetland and upland habitats in Connecticut and Massachusetts is Japanese stiltgrass and refuge staff are working with partners to try to keep it from spreading northward. Mile-a-minute vine is being controlled where found in Connecticut and refuge staff and volunteers have assisted partners to control the few sites in the watershed in Massachusetts. It has newly been found in New Hampshire, but not at all in Vermont. Oriental bittersweet, Japanese knotweed, multiflora rose, buckthorns, and Japanese barberry are widespread in upland areas, with the knotweed extending into northern New Hampshire and Vermont. Eurasian milfoil is a problem in the watershed, even in many northerly ponds and lakes, including Lake Morey in Fairlee, Vermont; Halls Lake in Newbury, Vermont; and Mill Pond in Windsor, Vermont (LaSala 1994).

Water chestnut, a floating invasive aquatic plant that can rapidly become established and cover the entire surface of shallow coves, ponds, or lakes, was reported in the watershed in 1997. Since the late 1990s, the refuge has led a partnership effort comprised of local and state agencies, conservation partners, landowners, and many volunteers to find and remove this plant. Seeds of this annual weed can remain viable in bottom sediment for a dozen years. As of 2016, the refuge and partners are actively controlling or evaluating success at approximately 50 known sites in the watershed of Massachusetts and Connecticut. It was newly reported from Hinsdale, New Hampshire in 2012.

Rock snot or didymo, a diatom that creates large mats in flowing water, was found in the upper Connecticut River and White River in 2007. Didymo can form extensive “blooms” on the bottoms of rocky river beds, and it is thought that these smother aquatic life forms such as aquatic insects, native algae, and other organisms fed on by fish (NHDES 2008). However, evidence emerged in 2016 showing that this species is native to New England and becomes problematic in areas with low phosphorus levels.

Comprehensive descriptions of invasive plant species are available from the Invasive Plant Atlas of New England (IPANE), now administered by the Early Detection and Distributional Mapping System (EDDMapS, at <https://www.eddmaps.org/ipane/>, accessed July 2016)). Along with the University of Connecticut and the New England Wild Flower Society, the Conte Refuge was a founding partner of IPANE. Under a grant from the USDA from 2001 to 2005, citizen scientists were trained through IPANE to collect distributional data while refuge staff worked with IPANE partners to administer the networking arm of IPANE to connect New Englanders concerned about the invasive plant issue via email newsbriefs and regional conferences. This networking was done under the name “New England Invasive Plant Group (NIPGro).” States comprising the watershed also provide extensive information on invasive plants and create statewide lists after evaluating species for invasiveness at the state level. Links to much of that information, including lists for species targeted for early detection and rapid response, can be found at the New England Wild Flower Society website at <http://www.newfs.org/conservation/controlling-invasives/> (accessed August 2016)

#### *Invasive Invertebrates*

Zebra mussels were first found in the U.S. in 1988 in Lake St. Clair, Michigan, and later spread to all five of the Great Lakes, the Finger Lakes area of New York, and the Mississippi River basin. Zebra mussels are currently found in at least 30 states, although have not been found in the Connecticut River watershed. This invasive mussel could have a profound effect on the native freshwater mussels in the watershed. This mussel attains a size of one half inch to an inch and one half as an adult. It is of great concern because, similar to the Asiatic clam (below), this exotic mussel has an incredible propensity to reproduce. Once established, zebra mussels have the capacity to clog water intake pipes of waste water treatment plants, electric generation plants, and industrial operations. This mussel poses a serious threat to aquatic ecosystems because it can outcompete and displace native species, particularly mollusks and impact natural processes. Large, established populations of these filter feeders can remove vast amounts of algae, phytoplankton, and zooplankton greatly reducing food supplies for native organisms. The discovery in July 2009 of zebra mussels in Laurel Lake, located in western Massachusetts (Housatonic River watershed), prompted Massachusetts to develop an Interim Zebra Mussel Action Plan (MDCR and MDFG 2009) and later a series of recommendations from the Zebra Mussel Task Force (MEOEEA 2009).

Asiatic clam is a freshwater invertebrate that first entered North America in the early 1900s, reaching the Mid-Atlantic States in the 1970s and 1980s. The animal grows to one-half inch as an adult. It has been identified in the lower reach of the Connecticut River, and is of great concern because of its reproductive capacity: an average of 70,000 offspring per adult per year. This clam poses a serious economic threat because of its ability to clog industrial water intake pipes. It also is a serious environmental menace because it can outcompete and displace native mollusks. In suitable environments, Asiatic clam densities can reach 10,000 to 20,000 individuals per square yard, impacting a diverse array of aquatic plants and animals (USGS 2013b).

The quagga mussel (named after the quagga, an extinct African relative of the zebra) was first sighted in the Great Lakes in September 1989. This mussel is now well established in the lower Great Lakes, but has not been found in great numbers outside this region. Its occurrence in the St. Lawrence Valley presents a clear concern for its spread into the Connecticut River watershed (USGS 2011). Although not yet documented in Massachusetts, the education and action components of the State's 2009 Interim Zebra Mussel Action Plan is designed to prevent the occurrence and spread of quagga mussels as well.

Introduced forest pests are a concern throughout the watershed. The scale insect responsible for beech bark disease (BBD) was introduced to the northeastern U.S. from Europe in the 1890s (Koch 2010). BBD causes significant mortality and defect in American beech. The disease results when bark, attacked and altered by the insect beech scale, is invaded and killed by native fungi, primarily. Currently BBD affects all of the Refuge forests where American beech occurs. After the killing front has moved through a stand, the aftermath zone areas where heavy mortality occurred at some time in the past, is characterized by some residual larger trees and many stands of small trees, often of root-sprout origin. Larger trees, over about 8 inches in diameter, succumb more readily than small ones, leaving landscapes devoid of larger-diameter mature beech trees. Gypsy moths have caused widespread damage over the years. In addition, attempts to control them severely affected non-target native species. Dichlorodiphenyltrichloroethane (DDT) spraying for gypsy moth control in the 1950s and 1960s severely depressed the populations of many butterflies and other insects. The hemlock wooly adelgid (HWA), an introduced aphid, is presently killing Eastern hemlock trees and compromising hemlock forest associations

throughout the eastern U.S. HWA is now established from northeastern Georgia to southeastern Maine and as far west as eastern Kentucky and Tennessee, and may spread northward with climate change. Biological control of HWA using lady beetles is showing some promise (Cheah et al. 2004). Emerald ash borer (EAB) was discovered in Michigan in 2002 and has since spread to three of the four states in the Conte's acquisition boundary. New Hampshire is the most recent and most northerly discovery. EAB kills 99 percent (99%) of ash trees and infects all ash species. Eradication efforts are underway in many states, and often involve complete removal of all ash trees in front of the advancing EAB population. The Asian longhorn beetle is established in Worcester, Massachusetts, and efforts are in effect to restrict activities with infected trees and wood within regulated, designated areas (city of Worcester 2013). The current goal of Federal and state agencies is complete eradication of Asian long-horned beetle. The beetle is able to attack and kill healthy trees across a wide range of species including maples. Eradication efforts are currently underway and involve removal, chipping, and burning of any and all material from infested trees.

#### *Invasive Fungi*

A number of introduced fungi have had devastating effects on the plant and habitat characteristics of Eastern North America and Connecticut River Valley. Most prominent are the 1904 American chestnut blight, 1930 Dutch elm disease, and 1967 butternut tree canker, all of which have impacted forest composition and ecology in New England. The chestnut blight caused the collapse of the most dominant hardwood in the Appalachian Mountains and beyond, completely eliminating a critical mast source and shelter for wildlife and food and fiber for mountain communities. Ironically, stunted American chestnut remain ubiquitous as the fungus prevents trees from maturing and producing nuts; eastern woods are abundant with stump sprouts with some immature trees reaching 20 to 30 feet. in height (Bolgiano 2007).

Dutch elm disease (DED) was introduced to the U.S. from Europe in the 1930s, and by 1977, the disease had spread throughout most of the country, killing an estimated 46 million American elms. DED has mostly affected urban populations of American elm, a widely planted shade tree. In forest stands where elms are relatively isolated from one another, spread of the disease is sporadic. The USDA Forest Service's Northern Research Station, has established demonstration plantings of DED-tolerant American elms on many of its sites in the east and mid-west to develop DED-tolerant elms. Disease resistant elms are often planted as replacement to diseased and destroyed trees (USFS 2011). Currently, TNC is evaluating the efficacy of disease resistant elm plantings in the watershed, including a possible planting at the Fort River Division in 2014. Butternut, also known as White walnut, is a highly valued hardwood species native to eastern North American forests. Like Chestnut blight and DED, Butternut canker has effectively eliminated butternut as a thriving tree species within the northeast forest ecosystem. In 1995, the Forest Service estimated that 77 percent (77%) of the butternuts in the Southeast were dead. Surviving butternuts are often found in riparian zones, and, in contrast to American chestnut, butternuts usually will not sprout after stem death. Most butternut dies within 15 years of infection and virtually all known populations of butternut are now infected (Schlarbaum et al. n.d., Lombard n.d.).

## **Socioeconomic Environment**

We enlisted the assistance of economists with the USGS, Fort Collins Science Center, to assist us in a regional economic report. The full report is included as appendix I. Among other details and analysis, the report includes a description of the current economic setting and illustrates the refuge's contribution to local economic communities. The refuge management activities of greatest, direct economic impact in the watershed are:

- Refuge purchases of goods and services within the local communities.
- Refuge staff salary spending.
- Refuge visitor spending in the local communities.
- Revenues generated from timber harvesting for habitat management on the refuge.
- Refuge land purchases and changes in local tax revenue.

The report also notes that the economic value of a refuge encompasses more than just the direct impacts to the regional economy. Refuges also provide substantial nonmarket values (values for items not exchanged in established markets) such as conserving threatened and endangered species, preserving wetlands, and helping to maintain clean water and air (Caudill and Henderson 2003). These natural “services” (often called ecosystem services) provided by the conserved landscape can be extremely valuable to one’s well-being and to society in a more traditional economic sense. Ecosystem service values can be substantial, and should be recognized as a contribution when evaluating refuge management activities. However, quantifying individual ecosystem service values is beyond the scope of the economic impact analysis.

Some highlights of the economic setting description follow. Please refer to appendix I for the full narrative.

In its entirety, the watershed encompasses an area of over 11,000 square miles and contains nearly 400 towns and cities. The 7.2 million-acre watershed is home to over 2.3 million people (Clay et al. 2006). The waters of the Connecticut River have played an important role in the watershed’s social and economic history. The river itself provided a source of energy to power mills, factories, and entire communities, irrigation water for working farmlands, and a means of transportation for the watershed’s people and goods. The regional economy has evolved from the original agricultural colonists and small goods traders, to robust manufacturing production and supporting commodity extraction industries, to relying more on the services sector and travel and tourism spending. Currently, large urban centers within the southern counties of the watershed serve as hubs to the greater New York City area with many residents employed in the service industry. Counties near the northern headwaters continue to provide a more rural way of life and are still highly dependent on manufacturing jobs.

Many of the towns within the watershed are attempting to capture more of the valuable tourism market by hosting annual festivals and cultural events that attract crowds from beyond the community borders. Many of these events are centered on the historic, cultural, and economic makeup of the region. Area farmers and artisans are once again finding local markets for their goods, while catering to buyers and their overall experience. Agritourism seems to be expanding at a considerable rate, with each State in the watershed now having a Web site and interactive map just for these enterprises.

There are abundant recreation opportunities within the counties of the watershed, including a range of opportunities on tracts under refuge management. Traditional activities on refuge lands include fishing, hunting, wildlife observation, photography, environmental education, and interpretation. Snowmobiling is very popular in various regions of the watershed, and is permitted on refuge land. The Appalachian Trail meanders through the northern-half of the watershed, making its way through the impressive White Mountain National Forest in New Hampshire. The middle portion of the

watershed in Massachusetts is bordered by the Berkshire Mountains to the west, which have been attracting tourists and recreationists for decades. Towns in the southern portion near the mouth of the Connecticut River heavily promote recreation opportunities associated with saltwater experiences. While large tracts of the watershed remain undeveloped, sprawling communities, particularly in the southern portion of the watershed, have begun to alter the dynamics in the region.

Given the vastness of the watershed, and the extensive diversity within, the economic report focuses on describing and assessing six focal sub-regions. The sub-regions incorporate 11 counties that make up the bulk of the watershed and are central to the refuge's existing and future land base. The sub-regions described are:

- (1) Northern Sub-Region: Essex County, Vermont, and Co s County, New Hampshire.
- (2) White River Junction Sub-Region: Orange County, Vermont, Windsor County, Vermont, and Grafton County, New Hampshire.
- (3) Tri-State Border Sub-Region: Windham County, Vermont, Cheshire County, New Hampshire, and Franklin County, Massachusetts.
- (4) Greater Amherst Sub-Region: Hampshire County, Massachusetts.
- (5) Greater Hartford Sub-Region: Hartford County, Connecticut.
- (6) Southern Connecticut Sub-Region: Middlesex County, Connecticut.

Section 1 of the report provides detailed socioeconomic demographic profiles for each focal sub-region. Each sub-region profile addresses historic and current trends in the area, and highlights important demographic and economic statistics. Included are population, regional employment and income, commodity industries, recreation and tourism industries, and land use and ownership. Few of these trends are consistent across all the sub-regions in the watershed, so we recommend the reader review the sub-region description of interest.

## **Part II: General Refuge Information**

### **Refuge Administration and Facilities**

#### **Refuge Staffing and Administrative Facilities**

The Conte Refuge is managed by a staff of nine full-time employees and one shared employee. As funding allows, the refuge also has additional temporary staff to help support visitor services or biological programs. The refuge also administers the Stewart B. McKinney National Wildlife Refuge along the Connecticut coast and the John Hay National Wildlife Refuge in Newbury, New Hampshire.

The refuge includes three staffed facilities. The headquarters office in Sunderland, Massachusetts, has the lead wildlife refuge manager (also known as the project leader), the deputy project leader, a general biologist, a Partners Program biologist, and a visitor services specialist. One temporary staff is stationed at the Great Falls Discovery Center in Turners Falls, Massachusetts. Full-time staff at the Nulhegan Basin Division office in Brunswick, Vermont, includes a refuge manager, forester, and a wildlife biologist. The refuge shares a full-time law enforcement officer with the Umbagog National Wildlife Refuge (Errol, New Hampshire), but this position is currently vacant. Temporary

positions vary between two and five per year and there are Youth Conservation Corps (YCC) crews, comprised of adult supervisors and local youths at the Nulhegan Basin Division, Pondicherry Division, and Fort River Division. During 2013 through 2016, 10-month Student Conservation Association crews were stationed at the Fort River Division. Please see appendix H for the current refuge staffing chart.

The three facilities for the refuge—Sunderland headquarters, Great Falls Discovery Center, and Nulhegan Basin Division Office—currently provide adequate space and amenities. The Sunderland headquarters office was made available following a renovation of the existing Connecticut River Fisheries Coordinator’s facility, allowing for more cost effective office space in contrast to former leased space in Turners Falls, Massachusetts. Solar panels were installed on the roof of this building in 2012 to reduce long-term energy costs and utilize a renewable resource.



Kathy Fournier/USFWS

*Nulhegan Basin Division office*

The Great Falls Discovery Center offers space for one visitor services specialist, and the public facilities are described below under “Public Use Facilities.” Working with our state partner, this building has undergone an energy audit and steps (e.g., cleaning climate control duct work, furnace repair) have been taken to make this old building more energy efficient.

The Nulhegan Basin Division office and visitor contact station was constructed in 2006 and provides space for the three full-time staff and the shared law enforcement officer as noted above. This office/visitor contact station is one of the first in the Northeast Region to employ a standard design approach for refuge

buildings. Its energy efficient design made it the first Energy Star building in the Service, and garnered a Silver designation from the “Leadership in Energy and Environmental Design for Existing Buildings” version 2.0 rating standard. This division also has two storage barns/garages and two heated quarters buildings: a 1990s era house occupied by permanent staff and the other is a 2004 modular home used for interns and visiting staff.

The Fort River Division includes a quarters building (i.e., three-bedroom house), a pole barn, stables building with two decrepit apartments, and office. Attached to the stables is a large former indoor riding arena which has a former horse hot-walker room attached. The stables building has been determined to be surplus to the refuge’s needs and will eventually be removed. Several water lines in this building are broken, leaving only barn water spigots functioning, which are used for cleaning equipment. The riding arena is used as a secured storage facility for vehicles and equipment. Utilities to this building have been shut off, although once the stables are removed, water and electrical services will be necessary. The arena is not insulated, but that is not necessary for its storage purposes. The quarters building was remodeled in 2009, including replacement of a large single-pane bow window and the entry doors. The original appliances also were replaced with energy efficient units. Potential additional energy conservation projects include installing energy efficient windows, replacing the water heater, additional insulation, solar and/or wind power.

The Salmon River Division includes a 1970s era two-story home on the shore of the Salmon River. At the present time this house has no functioning utilities and is not occupied. It will need a new electrical line from the house to the power lines and will likely require a new furnace, hot water heater, and some appliances should it be used as a quarters or support building. There are opportunities to incorporate energy efficient appliances and possibly solar panels.

There are some additional buildings on other units, such as the Pondicherry and Blueberry Swamp Divisions and the Roger Tory Peterson Unit.

**Budget**

Annual budgets are appropriated by Congress, and therefore, can vary year to year. Budget allocations are typically broken out into the following categories: wildlife and habitat, facility maintenance, visitor services, and law enforcement. Table 3.5 shows the refuge’s budget for fiscal year 2016.

**Table 3.5. Refuge Budget for Fiscal Year 2016**

Budget Category	2016 Budget
Wildlife and Habitat	\$921,478
Facility Maintenance	\$91,710
Visitor Services	\$351,285
Law Enforcement	\$81,763
<b>2016 Total Budget</b>	<b>\$1,446,236</b>

**Young Adult Programs**

*Youth Conservation Corps*

YCC is a government-funded summer program that gives young people (ages 15 to 18) paid opportunities to help work on public lands. While on board, participants conduct projects for the refuge while learning about the environment. Depending on annual appropriations, we host three or four crews at our divisions, with at least one each in Vermont, New Hampshire, and Massachusetts (and a crew at Stewart B. McKinney Refuge for which we handle the administrative aspects). Crews are typically comprised of a crew leader, an assistant leader, and four crewmembers. During the past 5 years, this program has served nearly 340 youth and young adults. The YCC crews provide valuable support to all refuge programs. Recent projects include boundary posting, multiple trail construction and maintenance projects, and invasive species control efforts and assisting partner organization with natural resource and environmental education projects.

The YCC crews working on the refuge are being administered through a cooperative agreement with Northwoods Stewardship Center, an established organization with a focus on youth employment in the outdoors. This provides us an opportunity to support this important program, but given our limited staff, allows us to rely on a partner to administer the program.

*Student Conservation Association/AmeriCorps*

AmeriCorps is a Federal community service program for young adults ages 18 to 23. The Student Conservation Association (SCA) is a youth training organization that places young adults interested in natural resources with government agencies and non-profits to assist the agency in work and provide job training skills to the young adults. Since 2013, the Conte Refuge has worked with 18 SCA interns that are subsidized by AmeriCorps. During 2013 to 2015, the SCA/AmeriCorps crew worked at the Fort River Division helping with trail construction, invasive plant control, fisheries biology assistance and boundary

posting. They also participated in visitor services programs at the Great Falls Discovery Center and WoW Express. During the 2016 year, the SCA/AmeriCorps interns assisted with trail maintenance, fisheries biology assistance, invasive species removal, Puritan tiger beetle translocations and rearing, as well as dwarf wedgemussel site surveys.

#### *Career Discovery Internship and Pathways Programs*

The Career Discovery Internship Program (CDIP) program is a recruitment tool that provides college-age individuals the opportunity to experience the refuge system from the perspective of a staff member, often filling roles in the biological or visitor services programs. CDIP was created in 2008 through a partnership with the Student Conservation Association. Designed to target diverse populations, the CDIP serves approximately 30 students every year, giving them the opportunity to pursue gainful summer employment on any of the Northeast's national wildlife refuges. These internships provide students with career experience in the field of conservation as well as the opportunity to develop professional networks with service employees. The Nulhegan Basin Division employed an intern the past 3 years: year one the intern worked with invasive plants, including the mapping of *Phragmites* locations on a neighboring parcel; the last 2 years interns have served at the visitor contact station.

The refuge has hosted a Pathways Program student in visitor services the past 2 years, and previously hosted a biological student under a similar program. In both cases, these students engaged in many diverse projects including field studies, administration, invasive plant control, in visitor services for the Great Falls Discovery Center and WoW Express, and to support the new Adopt-a-Habitat program. The goal of the Pathways Program is to offer students with internships in their field of study and prepare these students for future employment with the Service.



Sharon Lindsay

*Lewis Pond, Nulhegan Basin Division*

#### *Hispanic Access Foundation Program*

In 2016, refuge staff hosted one Hispanic Access Foundation (HAF) intern. HAF is a group that helps place Hispanic college students interested in natural resources with government agencies and non-profits to assist the agency with work and provide job training skills to the young adults. In 2016, the HAF intern assisted with trail maintenance, fisheries biology assistance, Puritan tiger beetle translocations, and environmental education.

#### *Other Interns*

Partner relationships allow us to support interns in unique ways. Often the partner organization recruits, hires, and pays the interns, and the Refuge



supplies housing, an office, or logistical support. A current partnership with Trout Unlimited (TU) serves as an example: interns with TU have stayed in Refuge quarters while conducting fish habitat and population surveys on and off Refuge lands. The Upper Connecticut River Cooperative Invasive Species Management Area hired interns who began mapping invasive plants along tributaries of the Connecticut River while staying in Refuge quarters. Nulhegan Basin staff supervised their day-to-day activities and provided logistical support to the CISMA effort through geographic information system (GIS) mapping.

### **Volunteer Program**

Volunteers are vital to all our refuge programs. Individuals involved in volunteering range from youth to adults, and include local residents, clubs, and organizations. Some are long-term volunteers and have been with us for years, while others volunteer for a few hours in one day. In 2016, for example, approximately 100 volunteers provided 1,546 hours of work on refuge lands. Projects range from invasive plant control, particularly water chestnut removal, outreach at visitor contact facilities, maintenance of infrastructure, biological surveys, public use and environmental and interpretive programs.

### **Refuge Operational Plans (Step-down Management Plans)**

Planning for the refuge occurs at three levels: a CCP, step-down refuge management plans, and annual work plans. The CCP addresses topics of species and habitat management, visitor use, refuge operations, and development in general terms. The refuge management step-down plans take the strategic direction from the CCP and provide more specificity on when, where, and how programs will be run, or how natural and cultural resources will be protected. The annual work plans identify fiscal year priority projects needed to implement the CCP and associated management plans.

Step-down Management Plans, identified in policy 602 FW 4, generally are prepared to provide detailed strategies and implementation schedules for meeting goals and objectives identified in CCPs, although they are also prepared to meet select policy requirements (e.g., Station Safety Plan). There are more than 25 step-down management plans that may be appropriate to ensure safe, effective, and efficient operation on every refuge, ranging from habitat management to pesticide use and disposal.

Some plans require annual revisions; others are on a 5 to 10 year revision schedule. Step-down management plans prescribe a host of activities (i.e., Federal actions) and are, consequently, subject to NEPA compliance, public involvement, compatibility determinations, and the like. Often CCPs provide sufficient management detail, provided adequate public involvement and NEPA compliance has occurred (along with necessary compatibility determinations), so that subsequent development of associated step-down management plans called for by a CCP may be done without further NEPA compliance considerations. Ideally, a CCP either contains the detailed management elements, thus precluding need for step-down plans, or it clearly sets the stage for needed step-down plans.

The following step-down plans have been through NEPA compliance and are current, but may be revised with new information or following major additions to the refuge land base:

- Visitor Services Plan–Nulhegan Basin Division.
- Hunt Management Plan–Pondicherry Division.
- Hunt Management Plan–Nulhegan Basin Division and Putney Mountain Unit.

- Furbearer Management Plan–Nulhegan Basin Division.

With completion of the CCP, our priority will be to develop hunting, fishing, and habitat management plans for each refuge division. These will be followed by visitor service’s plan and an inventory and monitoring plan.

### **Friends of Silvio O. Conte National Fish and Wildlife Refuge and Other Refuge Friends Groups**

The refuge benefits from a strong, productive, and cohesive partnership with the non-profit Friends of Conte who provide a forum and a foundation to forge creative partnerships. The group is a broad based partnership of over 70 conservation, education, and outdoor recreation organizations with representation from the local, state, and national level. The Friends of Conte is particularly focused on refuge goals related to conservation, education, and recreation in order to contribute toward the refuge’s legislated purposes established by Congress. The Friends of Conte routinely collaborates on mutually beneficial projects under the umbrella of the NWRA mentored Friends initiative.

Several refuge units and divisions also have their own Friends groups. Existing Friends groups include: Friends of Nulhegan Basin, Friends of Pondicherry Wildlife Refuge, Friends of the Great Falls Discovery Center, Friends of the Connecticut River Paddler’s Trail, Friends of the Fort River Trail, Friends of Salmon River, and Friends of the Roger Tory Peterson Unit. New Friends groups are a consideration on other units of the refuge. These groups play a vital role in outreach, education, and assisting in day-to-day refuge operations and maintenance. We discuss the importance of Friends groups under goal 4 in chapter 4.

### **Special Use Permits**

The refuge manager issues special use permits on a case-by-case basis after determining whether the use is appropriate and compatible with refuge purposes. Most special use permits have a 1-year or shorter term (5-year permits for privately owned cabins at Nulhegan Basin Division). Since 2000, we have issued annual special use permits for: snowmobile trail maintenance and use; wildlife research; access to privately owned hunting camps; horse hauling of moose during hunting season; furbearer trapping; surveying and monitoring wildlife; all-terrain vehicle (ATV) access for disabled hunters; group environmental education; and use of blinds to observe or photograph wildlife.

We also issued special use permits for use and occupancy of privately owned hunting camps located on the Nulhegan Basin Division. Lands on which the cabins sit were previously leased to cabin owners by the owner of the larger forested tracts and were included in the Service’s original land acquisition effort. The environmental documentation describing the land acquisition noted the Service’s intention to continue the camp lease program for the life of the camp leaseholders or 50 years, whichever period is shorter. If current owners decide to sell their camps, the Service will pay market value and then remove them and restore the site if not needed for refuge purposes. No change in camp management is expected with development of the CCP.

### **Research**

Conducting research is one of the purposes of the Conte Refuge Act. Refuge staff, graduate students, conservation organizations, and others have conducted surveys and studies on the refuge. A sampling of those efforts follows; other research projects are identified in the descriptions of existing divisions and units at the end of the is chapter. Additional information on these studies can be obtained from refuge headquarters.

The U.S. Forest Service, Northern Research Station has included the Pondicherry Division in long-term northern goshawk nest monitoring, when there is an active nest. This work is ongoing. The station also included the Fort River Division in a pilot study of nesting American kestrels that began in 2012. To date, several nest boxes have been erected at the division to evaluate use during the 2013 nest season.

In 2002 through 2004, researchers from Salve Regina University in Newport, Rhode Island, conducted a study on Canada warblers at the Nulhegan Basin Division. The study measured habitat-specific estimates of Canada warbler productivity and survivorship in the Nulhegan Basin. The results of this study are available on the Center for Northern Forest Research Web site at: <http://cnfr.us/research.php> (accessed August 2016).

A basin-wide evaluation of floodplain forests by TNC's Connecticut River Program included sampling locations at the Fort River and Mill River divisions (TNC 2011). Results of the initial study informed a TNC report and subsequent scientific paper (Marks et al. 2011, Marks et al. 2014).

The refuge has sponsored long-term monitoring of the federally threatened Puritan tiger beetle population in Northampton, Massachusetts, since 1998. The focus of this work has been to estimate adult numbers, monitor larvae and their habitats, enhance larval habitat, and augment the population from an intact metapopulation in Connecticut. During the mid-2000s there was an effort to educate beachgoers about these beetles. Numbers remain precariously low at this site and continued work at the site is needed to recover this species.

The University of Massachusetts initiated a study of the diversity and abundance of native bees in gravel and sand pits that included the Fort River Division in 2011. No results are yet available.

To help refuge staff choose the most effective control of pale swallow-wort, the invasive plant threatening rare plants on Mount Tom, the Connecticut Agricultural Experiment Station conducted a small experiment on-site to test various herbicides from 2007 to 2008.

### **Invasive Plant Control Program**

Refuge staff are very active in invasive plant issues in the New England region and work with partners to control invasive plants on both public and private lands. In 1999, the refuge published "The Invasive Plant Control Initiative Strategic Plan for the Connecticut River watershed/Long Island Sound Region," which highlighted agencies and organizations already working on invasive plant issues in the watershed and New England, identified needs, and described the actions that would best serve the region within the following 5 years (1999 to 2004). Many of the priority actions outlined in the document were undertaken by various agencies and organizations including the refuge.

The main priority actions undertaken by the refuge following this plan and then subsequent initiatives include:

- A watershed-wide effort with partners to find and control invasive water chestnut populations.
- Inventorying and controlling invasive plants on the Pondicherry, Nulhegan Basin and Fort River Divisions and the Mount Tom Unit, often within larger partnerships and with the help of Friends groups, volunteers, YCC and SCA members.

- Helping secure funding for the establishment of the Invasive Plant Atlas of engaged citizen-scientists to collect distributional data on invasive plants throughout New England and continue to serve as a comprehensive web-based informational resource.
- Facilitating communications and networking among numerous organizations and individuals through the formation and administration for several years of the NIPGro, including an informational e-newsletter distributed to more than 1,000 individuals.
- Planning and holding three large conferences on the invasive plant topic in cooperation with IPANE partners.
- Conducting numerous workshops on important topics such as prioritizing control on large parcels, control of key species, and early detection and rapid response.
- Working with partners to stop the spread of Japanese stiltgrass and mile-a-minute vine, two new invaders to Massachusetts and northward.

For nearly a decade, the refuge has been a leader on the issue of invasive plant management through:

- Our former coordination of the New England Invasive Plant Group (NIPGro).
- Our involvement in the Invasive Plant Atlas of New England project.
- Being a catalyst for water chestnut control in the southern portion of the watershed.
- Through our encouragement for the formation of subwatershed-based invasive species partnerships.
- Participating in educational offerings such as workshops and conferences with partnering organizations and landowners.

We also have actively controlled invasive species on several refuge divisions and units, including chemical and mechanical (cutting) treatment of Japanese knotweed and common reed on the Nulhegan Basin and Pondicherry Divisions, and served as a pilot for a national program enlisting volunteers to aid with invasive plant control (pulling) and monitoring efforts at the Pondicherry Division.

In 2011, the refuge participated in a national inventory and monitoring project that brought in experts to conduct an invasive plant inventory of the Salmon River, Blueberry Swamp, and Fort River Divisions, engage partners in discussions, and teach refuge staff how to continue with the inventory and prioritize invasive plant management. Subsequent inventories were conducted by seasonal staff on the refuge's Mill River Division, Putney Mountain Unit, and Peterson Unit.

Since 2010, refuge staff have encouraged subwatershed-based CISMA partnerships that actively work locally on inventory, public outreach, and control. A grant was secured to provide six such partnerships with limited funds for projects in 2012 and 2013. Through this grant, refuge staff members are

working with state and regional experts to prioritize invasive plant control in the watershed, with a focus on protecting important natural resources and planning for better early detection and rapid response.

The following principles will continue to guide our program:

- Focus on controlling invasive species that cause the greatest potential for harming native ecosystems and/or threaten refuge management goals on individual properties.
- Focus on protecting sensitive or rare habitats and species, those with high natural diversity, and/or those most resilient to climate change.
- Strive for early detection and rapid response.

## Urban Wildlife Conservation Initiative

The Urban Wildlife Conservation Initiative grew out of the recommendations from the 2011 Refuge System vision conference, “Conserving the Future: Wildlife Refuges and the Next Generation.” The goal of the program is to engage urban communities in wildlife conservation through partnerships, both on and off refuges. As the nation becomes increasingly urbanized, it is vitally important to connect urban audiences to wildlife by protecting and enhancing wildlife habitats in urbanized areas. As part of the program, the Service has developed eight standards of excellence for urban national wildlife refuges:

- (1) Know and relate to the community
- (2) Connect urban people with nature via stepping stones of engagement
- (3) Build partnerships
- (4) Be a community asset
- (5) Ensure adequate long-term resources
- (6) Provide equitable access
- (7) Ensure visitors feel safe and welcome
- (8) Model sustainability

The Urban Wildlife Conservation Program is particularly relevant to the Conte Refuge due to its proximity to several major cities and many urbanized areas, such as the Springfield, Massachusetts and Hartford, Connecticut metropolitan areas. The refuge’s existing and potential partnerships that operate in the urban environment are many and diverse. For example, Conte Refuge is an integral part of the Springfield Urban Wildlife Refuge Partnership, officially designated in September 2015. Urban Wildlife Refuge Partnerships are a key piece of the Service’s Urban Wildlife Conservation Program; they are long-term partnerships, formalized through official agreements, that engage urban communities in conservation issues on partner-owned lands within urban neighborhoods. The partnerships serve as opportunities to help engage residents in place-based, outdoor experiences in their community, which foster connections with fish and wildlife and their habitats.

The Springfield Partnership brings together a multitude of partners including the Conte Refuge, Friends of Conte Refuge, ReGreen Springfield, Springfield Watershed Restoration Partnership, U.S. Forest Service, Massachusetts Division of Ecological Restoration, University of Massachusetts Amherst, Mount Holyoke College, Connecticut River Watershed Council, Keep Springfield Beautiful, Springfield Museums, Pioneer Valley Planning Commission, Chicopee 4Rivers Watershed Council, and the City of Springfield. The Partnership aims to engage students and community members in environmental education and urban restoration projects to create a network of conserved habitats in the Connecticut

River watershed. One of these urban restoration projects focuses on restoring urban streams and forests in the Abbey Brook Conservation Area, which have suffered from erratic storm water flows, invasive plants, adverse amounts of sedimentation, and other pressures common to urban streams and forests. With careful planning and adequate resources, partners hope to reverse these impacts, resulting in a neighborhood haven for wildlife and an asset to the city's residents.

Implementation of the urban programs could also occur through existing refuge programs such as Adopt-a-Habitat, Conte Corners, WOW Express, YCC, SCA crews, and volunteers.

## Land Acquisition History

The 1995 Final EIS identified 48 SFAs for land protection encompassing 65 individual sites, for potential protection by the Service and its partners. While the Service was identified as the lead for 26,250 acres of the total, it was also identified as an alternate for acquisition on the total acres in the event a partner was not in a position to accomplish the habitat protection objective. The 1995 FEIS land protection approval, coupled with subsequent NEPA document decisions, currently gives authority to the Service to acquire up to 97,830 acres for the refuge. The 1995 Final EIS also indicated that the refuge would seek to offer challenge cost-share matching grants to assist partners in acquiring the land where they were identified as the lead; however, funding resources have not been adequate to meet both the operational needs of the refuge and support a viable grants program since 2001. Table 4.4 in the final CCP/EIS shows the relationship between our CFAs and the 1995 SFAs.

The refuge was officially established in October 1997 when the Connecticut River Watershed Council (now called the Connecticut River Conservancy) donated Third Island located in Deerfield, Massachusetts, to the Service. Currently, the refuge consists of nine divisions, eight smaller units, and two conservation easements totaling approximately 35,987 acres (table 3.5).

About 75 percent (75%) of the current refuge land base was acquired when Champion International Corporation liquidated nearly 133,000 acres in northeastern Vermont. The Conservation Fund purchased the entire liquidation package, of which, about 26,000 acres was ultimately acquired by the Service and became the Nulhegan Basin Division on July 20, 1999 (USFWS 1999). The other large Service holding, the Pondicherry Division was established on December 22, 2000, and is about 6,400 acres of fee and easement land. The area was primarily purchased from Hancock Timber Resource Group in 2003 when they liquidated some of their land assets.

Although both divisions were SFAs in the 1995 FEIS, decisions by industrial forest owners to liquidate holdings in the Northern Forest necessitated a change in the refuge conservation strategy to protect important habitat that was previously considered secure. Due to the changes in the scope of what was identified in the 1995 FEIS for these two SFAs, the Service initiated the NEPA compliance process completing individual environmental assessments for these two divisions. Findings of No Significant Impact decisions for both projects were issued. In consultation with the public, these decisions allowed the Service to respond to the unanticipated changes and acquire these two high wildlife-value areas.

There are eight other divisions in the initial stages of acquisition: two in New Hampshire, four in Massachusetts, and two in Connecticut. The divisions in New Hampshire include Blueberry Swamp (established 2007), and Mascoma River (established 2015). The divisions in Massachusetts include Fort River (2005), Mill River (2007), Dead Branch (2011), and Westfield River (established 2013). The

divisions in Connecticut include Salmon River (established 2009) and Whalebone Cove (established 2013). In addition to these divisions, the Service owns several smaller refuge units in Massachusetts, Connecticut, and Vermont that were identified in 1995 FEIS.

A full description of the refuge's existing divisions and units are provided below in part II of this chapter. Table 3.6 lists the acquisition history for the refuge as of February 2016. Refuge acquisitions have been ongoing since 2016. Contact refuge headquarters for an update.

**Table 3.6. Land Acquisition History for Conte Refuge as of February 2016.**

Refuge Division/Unit	State	Funding <sup>1</sup> Source	Acquisition Year	Acres <sup>2</sup>
Dead Man's Swamp Unit	CT	LWCF	2005	30.75
Salmon River Division	CT	LWCF	2009	285.00
Salmon River Division	CT	LWCF-R	2011	40.00
Roger Tory Peterson Unit	CT	LWCF-R	2011	1.84
Roger Tory Peterson Unit	CT	LWCF	2011	54.26
Salmon River Division	CT	LWCF	2012	48.52
Salmon River Division	CT	LWCF	2012	4.80
Salmon River Division	CT	LWCF	2013	38.00
Salmon River Division	CT	LWCF	2013	9.00
Salmon River Division	CT	LWCF	2014	1.62
Salmon River Division	CT	LWCF	2014	9.59
Salmon River Division	CT	LWCF	2014	1.00
Salmon River Division	CT	LWCF	2015	29.51
Salmon River Division	CT	LWCF	2016	.60
Salmon River Division	CT	LWCF	2016	.59
Whalebone Cove Division	CT	LWCF	2013	25.50
Whalebone Cove Division	CT	Donation	2013	41.00
Whalebone Cove Division	CT	LWCF	2014	49.2
<b>Total Connecticut Acres</b>				<b>670.78</b>
Fannie Stebbins Unit	MA	Donation	2015	98.0
Hatfield Unit	MA	Donation	2014	19.0
Third Island Unit	MA	Donation	1997	3.80
Honeypot Road Wetlands Unit	MA	LWCF	1999	20.26
Wissatinnewag Unit	MA	LWCF	2001	20.81
Mount Tom Unit	MA	LWCF	2002	140.82
Mount Toby Unit	MA	LWCF	2003	30.04
Fort River Division	MA	LWCF	2005	22.70

Refuge Division/Unit	State	Funding <sup>1</sup> Source	Acquisition Year	Acres <sup>2</sup>
Fort River Division	MA	LWCF	2007	1.80
Mill River Division	MA	MBCF	2007	197.00
Fort River Division	MA	LWCF	2008	82.00
Mill River Division	MA	MBCF	2008	13.86
Mill River Division	MA	MBCF	2008	19.52
Fort River Division	MA	LWCF	2009	66.52
Fort River Division	MA	LWCF	2010	24.40
Mill River Division	MA	LWCF	2010	18.50
Fort River Division	MA	LWCF	2011	19.32
Dead Branch Division	MA	LWCF	2011	80.00
Fort River Division	MA	LWCF	2012	32.07
Dead Branch Division	MA	LWCF	2012	17.54
Westfield River Division	MA	LWCF	2013	125.00
Fort River Division	MA	LWCF	2013	12.00
<b>Total Massachusetts Acres</b>				<b>1,064.96</b>
Pondicherry Division	NH	LWCF	2000	670.82
Pondicherry Division	NH	LWCF	2003	3,039.68
Pondicherry Division	NH	LWCF	2004	143.00
Pondicherry Division	NH	MBCF	2004	472.44
Pondicherry Division	NH	LWCF	2005	286.00
Pondicherry Division	NH	LWCF	2005	166.00
Pondicherry Division	NH	MBCF	2005	3.40
Pondicherry Division	NH	MBCF	2005	499.69
Pondicherry Division	NH	LWCF	2005	19.67
Pondicherry Division	NH	LWCF	2006	12.54
Pondicherry Division	NH	LWCF	2006	16.23
Blueberry Swamp Division	NH	LWCF	2007	13.00
Pondicherry Division	NH	LWCF	2007	2.28
Pondicherry Division	NH	LWCF	2007	71.55
Pondicherry Division	NH	MBCF	2008	101.59
Blueberry Swamp Division	NH	MBCF	2009	51.50
Blueberry Swamp Division	NH	MBCF	2009	56.00
Blueberry Swamp Division	NH	MBCF	2009	419.50
Pondicherry Division	NH	MBCF	2009	80.09
Pondicherry Division	NH	Donation	2009	18.50
Pondicherry Division	NH	MBCF	2009	11.23



Refuge Division/Unit	State	Funding <sup>1</sup> Source	Acquisition Year	Acres <sup>2</sup>
Blueberry Swamp Division	NH	MBCF	2010	62.50
Blueberry Swamp Division	NH	MBCF	2010	105.00
Blueberry Swamp Division	NH	MBCF	2010	113.00
Blueberry Swamp Division	NH	LWCF	2010	5.10
Blueberry Swamp Division	NH	LWCF	2010	5.00
Blueberry Swamp Division	NH	LWCF	2010	5.00
Blueberry Swamp Division	NH	MBCF	2010	66.00
Blueberry Swamp Division	NH	MBCF	2010	96.00
Blueberry Swamp Division	NH	LWCF	2010	25.42
Pondicherry Division	NH	MBCF/LWCF	2010	46.90
Pondicherry Division	NH	LWCF	2010	6.20
Pondicherry Division	NH	LWCF	2010	79.89
Pondicherry Division	NH	LWCF	2010	11.58
Pondicherry Division	NH	Donation	2010	21.15
Pondicherry Division	NH	LWCF	2010	65.00
Pondicherry Division	NH	LWCF	2011	18.00
Pondicherry Division	NH	MBCF	2011	510.00
Pondicherry Division	NH	LWCF	2011	31.84
Blueberry Swamp Division	NH	LWCF	2012	6.80
Blueberry Swamp Division	NH	LWCF	2012	136.00
Saddle Island Unit	NH			1.5
Pondicherry Division	NH	LWCF	2014	15.01
Pondicherry Division	NH	LWCF	2015	22.85
Mascoma River	NH	LWCF	2015	761.32
<b>Total New Hampshire Acres</b>				<b>8,371.77</b>
Nulhegan Basin Division	VT	LWCF	1999	9,042.12
Nulhegan Basin Division	VT	MBCF	1999	16,868.00
Nulhegan Basin Division	VT	Donation	1999	76.00
Putney Mountain Unit	VT	LWCF	1999	278.69
Putney Mountain Unit	VT	Donation	1999	5.86
Nulhegan Basin Division	VT	LWCF	2002	5.66
Nulhegan Basin Division	VT	LWCF	2002	13.47
Nulhegan Basin Division	VT	MBCF	2002	74.20
Nulhegan Basin Division	VT	MBCF	2002	170.11
Nulhegan Basin Division	VT	LWCF	2006	40.00
Nulhegan Basin Division	VT	MBCF	2007	76.90
Nulhegan Basin Division	VT	LWCF	2010	57.18

Refuge Division/Unit	State	Funding <sup>1</sup> Source	Acquisition Year	Acres <sup>2</sup>
Nulhegan Basin Division	VT	LWCF	2011	29.87
Nulhegan Basin Division	VT	LWCF	2012	72.58
Nulhegan Basin Division	VT	LWCF	2013	79.12
<b>Total Vermont Acres</b>				<b>26,889.76</b>
<b>Refuge Total Acres</b>				<b>36,997.27</b>

<sup>1</sup> LWCF = Land and Water Conservation Fund; MBCF = Migratory Bird Conservation Fund

<sup>2</sup> The Service owns all acreage in full fee title, except for two conservation easements on about 170 acres at the Pondicherry Division, and on the 761 acres that comprises the existing Mascoma River Division; acres compiled as of February 2016.

**Refuge Revenue Sharing**

Refuge lands are 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 the four-state area, those payments go to the towns. The annual payments are calculated on the federally appraised value for tax purposes, and are reduced proportionally based on the amount appropriated by Congress. Lands are reappraised by the Department of the Interior every 5 years. Table 3.7 shows the Service made the following refuge revenue sharing payments to local townships in recent years.

**Table 3.7. Refuge Revenue Sharing Payments to Towns, 2009 to 2015.**

Refuge Division/ Unit	Town	County	Refuge Revenue Sharing Payments in Dollars by Fiscal Year								
			2007	2008	2009	2010	2011	2012	2013	2014	2015
<b>Connecticut</b>											
Dead Man’s Swamp Unit	Cromwell	Middlesex	3,562	2,763	2,597	176	188	177	208	194	204
Salmon River Division	East Hampton	Middlesex	-	-	-	-	-	388	2,162	2,204	2,128
Salmon River Division	Haddam	Middlesex	-	-	-	1,629	1,746	1,887	2,393	2,240	2,365
Whalebone Cove Division and Roger Tory Peterson Unit	Old Lyme	New London	-	-	-	-	-	937	1,375	1,287	3,649
<b>Massachusetts</b>											
Third Island Unit	Deerfield	Franklin	7	5	5	6	6	6	7	6	6
Wissatinnewag Unit	Greenfield	Franklin	781	606	569	94	101	95	112	104	106
Mount Toby Unit	Sunderland	Franklin	778	604	567	1,063	1,139	1,070	1,256	1,176	1,236
Mount Tom Unit	Holyoke	Hampden	3,124	2,424	2,278	5,120	5,487	5,156	6,051	5,663	5,955
Honeypot Road Wetlands Unit	Westfield	Hampden	463	359	338	19	21	20	23	22	23
Hatfield Unit	Hatfield	Hampshire	-	-	-	-	-	-	-	342	360

Refuge Division/ Unit	Town	County	Refuge Revenue Sharing Payments in Dollars by Fiscal Year									
			2007	2008	2009	2010	2011	2012	2013	2014	2015	
Fannie Stebbins Unit	East Longmeadow	Hampden	-	-	-	-	-	-	-	-		
Westfield River Division	Becket	Hampshire	-	-	-	-	-	-	-	370	346	364
Dead Branch Division	Chesterfield	Hampshire	-	-	-	-	-	-	517	607	568	597
Fort River Division	Hadley	Hampshire	1,484	5,975	5,615	4,233	6,901	8,141	9,678	9,058	9,523	
Mill River Division	Northampton	Hampshire	-	900	846	211	258	243	285	267	280	
<b>New Hampshire</b>												
Saddle Island Unit	Bath	Grafton	-	-	-	-	-	-	-	-		187
Blueberry Swamp Division	Columbia	Coos	-	95	212	2,975	3,632	3,413	4,398	4,117	4,328	
Pondicherry Division	Jefferson	Coos	4,868	3,777	4,161	15,187	17,209	16,171	18,979	17,764	18,807	
	Whitefield	Coos	950	737	692	339	895	841	987	923	971	
<b>Vermont</b>												
Nulhegan Basin Division	Bloomfield	Essex	3,201	2,483	2,334	1,914	2,050	1,927	2,261	2,117	2,225	
	Brunswick	Essex	2,745	2,151	2,021	2,126	2,278	2,141	2,570	2,405	2,529	
	Ferdinand	Essex	2,069	1,605	1,508	1,063	1,139	1,483	1,740	1,629	1,712	
	Lewis	Essex	13,952	10,863	10,208	7,335	8,402	7,984	9,370	8,770	9,221	
Putney Mountain Unit	Brookline	Windham	191	148	139	109	117	110	129	121	127	
	Putney	Windham	444	345	324	975	1,045	982	1,152	1,078	1,134	
<b>Total Payments by Fiscal Year</b>			<b>\$38,619</b>	<b>\$35,840</b>	<b>\$34,414</b>	<b>\$44,574</b>	<b>\$52,614</b>	<b>\$53,689</b>	<b>\$66,113</b>	<b>\$62,221</b>	<b>\$68,041</b>	

### Conte Refuge General Public Use

Hunting, fishing, wildlife observation and photography, environmental education and interpretation were established as priority public uses by Executive Order 12996 (March 25, 1996), and legislatively mandated by the Refuge Improvement Act. These activities are appropriate uses of national wildlife refuges, as long as they are compatible with the mission of the System and the purposes of the refuge, and are often referred to as the “Big 6” wildlife dependent public uses. All six priority public uses are available to the public at the Nulhegan Basin, Pondicherry, Blueberry Swamp, Salmon River, and Fort River Divisions, while certain wildlife-dependent uses are available at most refuge lands. With the exception of the Putney Mountain Unit, none of the smaller units have been officially opened to public uses. Certain non-priority uses are allowed and have

been found to be appropriate and compatible. These include snowmobiling on designated trails at the Nulhegan Basin, Pondicherry, and Dead Branch Divisions

It is difficult to accurately characterize the amount or type of outdoor recreational activities occurring within the entire watershed, and numbers for refuge lands are broad estimates. This section will first provide an overview of the general hunting, fishing, and wildlife viewing trends occurring within the States based on the Service’s 2011 National Survey which is available at (USFWS 2012b). The 2011 survey shows that 90.1 million U.S. residents 16 years and older participated in wildlife-related recreation—a 3 percent (3%) increase from 2006. The number of hunters and anglers increased from 33.9 million in 2006 to 37.4 million in 2011. The most recent survey also showed 71.8 million people engaged in wildlife observation, an increase of about one percent (1%) since 2006, spending about \$55.0 billion on their activities. Table 3.8 illustrates participation in wildlife-associated recreation by State residents both inside and outside their state of residence. Table 3.9 shows the reported annual refuge visitation for the six priority public uses.

**Table 3.8. Results from the 2011 U.S. Fish and Wildlife Service National Survey of Fishing, Hunting, and Wildlife-associated Recreation for Connecticut, Massachusetts, Vermont, and New Hampshire.**

	Connecticut	Massachusetts	New Hampshire	Vermont	Total
<b>Participation in wildlife-associated recreation by state residents (either inside or outside of their own state)</b>					
Number of individuals participating in hunting	82,000	66,000	44,000	71,000	263,000
Number of individuals participating in fishing	340,000	457,000	164,000	105,000	1,066,000
Number of individuals participating in wildlife watching	1,093,000	1,530,000	388,000	273,000	3,284,000
Total number of participants	1,515,000	2,053,000	596,000	449,000	4,613,000
Percent (%) of Total Population	42.4%	31.4%	45.3%	71.8%	38.2%
<b>Total expenditures for wildlife-related recreation in state (by both state residents and nonresidents)</b>					
Hunting	\$302 million	\$87 million	\$61 million	\$292 million	\$742 million
Fishing	\$436 million	\$455 million	\$209 million	\$131 million	\$1.2 billion
Wildlife-watching	\$935 million	\$ 1.3 billion	\$281 million	\$289 million	\$2.8 billion
<b>Total</b>	<b>\$1.7 billion</b>	<b>\$1.8 billion</b>	<b>\$551 million</b>	<b>\$712 million</b>	<b>\$4.7 billion</b>

View entire report at: <http://www.census.gov/prod/www/fishing.html> (accessed August 2016).

Table 3.9. Reported Annual Refuge Visitation for Priority Public Uses, 2008 to 2016.

Priority Public Use Activity	Estimated Annual Visitation								
	2008	2009	2010	2011	2012	2013	2014	2015	2016
Fishing	191	186	205	210	210	210	210	210	210
Hunting	2,109	2,108	2,095	2,105	2,105	2,105	2,075	1,940	1,910
Environmental Education	1,345	1,388	1,334	4,022	1,833	4,854	6,178	6,000	535
Interpretation	1,007	1,280	1,220	10,873	9,743	15,420	10,995	9,000	1,559
Wildlife Observation	4,775	5,354	5,581	5,850	4,786	4,550	5,150	5,050	5,050
Wildlife Photography	1,000	1,078	1,051	1,050	1,000	1,000	1,000	1,000	1,000
<b>Total Visitation for Priority Public Uses</b>	<b>10,527</b>	<b>11,394</b>	<b>11,486</b>	<b>24,110</b>	<b>19,677</b>	<b>28,139</b>	<b>25,608</b>	<b>23,200</b>	<b>10,264</b>

### Public Use Facilities

The Conte Refuge Act mentioned establishment of “up to four visitor centers” but the preferred alternative in the 1995 FEIS recommended “multiple cooperative centers.” The refuge currently has three partnership visitor centers, as well as a visitor contact station with exhibits at the Nulhegan Basin Division.

#### *Great Falls Discovery Center*

The Great Falls Discovery Center is owned by the State of Massachusetts and administered by the Massachusetts Department of Conservation and Recreation (DCR). DCR manages cooperatively with a number of partners, including the Service. Located near the intersection of the major north-south interstate (I-91) and the principal east-west route in northern Massachusetts (Route 2), it is convenient for local families, school groups, and tourists. The site and building are both fully accessible. Other nearby recreational opportunities include a multipurpose biking/hiking path along the Turners Falls canal and observation of a fish ladder at the nearby dam. In addition, Route 2, also known as the Mohawk Trail, is a popular highway for tourists during the fall leaf season.

Great Falls Discovery Center also is an important part of an ongoing effort by local, State, and Federal officials to revitalize downtown Turners Falls. The center is located in historic mill buildings purchased and renovated by the DCR for \$3,000,000 in the early 1990s. The Service received an \$850,000 appropriation in 1998 to design and build ecological exhibits. DCR spent over \$350,000 retrofitting the building to house the Service’s exhibits. The Center is primarily staffed by DCR and the Friends of the Great Falls Discovery Center, while the grounds and facilities are maintained by DCR. Other partners assisted in the planning stages, some of which remain involved by offering programs at the center: Conte Anadromous Fish Research Center, USGS; Connecticut River Watershed Council; Massachusetts Division of Fisheries and Wildlife; Massachusetts Audubon Society; Northeast Utilities; Friends of the Great Falls Discovery Center; Hitchcock Center; and the Montague Economic and Industrial Development Corporation.

The Friends of the Great Falls Discovery Center is a non-profit group focused on a cooperatively managed visitor facility in Turners Falls, Massachusetts. Their mission is to “support and enhance the Great Falls Discovery Center and the Connecticut River watershed; to educate the public about the unique features of the Silvio O. Conte National Fish and Wildlife Refuge and the Commonwealth of Massachusetts’ Connecticut River Greenway State Park; and to foster public

use and enjoyment of the Center, the Park, and the refuge.” The Friends group assists in running the visitor facility, maintaining exhibits, and coordinating exceptional programs. The facility and program schedules, as well as information on the Friends group, can be viewed at: [www.greatfallsdiscoverycenter.org](http://www.greatfallsdiscoverycenter.org) (accessed August 2013).

The Center’s exhibits are a key component for delivering the refuge’s messages to citizens of the watershed. The theme of the exhibits is “Our Shared Home,” which emphasizes the concept that actions and choices of watershed citizens greatly affect wildlife habitats, and wise choices can conserve, protect, and enhance native species. Major exhibits include: a wall with portraits of our plant and animal neighbors; a watershed model; an introductory video that explains the concept of wildlife habitat; life-size walk-through dioramas depicting principal species and habitats of the watershed; text panels and interpretive walls with dioramas that reinforce key concepts regarding trade-offs in habitat resulting from human activities; and a video that describes habitat challenges facing diadromous fish; a photo gallery with pictures of agency personnel, volunteers, and citizens promoting “Our Shared Home,” and an exhibit that offers the visitor opportunities to participate in upcoming events and partner-sponsored volunteer projects.

A variety of programs for different age groups and interests is offered during open hours and occasionally in the evenings. Events are posted at: [www.greatfallsdiscoverycenter.org](http://www.greatfallsdiscoverycenter.org) (accessed February 2013). The non-profit Friends of Great Falls Discovery Center hosts a monthly coffee house with live music, assists in supporting programs, and many of its members voluntarily assist in staffing the center. Because of refuge and DCR staff limitations, the Center is only open Fridays and Saturdays 10 a.m. to 4 p.m. or for groups by appointment during the winter and spring. In the summer, both the refuge and DCR provide seasonal employees allowing the center to be open 7 days a week.

#### *Montshire Museum of Science*

The Montshire Museum of Science located in Norwich, Vermont, is home to an official “Silvio O. Conte National Fish and Wildlife Refuge Education Center” (<http://www.montshire.org/>; accessed August 2016). The museum is a hands-on museum, offering dozens of exhibits relating to technology, astronomy, and the physical sciences. In cooperation with the refuge, the museum has several exhibits that illustrate the natural history of the Upper Connecticut River Valley, the refuge, and its resources. The facility is located on a 110-acre site adjacent to the Connecticut River.

#### *Great Northwoods Interpretive Center*

The Great Northwoods Interpretive Center is a rest area and information center on U.S. Route 3 just north of Colebrook, New Hampshire, that is administered by the New Hampshire Department of Transportation. The Service financially contributed to the construction of a community multi-purpose room which opened in 2002. The refuge has no staff at the Center. At the front desk, visitors can get tourism information about the local area. The multi-purpose room contains interpretive displays informing visitors about the Service, System, and refuge, in addition to information about the Nulhegan Basin Division, Pondicherry Division, and Umbagog National Wildlife Refuge. It has displays with local themes. The room also contains a number of historical photographs and displays from the Colebrook area and other memorabilia. The interpretive center is open from Memorial Day to Columbus Day.

#### *Nulhegan Basin Division Visitor Contact Station*

The Nulhegan Basin Division has a headquarters office and visitor contact station on Route 105 in Brunswick, Vermont. The facility includes an exhibit

hall where visitors can learn about “The Nulhegan Basin- Sculpted by Nature, Worked by Human Hands-A Unique Landscape Conserved for Habitat, Wildlife, and People.” Informational exhibits include the cultural history of the basin, refuge partners, refuge research, geology and geography, habitat management, the watershed, the System, and northern forest habitats and species. Visitors can talk to staff to find out more about public uses, trails, and other refuge opportunities. The contact station is open 7 days a week, from 8 a.m. to 4:30 p.m.

### **Closed Refuge Units**

The Dead Man’s Swamp, Wissitinnewag, Hatfield, Roger Tory Peterson, and Saddle Island units are closed year-round to protect sensitive resources. The Mount Tom Unit is currently closed due to public safety and vandalism concerns. The refuge also has a seasonal closure on the Third Island Unit during the bald eagle nesting period (January 1 to July 31).

### **Hunting**

Currently, there are hunting opportunities on the Nulhegan Basin, Pondicherry, Fort River, Mill River, Mascoma River, Dead Branch, Blueberry Swamp, and Salmon River divisions, and Putney Mountain Unit. Game species include moose, white-tailed deer, black bear, waterfowl, ruffed grouse, American woodcock, and small game such as snowshoe hares.

### **Fishing**

Currently, there are fishing opportunities on the Nulhegan Basin, Pondicherry, Blueberry Swamp, Fort River, Mill River, and Salmon River divisions. The Nulhegan Basin Division is often fished for Eastern brook trout, and stocked rainbow and brown trout.

### **Wildlife Observation and Photography**

Wildlife observation and photography are popular activities on refuge lands. Both the Nulhegan Basin and Pondicherry divisions are designated IBAs, drawing many bird watchers during the spring and summer. Driving to see wildlife is a popular activity at the Nulhegan Basin Division where there are 40 miles of gravel roadway open during the summer. During the winter, many of these same routes become snowmobile trails totaling 37 miles. The Fort River Birding and Nature Trail is open year round to visitors for wildlife observation and photography. The ADA approved and accessible trail makes it a desired and heavily used trail by diverse groups of people.

### **Interpretation and Environmental Education**

There are numerous opportunities in the watershed for environmental education. Environmental education is available through public and/or private organizations in 121 of the 384 towns and cities in the watershed. Environmental education related to the watershed resources is available in written materials, educational programs and workshops, hands on activities, and public forums. Prominent examples include MassAudubon, Connecticut River Watershed Council, Connecticut River Joint Commission, and New England Wildflower Society. Additionally, conservation districts, conservation commissions, and university extension programs in the four-state region provide invaluable education and outreach resources. The private and public organizations or providers are too numerous to list here. For more information see Five College/Public School Partnership (1992), Hale and Schwartz (1991), National Wildlife Federation (1995), State of Connecticut (1994), and the Vermont State-wide Environmental Education Programs Web site at: <http://www.vermontsweep.org/> (accessed August 2016).

Small private groups have been active, not only in the watershed as a whole, but also in several tributary watersheds. Many tributaries are being monitored

Richard Tetreault



*Hunting deer on Nulhegan Basin Division*

by local associations, such as the Farmington River Watershed Association in Connecticut, and the Deerfield and Chicopee River watershed associations in Massachusetts, as well as a growing network of local River Watch groups. These organizations strive to develop an awareness of these tributaries, and provide water quality monitoring and restoration through localized education programs. Scarce funding often hampers their ability to achieve goals. Larger organizations, however, such as the Connecticut River Watershed Council, Joint River Commissions, Vermont Institute of Natural Science, TNC, and Mass Audubon provide important educational services. In chapter 4, goal 2 we describe other existing programs occurring on refuge lands. We also describe environmental education and interpretation partnerships in chapter 4 under goal 4.

*Watershed-On-Wheels  
(WoW Express)*

In the fall of 2010, the refuge launched a new mobile visitor center known as the WoW Express. The WoW Express is a traveling exhibit designed to engage children of all ages in the beauty and wonder of the Conte Refuge. It includes three components: a walk-through immersion exhibit featuring the diverse sights and sounds of plants and animals from habitats found in the Connecticut River watershed; a watershed table showing how rivers form and change; and seven interactive kiosks exploring the cultural, economic, and environmental significance of the watershed which the Conte refuge seeks to conserve.

The WoW Express travels throughout the watershed visiting schools, natural resource-related fairs, festivals, and conferences. From April 2012 to July 2013, the WoW Express visited over 70 communities within the watershed. The more structured environmental education visits touched nearly 4,000 students and 377 teachers from 30 schools in four states. Including visits to summer camps and over 50 special events, the WoW Express reached over 18,500 people across the watershed in the most recent 11-month period. The exhibit has become popular in recent months.



*Fort River Division*

USFWS



#### *Adopt-a-Habitat*

The refuge recently initiated an Adopt-a-Habitat program intended to establish long-term relationships that spur schools, organizations, and individuals (adults and youth) to adopt and manage local areas within the watershed. Program participants will manage public and private land in order to promote healthy habitat for plants, wildlife, and people. The Adopt-a-Habitat initiative poses an opportunity to accomplish more for wildlife and habitat on lands not governed by the Service. In the process, new contacts are made, awareness is elevated, relationships are established, partnerships develop, and commitment to wildlife and habitat is fostered.

The full curriculum, which is under development, will be designed for students to gain a more thorough understanding of the physical, chemical, and biological interactions within the wetland, stream, pond, or forest habitat area they have selected. The class may choose to use this understanding to implement projects to improve their adopted habitat with the assistance of refuge staff. In the course of study and implementation of projects, students have the opportunity to work with their peers, teachers, community members, and staff from the Service, other Federal and state agencies, and conservation organizations.

As part of this program's development, the refuge is currently working with a college intern to identify target audiences, develop presentations that relate certain concepts to use in the curriculum, create lesson plans, and evaluate limitations to the effectiveness of the program.

#### *Biological Assessment Trailer (BAT)*

As a project under development, the refuge will support field work, either as part of the Adopt-a-Habitat or another environmental education program, with a Biological Assessment Trailer (BAT) equipped with field gear that will be available to schools such as waders, dip nets, water quality test meters, field guides, dissecting scopes, and other educational research tools. Refuge staff will bring the trailer to the school, introduce students to the equipment, and oversee its use. In some cases equipment may be loaned to the teacher for additional field work on the habitat.

#### *Cooperatively Managed Visitor Centers*

As mentioned above, the refuge has a presence at three education or interpretive visitor centers managed cooperatively by partners: the Great Northwoods Center in Colebrook, New Hampshire; the Montshire Museum of Science in Norwich, Vermont; and the Great Falls Discovery Center in Turners Falls, Massachusetts. For more information on these centers, see "Public Use Facilities" above.

#### *Conte Corners*

The intent of a Conte Corner is to provide interpretive exhibits about the refuge System, Conte Refuge, and the natural resources in the watershed. The exhibits are housed in facilities run by partners, and are designed to complement the conservation messages of the host partner. Other than minor exhibit maintenance, the Refuge has no other overhead expenses. The partnership is also beneficial in that it provides opportunities for refuge staff to give programs and participate in partner events. Conte Corners are flexible in concept and have the ability to take many forms. There are two existing Conte Corners: one at the Springfield Museum of Science (Springfield, Massachusetts) and another in Cabela's (East Hartford, Connecticut). Both include aquariums and several informational panels. Another Conte Corner, that will include sophisticated

**Part III: Description of Individual Refuge Divisions and Units**

interactive displays, is planned for the Connecticut Science Center (Hartford, Connecticut).

Current refuge lands are comprised of ten refuge divisions and eleven refuge units (map 1.3. Existing Refuge Ownership). A refuge division is a relatively large, contiguous, or semi-contiguous area; a unit is often smaller and isolated from other refuge property. Table 3.10 lists each division and unit by state, and the acreage associated with each as of February 2016. Below we provide more descriptions on the natural resources of each division and unit. We also provide additional information on current public use opportunities, as well as any cultural or historic information, if available. Appendix A provides additional details on the resources for each division and unit and how we will manage them.

**Table 3.10. Current Refuge Ownership by Division and Unit.**

<b>Divisions (acres)*</b>	<b>Units (acres)*</b>
<b>Connecticut</b>	
Salmon River (468 acres)	Deadman’s Swamp (31 acres)
Whalebone Cove (116 acres)	Roger Tory Peterson (56 acres)
<b>Massachusetts</b>	
Fort River (261 acres)	Fannie Stebbins (98 acres)
Dead Branch (98 acres)	Hatfield (19 acres)
Mill River (249 acres)	Honeypot Road Wetlands (21 acres)
Westfield River (125 acres)	Mount Tom (141 acres)
	Mount Toby (30 acres)
	Third Island (4 acres)
	Wissatinnewag (21 acres)
<b>New Hampshire</b>	
Pondicherry (6,443 acres)	Saddle Island (2 acres)
Blueberry Swamp (1,166 acres)	
Mascoma River (761 acres)	
<b>Vermont</b>	
Nulhegan Basin (26,605 acres)	Putney Mountain (285 acres)

*\*This Refuge ownership information is current as of February 2016.*

**Refuge Divisions**

**Salmon River Division, Connecticut (468 acres)**

The Salmon River Division is located in the lower Connecticut River valley at the confluence of the Salmon River and the Connecticut River in the Haddam Neck section of the Town of Haddam, Middlesex County, Connecticut. The first acquisition for the Salmon River Division occurred in 2009, comprising 285 acres. The division corresponds to portions of SFA 6 “Salmon Cove” and SFA 7 “Salmon River, including tributaries below dam” in the 1995 FEIS (USFWS 1995).

### Natural Resources

The Connecticut River is affected by tidal influences as far north as East Hartford which includes Salmon River. The soils of this area consist of surface deposits of relatively thin and often discontinuous layers of glacial till overlaying bedrock. This till is a poorly sorted mixture of clay, silt, sand, gravel, cobbles, and boulders. Sediments associated with the floodplain of the Connecticut River and the Salmon River can be 10 to 100 feet thick. The uppermost portion of these sediments consists of thin (less than 20 feet deep) alluvial silts and sands deposited by the two river systems.

All stream flows associated with the Salmon River and Salmon Cove are wholly within the Connecticut River Basin. Although tidal influence in the Connecticut River extends upstream to East Hartford, saline water extends only as far north as East Haddam about two miles south of the confluence of the Connecticut and Salmon Rivers.

The aquatic habitats found within the Salmon River and Salmon Cove are recognized by the Service as a high-priority for fisheries. American shad, river herring, and a variety of other migratory fishes use this river system, and adult Atlantic salmon have entered its tributaries to spawn. Extensive beds of submerged aquatic vegetation provide significant overwintering, spawning, and feeding habitat for a large number of fish species, including commercial finfish and shellfish.

Recognized by the Service for its unusual terrestrial habitat types, the lower Salmon River/Salmon Cove complex provides an intact mosaic of diverse habitat types (table 3.11). Among them are tidally influenced rivers, internationally recognized freshwater tidal marsh and flats, riparian meadows, cold-water streams, floodplain forests, mixed hardwood forest, hemlock stands, and vernal pools. Downstream habitats include brackish tidal marshes and the estuarine system.

**Table 3.11. Percentage of Salmon River Division by Habitat Type. Values are based on a GIS analysis of the habitat in the division, using the Northeast Terrestrial Habitat Map data layer (TNC 2013c) and the North Atlantic LCC general habitat type classification.**

General Habitat Type <sup>1</sup>	Percent of Division
Hardwood forest	86%
Hardwood swamp	2%
Woodlands	1%
Open water	1%
Developed	5.5%

<sup>1</sup> See table A.52 at the end of appendix A for comparison.

Reflecting the diversity and quality of the lower Salmon River's habitats are a diversity and abundance of mammals (e.g., river otter, bobcat, fisher), reptiles and amphibians (e.g., Eastern box turtle, marbled salamander, Northern copperhead), breeding songbirds (e.g., warblers, thrushes, cuckoos), and breeding raptors (e.g., American kestrel, barred owl, Northern goshawk). The area harbors 15 state species of conservation concern.

The lower Connecticut River system is important stopover and breeding habitat for neo-tropical migrants, as well, and supports one of the largest concentrations of migratory waterfowl in southern New England. At the mouth of the Salmon River, Salmon Cove's freshwater tidal wetlands, flats, and adjacent intact forest provide neotropical birds and shorebirds with sources of food, water, and shelter and serve as bald eagle winter roost and perch sites. Ospreys also forage in these reaches. Wetland birds breeding in Salmon Cove include American black ducks, green-winged teals, wood ducks, and mallards.

In 2011, an extensive inventory of invasive plants revealed populations of several species that could degrade habitats. The most abundant species are Japanese stiltgrass (mostly along Pine Brook riparian areas and other wetland types), Oriental bittersweet (mostly along the Salmon River riparian areas), and Japanese barberry and multiflora rose (mostly within forest interior). Garlic mustard is newer to the refuge, but has the potential to spread quickly. Local volunteers have been removing garlic mustard and Japanese stiltgrass to prevent their spread within the more pristine interior. Kudzu, one of the most prevalent invasive plants in the southeastern U.S. was found near the Salmon River Division; this is a very uncommon sighting in central Connecticut, and is of concern to State authorities.

#### **Refuge Public Use**

Hunting, fishing, wildlife observation and photography, environmental education and interpretation are allowed on this division. The latter four recreational activities occur year round. The well-defined riffles and pools and a boulder-cobble substrate of the Salmon River support a good cold water fishing; in fact, the Salmon River is considered one of the State's top trout streams.

#### **Cultural Resources and Historic Preservation**

The Salmon River Division was not covered by the cultural resources overview that was completed for the refuge in 2011 (Waller and Cherau 2011) and no background research concerning known cultural resources has been conducted. However, the refuge recently acquired additional land on Haddam Neck in Haddam, Connecticut. This property is part of the Salmon River Division and contains multiple significant archaeological resources, including the Venture Smith Homestead archaeological site.

The Venture Smith Site is an 18th century homestead of African-American archaeological significance and has been identified as potentially eligible for listing on the NRHP. Venture Smith (Broteer Furro) was born around 1729 in West Africa, likely in current-day western Mali. Tradition holds that he was the eldest son of an African prince. At the age of six, he was kidnapped by an enemy tribe and sold to the steward of a Rhode Island slave ship. After a stop in Barbados, Smith was taken to Newport, Rhode Island, and then to Fisher's Island, where he was enslaved for about 13 years. In 1751, Venture married another slave. Later that year, he fled briefly from bondage, but changed his mind and returned. As a punishment for flight, he was separated from his wife. Eventually, the couple was reunited in the household of a slave owner in Stonington, Connecticut.

In 1765, Venture Smith purchased his freedom, and moved to Long Island, where he supported himself by farming, fishing, harvesting wood, river trafficking, and other activities. By 1775, Venture had purchased the freedom of his wife and children. Two years later, he sold his property on Long Island and purchased 10 acres on Haddam Neck in Connecticut, adding 70 acres

abutting the Salmon River Cove where he built his dwelling house. He continued to prosper in farming, fishing, lumbering, and river commerce, adding a wharf, small warehouses, blacksmith shop, and other dwellings near his home. In 1798, Venture narrated his life story to Elisha Niles, a Yale graduate and Revolutionary War veteran of anti-slavery background. The published narrative provided an extraordinary account of the American experience of an enslaved African.

Prior to Service acquisition, extensive archaeological investigations were conducted at the Venture Smith homestead. Evidence of the various homestead buildings was identified, as well as numerous artifacts associated with the lives of Venture Smith and his family.

In addition to the Venture Smith homestead site, the Salmon River Division contains a variety of other archaeological resources, including pre-Contact Native American sites and evidence of other historical settlements. The Service is now responsible for the preservation and management of these cultural resources.

**Whalebone Cove Division,  
Connecticut  
(116 acres)**

The Whalebone Cove Division currently consists of 116 acres at the confluence of the Connecticut River and Whalebone Cove in Lyme, Connecticut. The division corresponds to portions of SFA 11-“Whalebone Cove” in the 1995 FEIS (USFWS 1995).

**Natural Resources**

The division has 2,000 feet of frontage along the Connecticut River and forms the southern entrance to Whalebone Cove. It has a diverse topography, from low, flat tidal marsh to steep slopes (TNC 2013b, USFWS 2014). Its major soil type is the very poorly drained Westbrook mucky peat, found in tidal marsh areas. In the upland portions of the division, the major soil type is the moderately well-drained Pootatuck fine sandy loam (Web Soil Survey 2013).

The existing 116-acre division contains a diversity of habitat types, including high and low tidal marsh, wooded slopes, a kettle-pond wetland, floodplain forest, upland meadows, and mature forest with oak, hickory, and hemlock trees (table 3.12). The Whalebone Cove area is one of the most biologically important and undisturbed tidal marshes on the Connecticut River. It also has the largest stand of wild rice in the State of Connecticut. The cove is an important wintering area for bald eagles and black ducks because the tides prevent ice from forming in the cove. It is also a significant foraging area for migratory waterfowl, including black ducks, Canada geese, mallards, and wood ducks. Other birds that use the area include green and great blue herons, sora, and least bittern, marsh wren, Carolina wren, white-eyed vireo, osprey, and red-tailed hawks (TNC 2013b, USFWS 2014). The existing 67-acre division contains a diversity of habitat types, including high and low tidal marsh, wooded slopes, a kettle-pond wetland, floodplain forest, upland meadows, and mature forest with oak, hickory, and hemlock trees (table 3.11). The Whalebone Cove area is one of the most biologically important and undisturbed tidal marshes on the Connecticut River (TNC 2013a). It also has the largest stand of wild rice in the State of Connecticut. The cove is an important wintering area for bald eagles and black ducks because the tides prevent ice from forming in the cove. It is also a significant foraging area for migratory waterfowl, including black ducks, Canada geese, mallards, and wood ducks. Other birds that use the area include green and great blue herons, sora, and least bittern, marsh wren, Carolina wren, white-eyed vireo, osprey, and red-tailed hawks.

**Table 3.12. Percentage of Whalebone Cove Division by Habitat Type. Values are based on a GIS analysis of the habitat in the division, using the Northeast Terrestrial Habitat Map data layer (TNC 2013c) and the North Atlantic LCC general habitat type classification.**

General Habitat Type <sup>1</sup>	Percentage of Unit
Hardwood forest	29%
Hardwood swamp	less than 1%
Shrub swamp and floodplain forest	8%
Freshwater marshes	51%
Old fields and shrublands	2%
Pasture/hay/grassland	less than 1%
Open water	6%
Rocky coast and islands	less than 1%
Developed	2%

<sup>1</sup>See table A.52 at the end of appendix A for comparison.

To date, no biological surveys, inventories, or habitat mapping have been conducted at this newly established division.

#### Refuge Public Use

This division is open to wildlife observation, photography, environmental education and interpretation. The area is also popular with kayakers and canoeists. Opportunities for hunting and fishing will be determined through subsequent detailed planning. We will open this division to those uses as well to accommodate all six priority public uses.

#### Cultural Resources and Historic Preservation

The Whalebone Cove Division was not covered by the cultural resources overview that was completed for the refuge in 2011 (Waller and Cherau 2011) and no background research concerning known cultural resources has been conducted.

#### Dead Branch Division, Massachusetts (98 acres)

The Dead Branch Division currently consists of 98 acres in the town of Chesterfield, Massachusetts, formerly owned by Berkshire Hardwoods. The property slopes east to west toward the Dead Branch River. There are several buildings and log landings remaining from sawmill operation. A former gravel pit has been recontoured and revegetated. The Dead Branch River forms the division's western boundary. The division corresponds to portions of SFA 20 "Westfield River, including West Branch and Middle Branch" in the 1995 FEIS (USFWS 1995).

#### Natural Resources

The Dead Branch originates at Damon Pond in Chesterfield, Hampshire County, Massachusetts, and flows south through the Dead Branch Division eventually entering the Westfield River on the Chesterfield/Huntington town line. Seventy-eight miles of river in the Westfield River watershed are classified as wild, scenic, or recreational, although the Dead Branch is not included ([http://www.nps.gov/pwsr/westfield\\_pwsr\\_sub.html](http://www.nps.gov/pwsr/westfield_pwsr_sub.html); accessed August 2016). Headwaters of the several branches of the Westfield River are in the Berkshire Hills. The watershed includes historic villages, prime farmland, natural landscapes, several waterfalls, and gorges. One of the State's largest roadless areas is in the Westfield watershed.

The current division is primarily hardwood forest, with about 10 to 15 acres containing buildings, access roads, and landings from the former sawmill (table 3.13). A small one- to two-acre gravel pit has been reclaimed and now provides grass/forb habitat, along with small areas on the north side of East Street that were mowed by the previous landowner. No biological inventories have been initiated on this newly established division, except a cursory invasive plant survey on part of the property in 2013. Two invasive plant species were found: two populations of garlic mustard, which were partially pulled by staff and volunteers, and multiflora rose in the northwest boundary and riparian area.

**Table 3.13. Percentage of Dead Branch Division by Habitat Type. Values are based on a GIS analysis of the habitat in the division, using the Northeast Terrestrial Habitat Map data layer (TNC 2013c) and the North Atlantic LCC general habitat type classification.**

General Habitat Type <sup>1</sup>	Percent of Division
Hardwood swamp	90%
Freshwater marsh	1%
Pasture/hay/grassland	6.5%
Developed	3%

<sup>1</sup> See table A.52 at the end of appendix A for comparison.

Migratory birds expected to breed in this area include blackburnian warbler, wood thrush, Canada warbler, and American woodcock. Resident wildlife such as white-tailed deer, Eastern wild turkey, and ruffed grouse are likely found there.

We are not aware of stream surveys of the Dead Branch, but it appears to be a cool water stream that could support trout. Mussel surveys revealed two species in the Dead Branch: a large, viable population of Eastern elliptio and a small number of Eastern floater (Neadeau 2009). The former is the only viable mussel population in the upper Westfield River watershed, likely due to the low-gradient valley near the division with extensive wetland influence.

**Refuge Public Use**

The refuge completed pre-acquisition compatibility determinations so that hunting, fishing, wildlife observation and photography, environmental education and interpretation could continue at this division until the CCP is complete. Hunting is a popular recreational activity in the Berkshire hill towns and the Dead Branch Division offers a small area, but good habitat for white-tailed deer and eastern wild turkeys on the eastern and southern areas with good forest cover. Ruffed grouse also are present along with other small game. Fishing is available in the Dead Branch River on the western boundary of this Division, with trout likely being the primary game fish.

**Cultural Resources and Historic Preservation**

The Dead Branch Division was not covered by the cultural resources overview that was completed for the refuge in 2011 (Waller and Cherau 2011) and no background research concerning known cultural resources has been conducted.

**Fort River Division,  
Massachusetts  
(261 acres)**

One of the SFAs in the 1995 Conte Refuge FEIS (USFWS 1995) was the Grassland Complex, now identified as the refuge’s Fort River Division. This SFA, as described in the 1995 EIS, consisted of several disjunct areas totaling about 2,200 acres. In the years following 1995, the refuge worked with Massachusetts Audubon, Amherst College, the University of Massachusetts, the town of

Amherst, and a private landowner to encourage the restoration and appropriate management of several additional grasslands within the SFA. The current division is comprised of a total 261 acres that were acquired in several separate acquisitions since 2005.

### **Natural Resources**

The Fort River, located in the eastern portion of the Pioneer Valley, drains a 35,830-acre watershed, and is the longest free-flowing tributary to the Connecticut River in Massachusetts. The area lies on a valley plateau within a circle of hills. The north-south spine of hills running through the middle of Amherst are glacial drumlins that became the islands of ancient Lake Hitchcock that formed as glaciers receded. The area has a number of distinct geologic features including Rattlesnake Knob and Mount Norwottuck; and traprock formations of the former volcanic summit. The Fort River watershed is bounded by Bay Road and the Holyoke Range on the south, Route 47 on the west, the Norwottuck bicycle path on the north, and the Amherst town line on the East (town of Amherst 2009).

The area contains about 15 percent (15%) agricultural lands, and holds large farm fields, many with a high clay content which is undesirable for some higher value crops. Most farms are in Hadley and Amherst. Typically, these produce silage corn, hay, or are used for pasture. Approximately two percent (2%) of the area's 5,473 farmland acres is protected as development rights have been sold to the state through the Massachusetts Department of Agriculture's Agricultural Preservation Restriction program. About 65 percent (65%) of the watershed is forest, and 20 percent (20%) urban and other land use (TPL 2006).

Soils are mostly glacial tills of various types in the higher elevations in the east, whereas soils in the western portion of the watershed are finer, more organic sediments more suitable for agriculture. Soils in the northern portion of the watershed (Amherst) are generally sandy and loamy, including the Gloucester-Montauk-Paxton association, Hinkley-Merrimac-Windsor association, and Amostown-Scitico-Boxford association. Soils (Amostown association) in the area west of Route 116 in North Amherst have been put almost entirely into farming use, and the Mount Holyoke area also maintains more rock laden soils within the Rock Outcrop-Narragansett-Holyoke association. There are 6,185 acres of prime farmland in Amherst (town of Amherst 2009).

The Fort River and its tributaries help define South Amherst with its rich farmland and extensive wetlands. The river ranks high in freshwater mussel diversity, including the federally endangered dwarf wedge mussel that was historically found here. In 2009, 10 dwarf wedgemussels were documented in Hop Brook, a tributary of the Fort River. Also, recently, a single mussel was found (Nedeau 2008) above refuge ownership. The river also holds a naturally reproducing population of brook trout in headwater streams. Lawrence Swamp, located in the southeastern portion of the watershed, is an area rich in biodiversity. The upstream river has been heavily impacted by development in the town of Amherst, but in Hadley, where there is less development, the river has a narrow line of floodplain forest. The eastern Pelham Hills are less developed and its tributaries are generally in good condition (town of Amherst 2009).

The division has a variety of habitat types, including hardwood forest, floodplain forest, and grasslands (table 3.14). The largest tract of the division, located in Hadley, Massachusetts, was selected for Service acquisition because inventories by Massachusetts Audubon found notable populations of bobolinks and other grassland birds. In the early 2000s, owners of several of the parcels began



Wood duck



planning housing subdivisions on their fields, so the refuge stepped up its acquisition efforts. The division land on Moody Bridge Road, Mill Valley Road, and South Maple Streets in Hadley, Massachusetts, is managed for grassland birds such as bobolinks, savannah sparrows, and potentially grasshopper sparrows and upland sandpipers, and floodplain forests and their associated wildlife including tree swallows, warbling vireos, and red-bellied woodpeckers.

**Table 3.14. Percentage of Fort River Division by Habitat Type. Values are based on a GIS analysis of the habitat in the division, using the Northeast Terrestrial Habitat Map data layer (TNC 2013c) and the North Atlantic LCC general habitat type classification.**

General Habitat Type <sup>1</sup>	Percent of Division
Hardwood forest	22%
Hardwood swamp	5%
Shrub swamp and floodplain forest	12%
Pasture/hay/grassland	58%
Developed	3%

<sup>1</sup>See table A.52 at the end of appendix A for comparison.

Wildlife management activities at the division include mowing fields after July 15 each year to retain grass-dominated habitat following the initial nesting period. These fields provide habitat for bobolinks, savannah sparrows, and potentially grasshopper sparrows and upland sandpipers. Upland sandpipers nested here in the 1980s but were not seen again until recently in late summer, outside the breeding season (Parrish, pers. com. 2013). Invasive plants are impacting priority habitats including the floodplain of the Fort River. An invasive plant inventory has been undertaken, revealing substantial infestations. Invasive multiflora rose is a predominant shrub in both riparian floodplain forests and grassland fields and some control of this species has been undertaken by the YCC crew.

Volunteers have been controlling garlic mustard, which is beginning to spread in the flood plain forests, adjacent wetlands, and forest edge. Oriental bittersweet threatens the health of floodplain trees. Other invasive species present include Japanese barberry, purple loosestrife, glossy buckthorn, reed canary grass, autumn olive and black locust, among others.

The refuge has been engaged with academic and research partners on several projects at the division including: American kestrel nesting (U.S. Forest Service), abundance and diversity of native bees in sand and gravel habitats (University of Massachusetts), and smart phone use in early detection and mapping of invasive plants (University of Massachusetts).

Fields in the general vicinity of the division are often planted to either silage corn or cool season grasses to produce hay. Northern harriers hunt these fields during spring and fall migration. Red-tailed hawks and great horned owls nest in the area. Shorter grass areas in pastures provide nesting habitat for killdeer and Wilson's snipe. Horned larks are common in the winter, often in flocks of about 50 birds, often with a few Lapland longspurs and snow buntings. American woodcock, turkeys, and brown thrashers nest in the woods along the Fort River. Eastern bluebirds, Eastern kingbirds, barn swallows, and tree swallows are common breeders here. Also occurring are the sedge wren, wood turtle, marbled salamander, and spring salamander, all of which are state species of concern (town of Amherst 2009). The southern Mount Holyoke area of the watershed is a popular site of yearly hawk migrations, with thousands of birds making their way to southerly wintering grounds.

#### **Refuge Public Uses**

The refuge currently allows hunting, fishing, wildlife observation, and photography, environmental education and interpretation. Problem activities include trash dumping, driving vehicles in the fields, and illegal spotlighting of deer. The refuge completed a 1.1 mile long universally accessible trail on the division. It is very popular and is the site for hosting many conservation events, tours, and programs.

#### **Cultural Resources and Historic Preservation**

Three Native American archaeological sites occur within (or partially within) the existing Fort River Division. Information about these sites does not indicate the time period(s) of their occupation.

The Massachusetts State site files indicate that 13 Native American sites are known within a 1-mile radius of the division, providing evidence of settlement that occurred during the Middle and Late Archaic periods (7,500 to 3,000 years before present) and the Late Woodland period (1,000 to 450 years before present). The locations of a former sawmill and of a farmstead have also been documented.

The 2011 cultural resources overview for the refuge evaluated the archaeological sensitivity of the Fort River Division (Waller and Cherau 2011). The study assessed the likelihood for additional unrecorded Native American and Euro-American archaeological sites. Sensitivity for Native American sites ranges from high to low depending on the location within the unit, with well-drained areas at greater elevations having higher sensitivity. Sensitivity for Euro-American sites is considered high where documentary evidence suggests historic land use, moderate near the roadway, and low throughout the poorly drained wetland areas of the division.

The recently acquired division properties (Bri-Mar Stables area north of Moody Bridge Road, and also the area on the south side of Moody Bridge Road) were not covered by the cultural resources overview (Waller and Cherau 2011). Detailed background research has not been conducted for these areas. One Native American site of unknown date is located within the Bri-Mar Stables area, near the Fort River.

**Mill River Division,  
Massachusetts  
(249 acres)**

The Mill River Division is located in Northampton, Massachusetts. The refuge has worked closely with the city of Northampton and the Kestrel Land Trust (formerly the Valley Land Fund, which recently merged with Kestrel Trust to form the Kestrel Land Trust) to conserve wildlife habitat. The division is currently 249 acres in size and was acquired as four separate parcels since 2007. The division corresponds to portions of SFA 24 “Mount Tom/Mill River/Holyoke Range” in the 1995 FEIS (USFWS 1995).

**Natural Resources**

The Mill River begins at the outlet of Upper Highland Lake in Goshen at 1,440 feet above sea level and discharges into the Connecticut River in the City of Northampton with a total drop of 1,390 feet ([http://millrivergreenway.org/?page\\_id=1137](http://millrivergreenway.org/?page_id=1137); accessed August 2016). The East Branch joins the Mill River in Williamsburg forming the main stem. The river flows through Haydenville, Leeds, and Florence before entering the City of Northampton. Major tributaries include Beaver Brook and Roberts Meadow Brook which join the river below Haydenville. On its course, it flows through Hulburt’s Pond, Paradise Pond, and Look Park and there are two dams, Nonotuck and Cook’s, on the main stem.

Beginning at Searsville, the river follows Route 9 into Leeds. From there the river flows on the south side of Florence and Northampton (City of Northampton 2002). At the time of Anglo settlement, the river flowed through what would become Northampton. A series of disastrous floods over the course of two centuries, culminating in the floods of 1936 and 1938 spurred a major flood risk reduction project. A dike was constructed at Smith College that diverts flow south, away from town, through Pynchon Meadows at the Arcadia Wildlife Sanctuary and finally emptying into the Oxbow.

As a consequence, only a fraction of the original channel from town to the Connecticut River remains (City of Northampton 2002). Now disconnected from the rest of the watershed, there is little flow in the original channel. It was noted to be a blight in town because of stagnant water, trash, mosquitoes, and objectionable odors. The last 6,900 feet of the original channel is located on the existing Mill River Division where it joins the Connecticut River. Like the channel in the city, this reach has little to no flow most of the year.

The Mill River Division is a high priority because of the potential for floodplain forest habitat bordering the Connecticut River (table 3.15). This division was included in TNCs floodplain forest inventory and assessment that began in 2008, which concluded that the reach of the Connecticut River in Northampton and Hadley, Massachusetts, contained some of the largest patches of high quality remnant floodplain forest with some of the largest trees in the watershed (Marks et al. 2011). This floodplain forest is key stopover habitat for migratory landbirds and waterfowl during the spring and fall.

**Table 3.15. Percentage of Mill River Division by Habitat Type. Values are based on a GIS analysis of the habitat in the division, using the Northeast Terrestrial Habitat Map data layer (TNC 2013c) and the North Atlantic LCC general habitat type classification.**

General Habitat Type <sup>1</sup>	Percent of Division
Hardwood forest	4%
Hardwood swamp	51%
Freshwater marsh	3%
Pasture/hay/grassland	9%
Open water	31%
Developed	2%

<sup>1</sup> See table A.52 at the end of appendix A for comparison.

Unfortunately, Oriental bittersweet threatens the health of remaining canopy trees and is preventing the growth of saplings that would otherwise become future floodplain forests. Invasive black locust is outcompeting and replacing native cottonwoods and silver maples. In 2012, refuge staff and YCC crews began cutting bittersweet that was threatening overstory trees. Success in protecting the mature floodplain forest trees from bittersweet will be a long-term process.

Water chestnut, an aquatic invasive, is also a concern, occurring in one of two ponds within the Division. This species has been controlled by refuge staff and volunteers since 2003. Other invasive species on the division include exotic bush honeysuckle, garlic mustard, purple loosestrife, Japanese barberry, and Amur corktree.

**Refuge Public Use**

The Mill River Division has been open to all six priority public uses since the initial property was acquired by the Service. There are opportunities to hunt waterfowl on the Triangle and Magnolia ponds and in the river, as well as opportunities for white-tailed deer and small game hunting. Fishing occurs on the two ponds and from the banks of the Connecticut River. There are three native surface roads (Hockanum Road, 1st Square Road, and Parsons Swamp Road) which provide access to the refuge boundary and several unauthorized motorized trails. There is no refuge infrastructure other than boundary signs. The extent of public use is unknown. Nearby in the Mill River watershed there are extensive wood roads, trails, and forest with outstanding opportunities for hiking, hunting, fishing, walking, bicycling, mountain biking, and snowmobiling.

**Cultural Resources and Historic Preservation**

There are no recorded archaeological sites within the existing Mill River Division or within the division’s current, approved acquisition boundary. However, the Massachusetts State site files indicate that 15 Native American sites are known within a 1-mile radius of the division, providing evidence of settlement that occurred during the Middle Archaic period (7,500 to 5,000 years before present) and greater Woodland period (3,000 to 450 years ago).

The 2011 cultural resources overview for the refuge evaluated the archaeological sensitivity of the Mill River Division (Waller and Cherau 2011). The study assessed the likelihood for additional unrecorded Native American and Euro-American archaeological sites. Sensitivity for Native American sites is considered low except for an area at the northern edge of the Oxbow, which exhibits moderate sensitivity. Sensitivity for post-contact Euro-American sites is low throughout the division.

**Westfield River Division,  
Massachusetts  
(125 acres)**

The Westfield River Division currently consists of a 125-acre tract, purchased in 2013, on Benton Hill Road in Becket, Massachusetts. The division corresponds to SFA 14 “Westfield River, including West Branch and Middle Branch” in the 1995 FEIS (USFWS 1995).

**Natural Resources**

The northeast portion of this property has frontage on the West Branch of the Westfield River and Center Pond Brook. The West Branch of the Westfield River is the longest free-flowing river reach in Massachusetts (Westfield River Wild and Scenic Advisory Committee 2007). Over 78 miles of river in the Westfield River watershed are classified as wild, scenic, or recreational ([http://www.nps.gov/pwsr/westfield\\_pwsr\\_sub.html](http://www.nps.gov/pwsr/westfield_pwsr_sub.html); accessed August 2016). The West Branch (1993) and many of its headwater tributaries in the upper slopes of the Berkshires (2004) were designated as wild and scenic, including the reach on this division. The watershed includes historic villages, prime farmland, natural landscapes, several waterfalls, and gorges. One of the State’s largest roadless areas is in the Westfield watershed.

The Westfield River is particularly important habitat for shad and American eel and has one of the largest shad runs in the Connecticut River watershed (TNC 2013a). Mussel surveys conducted for the Westfield River Wild and Scenic Advisory Committee yielded both Eastern elliptio and Eastern floater in Center Pond and Yokum Pond, both in the West Branch watershed (Nedeau 2009b), about 2.6 miles from the current division.

The current division property is located on the eastern slope of the Berkshires in the West Branch of the Westfield River watershed. The current 125-acre division protects over 1,000 feet of riparian habitat along the West Branch. Habitat is primarily mixed hardwoods (table 3.16), hemlock stands with limited amounts of floodplain forest, vernal pools, and spruce/fir forest (TNC 2013a). Portions of the existing division have been logged within the past decade.

**Table 3.16. Percentage of Westfield River Division by Habitat Type. Values are based on a GIS analysis of the habitat in the division, using the Northeast Terrestrial Habitat Map data layer (TNC 2013c) and the North Atlantic LCC general habitat type classification.**

General Habitat Type <sup>1</sup>	Percentage of Unit
Hardwood forest	100%

<sup>1</sup> See table A.52 at the end of appendix A for comparison.

To date, no biological surveys, inventories, or habitat mapping have been conducted at this newly established division. However, migratory birds expected to breed in this area include Blackburnian warbler, wood thrush, Canada warbler, and American woodcock. Resident wildlife such as white-tailed deer, eastern wild turkey, and ruffed grouse are likely found there. The West Branch has excellent cold water habitat that supports a variety of fish species (Westfield River Wild and Scenic Advisory Committee 2007). In 2013, a cursory search for invasive species on the division, found very few invasive plant species.

**Refuge Public Use**

Public uses at the Westfield River Division will be determined through subsequent step-down planning. The preferred course is to open this division to the six priority public uses: hunting, fishing, wildlife observation and photography, environmental education and interpretation. This region in the Berkshires has long been a popular area for a variety of outdoor activities including these priority public uses.

**Cultural Resources and Historic Preservation**

The Westfield River Division was not covered by the cultural resources overview that was completed for the refuge in 2011 (Waller and Cherau 2011) and no background research concerning known cultural resources has been conducted.

**Blueberry Swamp Division,  
New Hampshire  
(1,166 acres)**

The Blueberry Swamp Division (formerly known as the Mohawk River Division) lies in northwestern Coos County in the town of Columbia, New Hampshire, about 5 miles southeast of the town of Colebrook, New Hampshire. The first 13-acre parcel for the division was purchased in 2007; since then, the division has grown to 1,166 acres. The Blueberry Swamp Division corresponds to SFA 47 “Colebrook Hill Farms” and SFA 46 “Mohawk River” in the 1995 FEIS (USFWS 1995), which included about 2,040 acres of pastureland and old field, shrubs and forest, fens, and swamps.

**Natural Resources**

This division lies within the Simms Stream watershed which drains into the Connecticut River about 1.5 miles south of Colebrook. Soils in this region of Coos County are derived from glacial till parent material, following the last glacial epoch and comprised of weathered phyllites, shales, and schists (Kerivan and Lanier 2006). They have a silt texture, relatively high pH, regardless of whether the substrate is granitic or sedimentary, and tend to be more productive than the igneous derived soils found south in the White Mountains region. The historic dairy farming and timber industries thrived, in large part, because of these relatively fertile soils.

The division lies in a bowl between Marshall Hill to the west, Cilley Hill to the south, and Baldhead Mountain to the west in the town of Columbia. Blueberry Swamp, the prominent wetland feature within the boundary, is drained to the west by East Branch Simms Stream, a tributary of Simms Stream.

The landscape is primarily mixed-wood forests and lowland spruce-fir (table 3.17). Blueberry Swamp is a large wetland in the northeast corner of the division consisting of shrub swamp, freshwater marsh and cedar swamp communities. These wetlands may contain suitable habitat for waterfowl like black ducks, mallards, and wood ducks. Common snipe and spotted sandpipers are shorebirds that can be expected on the fringes of the swamp.

**Table 3.17. Percentage of Blueberry Swamp Division by Habitat Type. Values are based on a GIS analysis of the habitat in the division, using the Northeast Terrestrial Habitat Map data layer (TNC 2013c) and the North Atlantic LCC general habitat type classification. Percentage of Blueberry Swamp Division by Habitat Type.**

General Habitat Type <sup>1</sup>	Percentage of Division
Conifer swamp/spruce-fir	67%
Hardwood forest	16%
Shrub swamp and floodplain forest	12%
Freshwater marsh	1%
Pasture/hay/grassland	2%
Developed	2%

<sup>1</sup>See table A.52 at the end of appendix A for comparison.

Pasture, hay, and grassland habitats are also present within this division providing breeding habitat for northern harrier, a State-listed species, American woodcock and bobolink. Simms Stream and its East Branch flow through this division. Both Eastern brook trout and brown trout are found in Simms Stream and brook trout likely inhabit the east branch that drains Blueberry Swamp.

Several invasive plants were identified on the division during a survey in 2011, including autumn olive, purple loosestrife, reed canarygrass, glossy buckthorn, Canada thistle, and common reed. These weeds may be recent invaders to the area because they are found in small clusters and individual plants and do not appear to be firmly established. Control efforts at this stage have a good chance of success.

#### **Refuge Public Uses**

Pre-acquisition compatibility determinations were completed for the six priority public uses prior to acquisition, so the division is currently open to hunting, fishing, wildlife observation and photography, and environmental education and interpretation. No surveys or inventory of public uses have been undertaken, but hunting, wildlife observation, general hiking, and berry picking are probably popular activities in the area. Fishing may occur in East Simms Stream. Both Eastern brook trout and brown trout are found in Simms Stream and brook trout likely inhabit the east branch that drains Blueberry Swamp.

#### **Cultural Resources and Historic Preservation**

There are no recorded archaeological sites within the existing Blueberry Swamp Division or within the division's current, approved acquisition boundary. The 2011 cultural resources overview for the refuge evaluated the archaeological sensitivity of the Blueberry Swamp Division (Waller and Cherau 2011). The study assessed the likelihood for additional unrecorded Native American and Euro-American archaeological sites. Sensitivity for Native American sites is considered low throughout the division. Sensitivity for post-contact Euro-American sites is low except for areas bordering on East Road, where it is considered moderate.

#### **Pondicherry Division, New Hampshire (6,443 acres)**

The Pondicherry Division is located in Jefferson, Whitefield, and Carroll, Coos County, New Hampshire, 5 miles south of Lancaster, New Hampshire, and 12 miles northwest of Mount Washington. The Pondicherry area was SFA 41 in the 1995 FEIS (USFWS 1995) and was identified with 1,665 acres. Division lands have been acquired from several landowners and it now comprises 6,443 acres. Prior to expanding beyond the original SFA's 1,665 acres, and to comply with NEPA requirements, refuge staff re-engaged the public and completed a separate environmental assessment and "finding of no significant impact" administratively authorizing the larger boundary for the Pondicherry Division. Officially, the division was established in 2000 when 670 acres were purchased from the Hancock Timber Resource Group.



*Raccoon*

Bill Buchanan

#### **Natural Resources**

Pondicherry Division's landscape is, in part, a product of ancient glacial activity. Approximately 10,000 years ago, as glaciers from the last ice age receded, this

area was at the bottom of Lake Israel. As Lake Israel drained, huge residual glacial ice blocks remained embedded in the bottom substrate. These blocks melted, leaving water-filled depressions or kettle lakes known today as Cherry, Little Cherry, and Mud Ponds.

Pondicherry Division lies about 1,110 feet above sea-level in a three-sided basin, surrounded to the north, east, and south by peaks rising from 5,000 feet (Pliny Range) to 5,580 feet (Presidential Range) above the basin. To the west, low hills separate the basin from the Connecticut River Valley. Most of the division is drained by the John’s River which flows west out of Cherry Pond into Little Cherry Pond. Little Cherry Pond drains to the west through a low-gradient reach known as the Deadwater. The river is about 10 feet wide and ranges in depth from 4 inches to 3 feet. An unnamed stream drains Mud Pond flowing into the north side of Little Cherry Pond. After the John’s River leaves the division, it flows through Whitefield, New Hampshire, and reaches the Connecticut River across from South Lunenburg, Vermont. Stanley (a.k.a. Slide or Mill) Brook drains the eastern quarter of the division into the Israel River which enters the Connecticut River in Lancaster, New Hampshire.

The wetland and saturated soils are very deep and very poorly drained in depressions on outwash plains, lake plains, and glaciated uplands. They are influenced by herbaceous organic deposits and underlain by sandy textured sediments. Slopes range from zero to 2 percent (2%).

Noted habitat attributes included “...a wetland complex of bogs, streams, and ponds surrounded by spruce/fir forest...” The area was recognized as good stopover habitat for several waterfowl species and the site of a great blue heron rookery.

The most abundant habitats are lowland spruce-fir which is found throughout the division and mixed-wood forests in the uplands (table 3.18). Peatlands surround Little Cherry and Mud ponds and are found between Mud Pond and the northern shore of Cherry Pond. Wet meadow/shrub habitats are concentrated along the John’s River, in the Moorhen Marsh/Cedar Marsh area south of Cherry Pond, and along the edges of the ponds and the John’s River. Aquatic habitats include the three ponds, the John’s River and its tributaries, and Stanley Brook which flows into the Israel River.

**Table 3.18. Percentage of Pondicherry Division by Habitat Type. Values are based on a GIS analysis of the habitat in the division, using the Northeast Terrestrial Habitat Map data layer (TNC 2013c) and the North Atlantic LCC general habitat type classification.**

General Habitat Type <sup>1</sup>	Percent of Division
Conifer swamp/spruce-fir	67%
Hardwood forest	16%
Shrub swamp and floodplain forest	6%
Freshwater marsh	Less than 1%
Pasture/hay/grassland	Less than 1%
Peatland	10%
Open water	Less than 1%
Developed	1%

<sup>1</sup>See table A.52 at the end of appendix A for comparison.



Much of the existing forest is relatively young due to past natural disturbance and recent forest management activities. A large fire swept through the basin in the early 1900s resetting a substantial portion of the forest back to an early age structure. Throughout the 1900s trees were harvested on what is now Service land. The most recent harvests occurred during the 1980s and 1990s. Some of the peatlands were excluded from the last round of harvesting, because of the fragile saturated soils. A New Hampshire Public Service powerline corridor crossing the southern half of the division from east to west and a portion of the western boundary north to south is held in an early successional shrub/sapling structure. Acquired land not previously owned by timber companies has a varied history, ranging from active to passive forest management and agricultural use.

Invasive plants are a growing concern at the division. Documented species include purple loosestrife, Japanese knotweed, Canada thistle, spotted knapweed, Morrow's honeysuckle, *Phragmites*, and coltsfoot. Loosestrife and knotweed appear to be the most problematic species. The former is gaining a foothold in emergent wetlands around Moorhen Marsh and in the riparian habitats of the John's River, including the Cherry Pond outlet. We released beetles of the genus *Galerucella* during the summer from 2007 to 2009 in an effort to control loosestrife. Subsequent monitoring indicated minimal success and no further releases are planned. Canada thistle is present in low numbers at log landings and on the logging road network. Volunteers and YCC crews hand pull any plants found each year. It does not seem to be spreading at this time. Spotted knapweed and Morrow's honeysuckle are confined to the railroad bed, near Waumbeck Junction. Coltsfoot has been found in an old corduroy road from the last timber harvest entry between the State Route 116 parking lot and Mud Pond. Surveys by volunteers indicate it is not a threat to spread at this time. *Phragmites* was found near the southern boundary in 2011 and chemical control was initiated in 2012. At this time the infestation is limited to a small, isolated wetland.

Pondicherry supports a broad array of wildlife, and is especially known for an abundance of breeding and migrating songbirds. A total of 238 birds have been documented on land that now comprises the division, and 129 of these are confirmed breeders. Pondicherry lies within the Atlantic Northern Forest BCR 14. Five of the six highest priority species for BCR 14 habitats found at Pondicherry are confirmed nesters. These are the American black duck, American woodcock, Canada warbler, wood thrush, and bay-breasted warbler. Ten of the 16 high priority species nest at Pondicherry and three others occasionally use the division as stopover habitat during migration.

The importance of Pondicherry to birds has been officially recognized several times. In 1963, New Hampshire Audubon and the New Hampshire Fish and Game Department collaborated to establish the Pondicherry Wildlife Sanctuary, comprised of Cherry and Little Cherry ponds and 166 acres of shoreline. The National Park Service recognized the Pondicherry Wildlife Sanctuary in 1972 for its "...relatively stable bog-forest supporting an unusual variety of birdlife..." by naming it a National Natural Landmark. The refuge subsequently purchased a conservation easement on these lands and they are now part of the refuge's Pondicherry Division. In 2003 the division and the adjacent Mount Washington Regional Airport were designated the first Important Bird Area in New Hampshire.

Aquatic habitats within the division boundary support several fish species one of which, the brook trout, has been identified as a conservation priority for the Service's Northeast Region. Other species documented from Pondicherry include chain pickerel and several perch species from Cherry Pond, and the northern red-bellied dace from riverine habitats.

This division has been part of larger studies on American woodcock habitat (Salve Regina University), the distribution and abundance of robber flies (Diptera: Asilida) (Connecticut Agricultural Experiment Station), and Northern goshawk nesting and reproduction (U.S. Forest Service). The refuge has conducted breeding bird surveys and habitat inventories. In partnership with the Friends of Pondicherry, there have been surveys of whip-poor-wills, and documentation of birds, reptiles, and amphibians on the division. In 2013, the refuge began an inventory of bats on the division.

#### **Refuge Public Uses**

Pondicherry is well known for its outdoor recreational opportunities. All six of the priority, wildlife-dependent uses (i.e., hunting, fishing, wildlife observation and photography, environmental education and interpretation) are available at Pondicherry.

Hunting has been a popular recreational activity at Pondicherry for decades. Ruffed grouse are probably the most popular game species sought by hunters, but white-tailed deer, moose, black bear, American woodcock, and snowshoe hare are also hunted. Division-specific regulations for sport hunting have been in place since the fall of 2005. Popular hunting areas include the powerline corridor, early successional forest stands, and forests adjacent to the old road network. In 1963, Cherry and Little Cherry Ponds (130 acres) and a 166-acre area around the ponds were closed to hunting by the New Hampshire Fish and Game Department and New Hampshire Audubon. In 2005, another 250 additional acres around the Little Cherry Pond Loop Trail was closed to reduce potential conflicts between hunters and non-hunters.

Fishing occurs at the Pondicherry Division, however, fishing pressure outside of the winter season is limited because the best fishing area, Cherry Pond, requires a 1.5-mile hike or bicycle ride on the State rail-trail. Most fishing probably occurs during the winter, as snowmobilers ride on the state trails to Cherry Pond. Little Cherry Pond and the John's River are less popular because they are more remote.

Wildlife observation and photography are probably the most popular activities at Pondicherry. People began birding there as early as 1911 when Horace Wright published *The Birds of the Jefferson Region in the White Mountains* (Wright 1911). Today people trek out to Cherry Pond, Little Cherry Pond, and more remote sections seeking wildlife. Guided group tours are offered by the Friends of Pondicherry each year in celebration of International Migratory Bird Day. Photographers are drawn to the spectacular view of the Mount Washington and the Presidential Range in the background from the western shore of Cherry Pond. The Appalachian Mountain Club (AMC) has offered outdoor photography courses that included a day at Cherry Pond.

The Friends of Pondicherry have offered field trips led by visiting instructors each year. The White Mountains Regional School uses the division for educational field trips. As discussed above, organizations such as Audubon and the AMC bring people to Pondicherry for nature-based learning. There are self-service educational materials at the informational kiosks located at the parking lots on State Route 116 and at the state trailhead on Airport Road.

Within the Pondicherry boundary are the Presidential Recreational Trail, an active railroad line, and Cherry Pond, and Little Cherry Pond which are under the jurisdiction of the State of New Hampshire. Hiking and bicycling are allowed on the rail-trail throughout the year and snowmobiling occurs during the winter months. The division proper is not open to motorized or mechanized travel,

*Pondicherry YCC—  
Airport Road Kiosk*



David Govatsk

except during the winter on a state snowmobile trail (Powerline Trail) located on the Public Service of New Hampshire utility corridor easement.

**Cultural Resources and Historic Preservation**

There are no recorded archaeological sites within the existing Pondicherry Division or within the division’s current, approved acquisition boundary. However, the New Hampshire State site files indicate that six Native American sites are known within a 1-mile radius of the division, providing evidence of settlement that occurred during the Paleo-Indian period (11,500 to 9,500 years before present).

The 2011 cultural resources overview for the refuge evaluated the archaeological sensitivity of the Pondicherry Division (Waller and Cherau 2011). The study assessed the likelihood for additional unrecorded Native American and Euro-American archaeological sites. Sensitivity for Native American sites is variable. It is considered high in the level, northern plateau; moderate in areas where wetland margins are well drained; and low in poorly drained wetland areas. Sensitivity for post-contact Euro-American sites also varies. It is considered high in documented settlement areas and in proximity to historic railroad easements, moderate near historic roads, and low elsewhere.

**Mascoma River Division,  
New Hampshire  
(761 acres)**

In 2015, the Service acquired a 761-acre easement which established the Mascoma River Division. This easement gives us the authority to manage habitat and public use in this area. The division is located within an existing network of conserved lands, including the White Mountain National Forest, Mascoma River and Cumins Pond Wildlife Management Areas, and several privately owned tracts.

**Natural Resources**

This division, and surrounding area, is identified as high priority for conservation for the State of New Hampshire and contains a large, intact forested area which has diversity in elevation and aspect and includes numerous small, scattered, forested wetlands.

**Table 3.19. Percentage of Mascoma River Division by Habitat Type. Values are based on a GIS analysis of the habitat in the division, using the Northeast Terrestrial Habitat Map layer (citation).**

General Habitat Type <sup>1</sup>	Percent of Division
Hardwood Forest	97%
Pasture/Hay/Grassland	1%
Open Water	2%
Developed	Less than 1%

<sup>1</sup> See table A.52 at the end of appendix A for comparison.

**Public Use**

When the Service acquired a conservation easement on this division, the rights to manage habitat and provide public access for compatible uses was as acquired. Presently, the division is open to all six priority public uses since they were ongoing at the time the property was acquired. Consideration of additional public access will be evaluated when then visitor services step-down plan for this division is completed.

**Cultural Resources and Historic Preservation**

The Mascoma River Division was not covered by the cultural resources overview that was completed for the refuge in 2011 (Waller and Cherau 2011) and no background research concerning known cultural resources has been conducted.

**Nulhegan Basin Division, Vermont (26,605 Acres)**

The Nulhegan Basin Division was SFA 45 in the 1995 FEIS (USFWS 1995). It encompassed 71,900 acres, of which the refuge intended to acquire 11,000 acres. Since the 1995 Conte Refuge FEIS (USFWS 1995) was completed, the Service opted to purchase approximately 27,000 acres from The Conservation Fund as part of a larger land conservation effort. To comply with NEPA requirements, the refuge re-engaged the public and completed an environmental assessment and a “finding of no significant impact” which administratively modified the original 1995 Conte Refuge FEIS to allow expanded acres for refuge acquisition (USFWS 1999).

The Nulhegan Basin Division is located in Essex County in the towns of Brunswick, Ferdinand, Bloomfield, and Lewis, Vermont. The refuge headquarters and visitor contact station is located in Brunswick (about 10 miles east of Island Pond). A five-room quarters building and storage barn are located adjacent to the headquarters building. There is a 200-foot interpretive boardwalk on Four Mile Road in the area known as Mollie Beattie Bog. There are interpretive kiosks at the main entrances of the division and scenic overlooks at the headquarters and at the end of Lewis Pond Overlook road. About 15 year-round residences and numerous seasonal cabins are within 1 mile of the division boundary, primarily along Vermont Route 105.

**Natural Resources**

The Nulhegan Basin was created when a pool of magma formed within existing metamorphic rock. The magma cooled into a relatively soft granitic rock called quartz monzonite. Once erosion wore away the cap of metamorphic rock, the softer monzonite eroded more rapidly than the surrounding metamorphic rock. This resulted in a relatively flat circular interior area, roughly 10 miles in diameter, surrounded by hills. Sand and gravel were later deposited in



Gary Kramer/USFWS

Bobcat

the bottom of the Basin by melting glaciers. Elevations on the division range from 1,000 feet to 2,800 feet above sea level.

Three of the four major tributaries of the Nulhegan River, the North, Yellow, and Black Branches, flow north to south through the division. A network of smaller streams feed these branches. The main course of the Nulhegan River flows adjacent to the south boundary of the division. The 68-acre Lewis Pond is in the northwest portion of the division.

The division is predominantly forested with natural small openings. These openings are most frequently associated with wetlands (e.g., bogs and beaver flowages), although windthrow events temporarily create larger openings. Twenty-three natural communities are mapped on the Nulhegan Basin Division. These include the most significant mosaic of lowland conifer natural communities in the State, including spruce-fir-tamarack swamp, black spruce swamp, northern white cedar swamp, and peatlands. Six of the natural communities have a Vermont Natural Heritage classification of S2 (rare) and 10 are classified as S3 (uncommon). Wetland and aquatic natural communities support the majority of identified rare plants. Shrublands, primarily dominated by speckled alder, are restricted to poorly drained areas, small seepage zones, and wide alluvial stretches of the Nulhegan River and its principal tributaries (table 3.20).

**Table 3.20. Percentage of Nulhegan Basin Division by Habitat Type. Values are based on a GIS analysis of the habitat in the division, using the Northeast Terrestrial Habitat Map data layer (TNC 2013c) and the North Atlantic LCC general habitat type classification.**

General Habitat Type <sup>1</sup>	Percent of Division
Conifer swamp/spruce-fir	57%
Hardwood forest	40%
Shrub swamp and floodplain forest	1%
Cliff and talus	Less than 1%
Freshwater marsh	Less than 1%
Peatland	1%
Rocky outcrop	1%
Open water	Less than 1%
Developed	Less than 1%

<sup>1</sup>See table A.52 at the end of appendix A for comparison.

Riparian habitats and wetlands are generally in good condition. Historically, dams and log drives impacted the area’s streams. Forested habitats in the division have long supported the timber industry, dating back 150 years. The species removed and the intensity of harvesting varied over time as technologies and markets changed.

Northern hardwood forest, dominated by sugar and red maple, American beech, and yellow and paper birch, cloak the mountains of the Basin rim and the larger hills of the Basin interior. Notably absent in the Basin are oaks, another indicator of the more northern character of the forest. Spruce-fir forest covers large areas of the Basin bottom. Red and Black spruce and Balsam fir are the principal trees in these forests, which cover both wetlands on shallow to deep peat soil deposits, and adjacent glacial kame and till soils of the shallow valleys, flats, and low hills.

Another northern forest conifer, white spruce, occurs sparingly in flood plains and certain swamps. In upland situations, successional stages of these spruce-fir forests can be dominated by quaking and bigtooth aspen, red maple and paper birch. Tamarack, northern white cedar, and black ash occur commonly in the basin, although restricted to wetlands more heavily influenced by groundwater.

State rare plants found in the division include white-fringed orchid, bog sedge, shining rose, drooping bluegrass, lignonberry, and the State-endangered auricled twayblade. Most of these plants are associated with bogs and other peatlands common in the division, and are more common to the north of the Basin. Peat mosses of the genus *Sphagnum* are a predominant groundcover in the numerous swamps and bogs of the refuge. No plant species are currently known to occur on the division that are federally listed as endangered or threatened, or are proposed for Federal listing.

The division provides habitat for a wide diversity of vertebrate and invertebrate fauna. Some notable species that inhabit the refuge are black bear, moose, marten, snowshoe hare, Eastern wild turkey, ruffed grouse, spruce grouse, coyote, red squirrel, fisher, bobcat, porcupine, raptors, amphibians and reptiles, many migratory and resident song birds, and fish including Eastern brook trout. Specifically, the division provides nesting and migratory habitat for numerous forest-dependent migratory bird species, waterfowl, and raptors.

In addition, the Basin contains the largest deer wintering area in the state, about 10,000 acres, the majority of which is located on the Division. White-tailed deer are at the northern end of their range on the Division and are limited by harsh winter conditions. Deer survival depends on adequate shelter and food. Deer wintering areas provide critical winter cover for deer; a core area of softwoods with high crown closure and patches of mixed hardwood or softwood providing accessible browse within or near the core of the area. Our management of spruce-fir habitat will provide a diverse canopy structure which will ensure adequate snow interception and regenerating intolerant hardwoods (e.g. white birch and red maple) associated with spruce-fir landscapes will provide important winter browse. The division was also designated part of the State's largest IBA by the Vermont chapter of The Audubon Society in 2001.

The following biological studies and inventories have occurred on the Nulhegan Basin Division:

- A 2000 to 2001 inventory of fish, macroinvertebrates, marsh birds, waterfowl broods (resurveyed in 2008), and small mammals.
- A 2000 to 2005 survey of owls.
- A 2000 to 2005 survey of breeding amphibians and vernal pools.
- A 2000 to 2006 breeding landbird survey. From 2003 and 2012, additional landbird data was collected at a Monitoring Avian Productivity and Survivorship (MAPS) banding station. Also, Canada warblers were monitored as part of a larger study effort, to obtain and model habitat-specific estimates of productivity, survivorship, dispersal, and site fidelity for northeast Vermont.
- A 2001 inventory and mapping of natural communities and rare plants. The mapping was updated in 2012 to include new refuge land acquisitions.
- A 2007 habitat inventory, including information on species composition, forest stand structure, fuel load, size class, height class, and amount of crown closure.

- A 2012–2015 bat acoustic survey.
- From 2009 to the present, surveys of refuge aquatic habitats, including assessing fish passage and in-stream features.
- From 2012 to present, snow tracking surveys conducted for Canada lynx and other carnivore distributions at the division and surrounding lands. Permanent camera trapsites established in 2014 and monitored year round within lynx habitat. Over 800 snowshoe hare pellet plots in 17 stands established in 2015, and monitored twice a year to index snowshoe hare abundance. These surveys are part of a study evaluating the relative influence of climate, habitat, and competition on predator-prey dynamics with a focus on snowshoe hare.
- In 2015, New Hampshire Audubon conducted research evaluating rusty blackbird habitat within the northern divisions of the Conte Refuge, Umbagog Refuge and other areas in northern NH to develop habitat management guidelines for the species.
- A recent inventory for invasive species.

There are also several ongoing surveys on the refuge:

- American woodcock surveys, including spring singing ground surveys and summer roosting surveys.
- Spruce grouse breeding surveys in partnership with the State.

Results of these studies and inventories can be obtained from refuge headquarters.

#### **Refuge Public Use**

The division is a popular area for hunting, fishing, wildlife observation, snowmobiling, and wildlife photography. These uses were allowed under the previous ownership. Much of the hunting on the division, particularly deer hunting, is based out of leased cabins located within the refuge boundary. Day use is frequent on a year-round basis, particularly for hunting, fishing, dog-training, wildlife observation, and photography. Major wildlife species of interest to the public for observation or harvest include white-tailed deer, black bear, moose, snowshoe hare, ruffed grouse, neotropical songbirds, furbearers, and Eastern brook trout. The division’s “boreal” bird species, including spruce grouse, black-backed woodpecker, gray jay, and boreal chickadee are an important attraction for serious birdwatchers.

Snowmobiling on designated trails is currently allowed on the division to facilitate winter access in support of priority public use activities. Snowmobiling is confined to designated State trails, which are generally open the third week of December to about mid-April every year.

To prevent excessive damage to the division’s 40-mile road network, public travel by motor vehicle is prohibited during the spring mud season. During this period, which generally is from snow breakup to late May, roads on the division (and adjacent West Mountain Wildlife Management Area (WMA) and Plum Creek Timber lands) are closed to vehicular access. After mud season, people may drive on the designated refuge road network.

#### **Cultural Resources and Historic Preservation**

The Nulhegan Basin Division was included in a 2001 cultural resource study assessment and management plan of 48,000 acres of the former Champion International forestlands in the Northeast Kingdom of Vermont (Scharoun et al.

2001). The study was conducted by the University of Maine-Farmington for the Vermont Land Trust and included 26,000 acres of Federal land (the Nulhegan Basin Division). The study identified no known Native American archaeological sites within the division. However, eight Native American sites are known within a 4-mile radius of the division, providing evidence of settlement that occurred during the pre-Contact period. Regarding historical sites, the study considered sites that were identified in the field during the study, sites referenced on historical maps and/or the archival record, and sites that were referred to anecdotally. Five historical resources, consisting of the remnants of log dams, were confirmed on division lands. The 2001 study also included a preliminary architectural assessment of all standing structures within the former Champion Paper Company forestlands, which included 59 former lumber camps and/or recreational camps dating to the late 19th century through the late 20th century.

The 2011 cultural resources overview for the refuge evaluated the archaeological sensitivity of the Nulhegan Basin Division (Waller and Cherau 2011). The study referred to the previous cultural resource study assessment and management plan (Scharoun et al. 2001) and assessed the likelihood for additional unrecorded Native American and Euro-American archaeological sites. Sensitivity for Native American sites is variable. Sensitivity for post-contact Euro-American sites also varies, according to local topography and landscape features.

## Individual Refuge Units

### Dead Man’s Swamp Unit, Connecticut (31 acres)

#### Natural Resources

This 31-acre unit consists of a freshwater wetland and sand spit adjacent to the Connecticut River (table 3.21, see appendix A for map). It is 45 miles upriver from the Long Island Sound, and therefore, not directly influenced by tides. River bulrush, tuckahoe or arrow arum, cattail, and water horsetail dominate the wetland. The water depth is mostly over one meter, and it has a quaking surface that cannot be negotiated on foot. Freshwater wading birds and secretive marsh birds use the swamp. The riverine sand spit along the Connecticut River main stem supports the federally listed Puritan tiger beetle (CTDEEP 1999). The refuge has worked in partnership with CTDEEP to monitor Puritan tiger beetles and create suitable larval habitat by removing plants that are encroaching onto the spit.

**Table 3.21. Percentage of Dead Man’s Swamp Unit by Habitat Type. Values are based on a GIS analysis of the habitat in the division, using the Northeast Terrestrial Habitat Map data layer (TNC 2013c) and the North Atlantic LCC general habitat type classification.**

General Habitat Type <sup>1</sup>	Percent of Unit
Hardwood forest	27%
Hardwood swamp	50%
Freshwater marsh	7%
Open water	17%

<sup>1</sup> See table A.52 at the end of appendix A for comparison.

#### Public Use

The Dead Man’s Swamp Unit is closed to public access to protect habitat for the federally threatened Puritan tiger beetle.

#### Cultural Resources and Historic Preservation

There are no recorded archaeological sites within the existing Dead Man’s Swamp Unit and within the unit’s current, approved acquisition boundary.



However, the Connecticut site files indicate that several Native American sites are known within a 1-mile radius of the unit, offering evidence of settlement during the Middle Archaic period (7,500 to 5,000 years before present) and Early Woodland period (3,000 to 2,000 years before present). No historical archaeological sites have been identified within the unit to date, and there are no historic structures.

The 2011 cultural resources overview for the refuge evaluated the archaeological sensitivity of the Dead Man’s Swamp Unit (Waller and Cherau 2011). The study assessed the likelihood for additional unrecorded Native American and Euro-American archaeological sites. Sensitivity for Native American sites ranges from high to low depending on the location within the unit (with the eastern portion having higher sensitivity). Sensitivity for post-contact Euro-American sites is considered low throughout the unit.

**Roger Tory Peterson Unit, Connecticut (56 acres)**

**Natural Resources**

This unit, located in Old Lyme, Connecticut, was once part of the estate of the famous author and naturalist, Roger Tory Peterson (see appendix A for map). The property extends from Route 156 to the Lieutenant River. The predominant habitat is hardwood forest, with fluvial wetlands along the river (table 3.22). This unit is an important component of migratory bird stopover habitat because the forest is intact and it is in close proximity to the Connecticut River flyway corridor.

**Table 3.22. Percentage of Roger Tory Peterson Unit by Habitat Type. Values are based on a GIS analysis of the habitat in the division, using the Northeast Terrestrial Habitat Map layer (citation).**

General Habitat Type <sup>1</sup>	Percent of Unit
Hardwood forest	89%
Salt marsh	4%
Developed	7%

<sup>1</sup> See table A.52 at the end of appendix A for comparison.

In 2012, an inventory for invasive plant species was conducted on this unit similar to other parcels within the refuge. Several invasive plants were identified, including common reed, multiflora rose, burning bush, and Japanese barberry. Although Japanese stiltgrass was not discovered within the boundaries of the unit, it’s likely that new populations will arise given a known population’s proximity to the parcel. In the southeast section of the parcel, common reed (commonly known as *Phragmites*), has severely invaded the brackish marsh outcompeting native *Juncus* spp. and *Spartina* spp. The eastern uplands of the unit are less invaded.

**Public Use**

The Roger Tory Peterson Unit was acquired 2012 and does not have any existing public use facilities, such as designated trails or interpretive kiosks and panels. This unit is not currently open to public use, including hunting. The unit also does not have any suitable areas for fishing.

**Cultural Resources and Historic Preservation**

The Roger Tory Peterson Unit was not covered by the cultural resources overview that was completed for the refuge in 2011 (Waller and Cherau 2011) and no background research concerning known cultural resources has been conducted. The unit is located in Old Lyme and contains multiple historic landscape features (stone fences, historic road traces), as well as a small house (York House) that served as Roger Tory Peterson’s office and an adjacent small

garage. Peterson was a renowned naturalist, ornithologist, artist, and educator, best known for his series of successful nature field guides (Houghton Mifflin 2009). In 1934, his first book, “A Field Guide to the Birds,” was published. The book’s clear and simple bird identification system helped introduce many people to bird watching and nature observation (Roger Tory Peterson Institute 2008). By the time of his death in 1996, he had authored and illustrated dozens of books on birds, other wildlife, and plants and had received numerous awards for his work as a naturalist and conservationist, including the Presidential Medal of Freedom (Houghton Mifflin 2009).

**Fannie Stebbins Unit,  
Massachusetts  
(98 acres)**

**Natural Resources**

Beginning more than fifty years ago, members of the Allen Bird Club worked to acquire approximately 330 acres of land between Interstate 91 and the Connecticut River in Longmeadow, Massachusetts. This property became the Fannie Stebbins Memorial Wildlife Refuge, owned and managed by a separate Board of Trustees elected by Allen Bird Club members. Eventually the Town of Longmeadow began acquiring additional property in the area, leading to the protection of over 1000 acres. The Stebbins property and the larger floodplain area known as the “Longmeadow Flats” has been designated an NNL by the Department of the Interior and an Important Bird Area by the Massachusetts Audubon Society (Allen Bird Club 2015).

The area is subject to periodic flooding that is representative of this habitat. It includes bordering swamps, ponded water, vegetated wetlands, meadows that are maintained by mowing, hardwood forest, sandbars, riverbank, and an island. It encompasses one of the largest remaining patches of floodplain forests and wetlands along this heavily human-impacted section of the Connecticut River. The wetlands provide breeding habitat for marsh birds and stop-over habitat for migratory waterfowl. During summer and fall the shoreline offers shallows and sandbars for resting and feeding gulls, raptors, shorebirds, and herons. The woodlands and brushy areas provide important habitat for many species of breeding, migratory, and wintering land birds (Allen Bird Club 2015, Mass Audubon n.d.).

In order to ensure the protection of the Stebbins Refuge lands in perpetuity, the Fannie Stebbins Memorial Wildlife Refuge (a registered nonprofit) initiated negotiations with Conte Refuge (Allen Bird Club 2015). Fannie Stebbins was a SFA in the 1995 Conte FEIS. The Fannie Stebbins CFA area is considered important floodplain forest by The Nature Conservancy and the CFA will allow for the restoration and conservation of the floodplain forest and associated wetland complex. Habitat conservation in this CFA will help allow for the landward migration of the coastal wetland complex (salt-, brackish-, and freshwater tidally influenced wetlands) due to climate change.

**Table 3.23. Percentage of Fannie Stebbins Unit by Habitat Type. Values are based on a GIS analysis of the habitat in the division, using the Northeast Terrestrial Habitat Map data layer (TNC 2013c) and the North Atlantic LCC general habitat type classification.**

General Habitat Type <sup>1</sup>	Percent of Unit
Hardwood forest	54%
Hardwood swamp	15%
Freshwater marsh	25%
Open water	3%
Developed	3%

<sup>1</sup> See table A.52 at the end of appendix A for comparison.

**Public Use**

At the time of acquisition, this unit was open to wildlife observation, photography, environmental education and interpretation. These uses are allowed to continue. The unit is not presently open to hunting and fishing.

**Cultural Resources and Historic Preservation**

The Fannie Stebbins Unit was not covered by the cultural resources overview that was completed for the refuge in 2011 (Waller and Cherau 2011) and no background research concerning known cultural resources has been conducted.

**Natural Resources**

The Hatfield Unit is approximately 19 acres. It includes a portion of the Connecticut River floodplain and forested upland approximately 150 to 200 feet above the floodplain. The western third of the unit, along Cronin Hill Road is primarily deciduous forest comprised of white ash, red maple, beech, and black cherry with some white pine. There is a steep drop east to the floodplain adjacent to Great Pond. Historically, this pond was part of the Connecticut River mainstem that was cutoff, forming an oxbow. Today this wetland complex is listed as Core Habitat and a Priority Wetland and Aquatic Core by the Massachusetts Natural Heritage and Endangered Species Program. Floodplain forests were at one time quite common in the state, particularly on the extensive alluvial silt deposits of the Connecticut River Valley, but they have been largely converted to agricultural land due to their high fertility (Paveglio and Taylor 2010; UMass 2012).

**Hatfield Unit,  
Massachusetts  
(19 acres)**

**Table 3.24. Percentage of Hatfield Unit by Habitat Type. Values are based on a GIS analysis of the habitat in the division, using the Northeast Terrestrial Habitat Map data layer (TNC 2013c) and the North Atlantic LCC general habitat type classification.**

General Habitat Type <sup>1</sup>	Percent of Unit
Hardwood forest	17%
Freshwater marsh	48%
Pasture/Hay/Grassland	23%
Developed	12.5%

<sup>1</sup> See table A.52 at the end of appendix A for comparison.

**Public Use**

This unit is not presently open to public access, but will be evaluated for compatible recreational opportunities when a visitor services step-down plan is undertaken.

**Cultural Resources and Historic Preservation**

The Hatfield Unit was not covered by the cultural resources overview that was completed for the refuge in 2011 (Waller and Cherau 2011) and no background research concerning known cultural resources has been conducted.

**Natural Resources**

Honey Pot Road Wetlands near Westfield, Massachusetts, is one of the original SFAs identified in the 1995 Conte Refuge FEIS (USFWS 1995); identified for three rare vertebrates and two rare invertebrates. The SFA identified 960 acres needing protection consisting of a complex of vernal pools and scrub/shrub wetlands along with associated forests and fields (table 3.25). In 1999, the Service purchased a 20-acre upland and wetland parcel adjacent to a unit of the Honey Pot WMA. Wetlands in the vicinity host some of the world’s few known populations of the American clam shrimp recorded in Massachusetts, Florida,

**Honeypot Road Wetlands  
Unit, Massachusetts  
(21 acres)**

South Carolina, Georgia, and Europe (MassWildlife, NHESP 2008, see appendix A for map).

**Table 3.25. Percentage of Honeypot Road Wetlands Unit by Habitat Type. Values are based on a GIS analysis of the habitat in the division, using the Northeast Terrestrial Habitat Map data layer (TNC 2013c) and the North Atlantic LCC general habitat type classification.**

General Habitat Type <sup>1</sup>	Percent of Unit
Hardwood forest	71%
Hardwood swamp	24%
Pasture/hay/grassland	5%

<sup>1</sup> See table A.52 at the end of appendix A for comparison.

**Public Use**

Honeypot Road Wetlands Unit is open to wildlife observation and photography, environmental education, and interpretation. Hunting under State regulations will be considered development of a step-down plan as the unit lies adjacent to the state-owned, 137-acre Honey Pot Natural Heritage Area and across Honey Pot Road from the 227-acre Westfield WMA. Both these state areas are managed by the Massachusetts Division of Fisheries and Wildlife and are open to hunting, fishing, and passive recreation such as wildlife observation, photography, and hiking.

**Cultural Resources and Historic Preservation**

There are no recorded archaeological sites within the existing Honeypot Road Wetlands or within the unit’s current, approved acquisition boundary. However, the Massachusetts State site files indicate that one Native American site is known within a 1-mile radius of the unit.

The 2011 cultural resources overview for the refuge evaluated the archaeological sensitivity of the Honeypot Road Wetlands Unit (Waller and Cherau 2011). The study assessed the likelihood for additional unrecorded Native American and Euro-American archaeological sites. Sensitivity for Native American sites is considered moderate throughout the unit, while sensitivity for post-contact Euro-American sites is low.

**Mount Toby Unit,  
Massachusetts  
(30 acres)**

**Natural Resources**

Similar to Mount Tom, Mount Toby is a high (1,269-foot), traprock, heavily forested ridge containing small wetland areas including fens, seeps, and wooded swamps (table 3.26, see appendix A for map). Mount Toby Unit is one of the original SFAs identified in the 1995 Conte Refuge FEIS (USFWS 1995) known for its value to breeding and migrating neotropical and resident birds and a rare assemblage of plants and animals. In 2003, the refuge acquired 30 acres near the base of Mount Toby off Gunn Road in Sunderland, Massachusetts, helping to protect this traprock habitat along with the Massachusetts DCR which owns and manages portions of Mount Toby as part of the Connecticut River Greenways State Park (MDCR n.d.). The nearby 755-acre Mount Toby Demonstration Forest is owned by the University of Massachusetts and managed by the Massachusetts DCR Recreation (Caputo and D’Amato 2006).

**Table 3.26. Percentage of Mount Toby Unit by Habitat Type. Values are based on a GIS analysis of the habitat in the division, using the Northeast Terrestrial Habitat Map data layer (TNC 2013c) and the North Atlantic LCC general habitat type classification.**

General Habitat Type <sup>1</sup>	Percent of Unit
Hardwood forest	97%
Pasture/hay/grassland	3%

<sup>1</sup> See table A.52 at the end of appendix A for comparison.

**Public Use**

The Mount Toby Unit is part of a partnership conservation effort with the University of Massachusetts, Massachusetts DCR, TNC, and The Trustees of Reservations. The Mount Toby Unit is open to wildlife observation and photography, environmental education, and interpretation. There are no fishing opportunities and the unit is not currently open to hunting.

**Cultural Resources and Historic Preservation**

There are no recorded archaeological sites within the existing Mount Toby Unit or within the unit’s current, approved acquisition boundary. However, the Massachusetts State site files indicate that several Native American sites are known within a 1-mile radius of the unit.

The 2011 cultural resources overview for the refuge evaluated the archaeological sensitivity of the Mount Toby Unit (Waller and Cherau 2011). The study assessed the likelihood for additional unrecorded Native American and Euro-American archaeological sites. Sensitivity for Native American sites is considered high in areas where exposed bedrock outcrops may have been used for rockshelters, and is moderate elsewhere. Sensitivity for post-contact Euro-American sites is considered low throughout the unit.

**Mount Tom Unit,  
Massachusetts  
(141 acres)**

**Natural Resources**

Mount Tom is a 1,800-acre area adjacent to the Connecticut River near Easthampton, Massachusetts, and was identified as an SFA in the original 1995 Conte Refuge FEIS (USFWS 1995, see appendix A for map). Mount Tom is part of the Metacomet Range, formed over 200 million years ago due to volcanic activity and subsequent geologic and erosive pressures (Sinton et al. 2007). The predominantly basalt or traprock mount offers unique habitat for State-listed rare and endangered species, and is recognized as one of the premier fall hawk watch locations in the eastern U.S. (Ortiz et al. 2003).

In 2002, the Service acquired 141 acres on Mount Tom in Holyoke, Massachusetts, part of a coordinated conservation purchase with the Massachusetts DRC (who purchased adjacent land to the north and owns a majority of the remainder of the mountain), The Trustees of Reservations (who bought the adjacent Little Mount Tom), and the Holyoke Boys and Girls Club (who bought the former ski lodge buildings at the base of the mountain). The portion owned by the Service holds former ski slopes, forests, streams, and vernal pools (table 3.27x). Mount Tom provides habitat for 13 State-listed plants, several State-listed reptiles, and amphibians, and is used heavily by raptors and other birds during migration.

**Table 3.27. Percentage of Mount Tom Unit by Habitat Type. Values are based on a GIS analysis of the habitat in the division, using the Northeast Terrestrial Habitat Map data layer (TNC 2013c) and the North Atlantic LCC general habitat type classification.**

General Habitat Type <sup>1</sup>	Percent of Unit
Hardwood forest	86%
Pasture/hay/grassland	11%
Open water	3%

<sup>1</sup> See table A.52 at the end of appendix A for comparison.

A concerted effort to control invasive plants, especially pale swallowwort, was undertaken by the refuge and abutting partnering landowners for several years. Unfortunately, control of the swallowwort was not successful on Service land. More recently, control efforts have focused on a collaborative effort with the Massachusetts Natural Heritage Program to control pale swallowwort where it threatens State-listed plants and other priority habitat. Other invasive species present include spotted knapweed, Oriental bittersweet, multiflora rose, purple loosestrife, and exotic bush honeysuckles, among others. We have conducted some control of all of these species over the years.

Studies on this unit include natural community mapping, plant and invertebrate inventories, an initial breeding bird inventory, vernal pool and wetland delineations, and amphibian and reptile habitat use and home range studies.

**Public Use**

The Mount Tom Unit is not currently open to visitors because the partnership did not want to encourage public use with the nearby rock quarry (active until 2012) and the threat of vandalism to the former ski lodge facilities owned by the Holyoke Boys and Girls Club. There are no developed trails on the unit, however, the Metacomet-Monadnock Trail runs along the ridge at the top of the mountain. This trail is a 114-mile long hiking trail that runs from central Massachusetts to Mount Monadnock in southern New Hampshire. Hunting is not allowed on the unit and there are no fishing opportunities. There is also a right-of-way easement for access through the unit to the cellphone, radio, and television towers on Mount Tom. The intention of the partners is to open the property for compatible public uses, with an emphasis on environmental education and interpretation, particularly for adjacent cities such as Holyoke, once it is safe to do so.

**Cultural Resources and Historic Preservation**

There are no recorded archaeological sites within the existing Mount Tom Unit or within the unit’s current, approved acquisition boundary. However, the Massachusetts State site files indicate that several Native American sites are known within a 1-mile radius of the unit, although these are on the valley floor and not the mountaintop area. Several Native American sites have been recorded in the mountaintop zone, but these are approximately 2 miles north of the Mount Tom Unit itself. Historical archaeological resources located on Mount Tom more than 1 mile from the Mount Tom Unit provide evidence of quarries, sawmills, inns from the 18th and 19th centuries, and 20th-century Civilian Conservation Corps (CCC) activities. In 1946, a World War II B-17 aircraft crashed into Mount Tom in what is now the southwest corner of the unit. The crash site is commemorated by a granite monument erected in 1996 by the town of Holyoke, before the property was acquired by Service. A makeshift shrine contains debris from the crash site collected over the years by visitors. This vicinity also contains a bronze plaque in memory of a local Vietnam veteran who died in 1995.

**Third Island Unit,  
Massachusetts  
(4 acres)**

The 2011 cultural resources overview for the refuge evaluated the archaeological sensitivity of the Mount Tom Unit (Waller and Cherau 2011). The study assessed the likelihood for additional unrecorded Native American and Euro-American archaeological sites. Sensitivity for Native American sites is considered high in areas where exposed bedrock outcrops may have been used for rockshelters, and is moderate elsewhere. Sensitivity for post-contact Euro-American sites is considered low throughout the unit.

**Natural Resources**

Third Island is a 4-acre island in the Connecticut River in Deerfield, Massachusetts. The island, 4.3 miles upriver from the Sunderland Bridge at Route 116, is contained within one of the original SFAs (#29A) known as the “Connecticut River Main stem–Turners Falls Dam to Highway 116 at Sunderland Bridge” (see appendix A for map). The refuge was established when this island was donated to the Service from the Connecticut River Watershed Council in 1997. It is upriver from First Island and Second Island, which are owned and managed by the Massachusetts Division of Fisheries and Wildlife. The island is mostly hardwood forest, with some shallow water habitats (table 3.28).

The island is used as a nesting site by bald eagles, and, as such, is off-limits during the first half of the year until young eagles have fledged. Along with the other two islands, Third Island provides valuable shallow water habitats for spawning Atlantic sturgeon and both American shad and blueback herring (USFWS 1995). Mussels are common on the river bottom near Third Island. Invasive plants including Japanese knotweed, Oriental bittersweet, and purple loosestrife are well established and some management has taken place. The bittersweet is of particular concern to the health of the trees supporting the eagle nest.

**Table 3.28. Percentage of Third Island Unit by Habitat Type. Values are based on a GIS analysis of the habitat in the division, using the Northeast Terrestrial Habitat Map data layer (TNC 2013c) and the North Atlantic LCC general habitat type classification.**

General Habitat Type <sup>1</sup>	Percent of Unit
Hardwood forest	50%
Open water	50%

<sup>1</sup> See table A.52 at the end of appendix A for comparison.

**Public Use**

The Third Island Unit is closed each year to public use during the bald eagle nesting season (January 1 through July 31). From August 1 to December 31 the refuge is open to wildlife observation and photography, environmental education, and interpretation. Because of the unit’s location in the Connecticut River, it is also a popular stop for canoeists and kayakers. It is not currently open to fishing or hunting.

**Cultural Resources and Historic Preservation**

There are no recorded archaeological sites within the existing Third Island Unit or within the unit’s current, approved acquisition boundary. However, the Massachusetts State site files indicate that three Native American sites are known within a 1-mile radius of the unit, providing evidence of settlement that occurred during the Late Archaic period (5,000 to 3,000 years before present) and the greater Woodland period (3,000 to 450 years before present).

The 2011 cultural resources overview for the refuge evaluated the archaeological sensitivity of the Third Island Unit (Waller and Cherau 2011). The study assessed

the likelihood for additional unrecorded Native American and Euro-American archaeological sites. Sensitivity for Native American sites is considered moderate in the Third Island Unit elsewhere, while sensitivity for post-contact Euro-American sites is considered low.

**Wissatinnewag  
Unit, Massachusetts  
(21 acres)**

**Natural Resources**

The 21-acre Wissatinnewag Unit was acquired by the Service in 2001. It, like Third Island above, is contained within SFA 29a “Connecticut River Main stem–Turners Falls Dam to Highway 116 at Sunderland Bridge” (see appendix A for map). The site lies opposite the Great Falls Discovery Center on the upper slope above the Connecticut River in Greenfield, Massachusetts.

The predominant habitat is hardwood forest on a steep, southeast facing slope (table 3.29). The forest serves as important migratory bird stopover habitat during the spring, and supports a variety of nesting songbirds. No biological inventories have been initiated on this unit.

**Table 3.29. Percentage of Wissatinnewag Unit by Habitat Type. Values are based on a GIS analysis of the habitat in the division, using the Northeast Terrestrial Habitat Map data layer (TNC 2013c) and the North Atlantic LCC general habitat type classification.**

General Habitat Type <sup>1</sup>	Percentage of Unit
Hardwood forest	50%
Woodlands (natural)	14%
Developed	6%

<sup>1</sup> See table A.52 at the end of appendix A for comparison.

**Public Use**

The Wissatinnewag Unit is closed to the public to protect sensitive archaeological resources.

**Cultural Resources and Historic Preservation**

The 2011 cultural resources overview for the refuge compiled information about known archaeological resources within the Wissatinnewag Unit and evaluated its archaeological sensitivity (Waller and Cherau 2011). The unit is within a locality that witnessed Native American settlement over a span of thousands of years. The State site files indicate that at least 30 Native American archaeological sites have been recorded within 1 mile of the unit. More than half of these are contained within the Riverside Archaeological District, which is listed on the NRHP. Nearly all of this unit and its corresponding approved acquisition boundary are within this Archaeological District.

The Wissatinnewag Unit contains portions of the extensive, complex Mackin Sand Bank Site, which has produced burials and evidence of Native American settlement starting at least by the Middle Archaic period (7,500 to 5,000 years before present). The site has been damaged by looters, and has also been investigated by professional archaeologists. It is the subject of great interest and concern for the Narragansett Indian Tribe. It is very likely that additional, significant resources await discovery in undisturbed portions of the unit. The sensitivity for post-contact Euro-American sites is considered moderate.



**Saddle Island Unit, New Hampshire  
(2 acres)**

**Natural Resources**

The two acre Saddle Island is located in the Connecticut River, bordering the town of Bath, NH. This island has a unique physical environment due in part to its location in the Connecticut River, geological features and size. The upper portion of the island contains a wooded bluff which transitions to steep banks of sparsely vegetated bedrock ledges. Ice scour regularly clears woody vegetation and soils from the ledges which has a significant impact on the terrain and vegetation. The soils that settle into fractures and pockets in the bedrock provide conditions for unique plant species and communities.

**Table 3.30. Percentage of Saddle Island Unit by Habitat Type. Values are based on a GIS analysis of the habitat in the division, using the Northeast Terrestrial Habitat Map data layer (TNC 2013c) and the North Atlantic LCC general habitat type classification.**

General Habitat Type <sup>1</sup>	Percent of Unit
Open water	67%
Developed	33%

<sup>1</sup> See table A.52 at the end of appendix A for comparison.

**Public Use**

This unit is not open to public access.

**Cultural Resources and Historic Preservation**

The Saddle Island Unit was not covered by the cultural resources overview that was completed for the refuge in 2011 (Waller and Cherau 2011) and no background research concerning known cultural resources has been conducted.

**Putney Mountain Unit, Vermont  
(285 acres)**

**Natural Resources**

The refuge acquired 285 acres at Putney Mountain in 1999 (see appendix A for map). This unit was acquired to protect a population of Northeastern bulrush, a federally endangered species. The population of bulrush is periodically visited by refuge staff and State of Vermont botanists. The population was sampled as part of a large-scale genetics study by researchers at Wilmington College and Wright State University. Their results have not been published yet.

Putney Mountain Unit is a forested mountain summit in Windham County, Vermont, with a height of 1,657 feet (table 3.31). It lies about 20 miles north of the Massachusetts border and 5 miles west of the Connecticut River. The Putney Mountain Hawkwatch is the most important survey point for monitoring migrating hawks in Vermont and also one of the most important along the east coast of the United States (<http://www.putneyvt.org/hawks/index.php>; accessed August 2016).

**Table 3.31. Percentage of Putney Mountain Unit by Habitat Type. Values are based on a GIS analysis of the habitat in the division, using the Northeast Terrestrial Habitat Map data layer (TNC 2013c) and the North Atlantic LCC general habitat type classification.**

General Habitat Type <sup>1</sup>	Percentage of Unit
Hardwood forest	99%
Developed	1%

<sup>1</sup> See table A.52 at the end of appendix A for comparison.

In 2012, sections of the Putney Mountain Unit were inventoried for invasive plant species in a similar manner as the 2011 pilot inventory project. A variety of invasive species were identified, although glossy buckthorn was the most prominent. Glossy buckthorn is widespread along forest edges along roads adjacent to the parcel and is highly threatening forest interior and the wetlands in the eastern and northern parts of the parcel. Some plants are relatively small and may be easier to control. Other invasive plant species include Japanese barberry, multiflora rose, and reed canary grass.

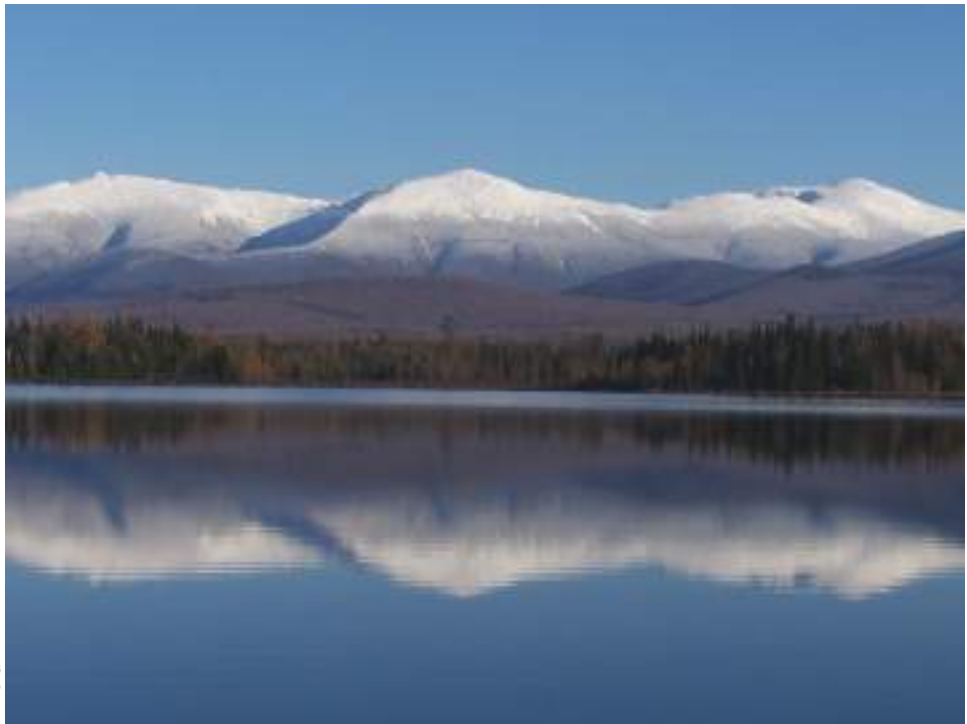
#### **Public Use**

The Putney Mountain Unit is open to wildlife observation and photography, environmental education, and interpretation. It is also open to hunting under State regulations, with the following stipulations: retrieving, flushing, pointing, and pursuit dogs must be under voice command at all times and nighttime raccoon hunting with dogs requires a special use permit (78 FR 58771). The unit does not have any suitable fishing sites.

#### **Cultural Resources and Historic Preservation**

There are no recorded archaeological sites within the existing Putney Mountain Unit or within the unit's current, approved acquisition boundary. However, numerous large Native American settlement areas are known to have existed in the nearby lowlands adjacent to the Connecticut River. The 2011 cultural resources overview for the refuge evaluated the archaeological sensitivity of the Putney Mountain Unit (Waller and Cherau 2011). The study assessed the likelihood for additional unrecorded Native American and Euro-American archaeological sites. Sensitivity for Native American sites is variable. It is considered generally high on level natural terraces, hilltops, wetland margins, and areas adjacent to watercourses, while sensitivity is considered low in poorly drained or steeply sloping areas. Sensitivity for post-contact Euro-American sites also varies. It is considered high in locations of documented historic land use, moderate in proximity to historic road corridors, moderate near historic roads, and low elsewhere.

## Chapter 4



Dave Govatski

*Cherry Pond on Pondicherry Division, New Hampshire*

# Management Direction

- Introduction
- Management Goals, Objectives, and Strategies
- General Refuge Management Direction
- Existing and Approved Refuge Ownership
- Summary of Management Goals, Objectives, Actions and Strategies
- Maps of CPAs
- Maps of CFAs
- Maps of Recreational Access for the Nulhegan Basin and Pondicherry Divisions



## Introduction

### Developing Management Direction

#### Relationship between Goals, Objectives, and Strategies

As we describe in chapter 2, developing watershed-based goals for the refuge was one of the first steps in our planning process and a prerequisite to developing alternatives. Goals are intentionally broad, descriptive statements of our desired future condition for the watershed's and refuge's resources. By design, they are less quantitative and more general in defining the targets of our management. They also articulate the principal elements of refuge purposes and our vision statement and provide the foundation for developing alternative management objectives and strategies. All the alternatives evaluated share the same goals.

Objectives are essentially incremental steps toward achieving a goal; they also further define the conservation and 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. Management objectives and strategies are also developed to respond to public input concerning challenges and opportunities identified during the planning process and public scoping meetings. A rationale accompanies each objective to explain its context and importance.

Strategies are the actions, tools, or techniques we may use to achieve each objective. While some strategies are noted here, appendix A contains further division-, unit-, and CFA-specific details. The reader will benefit from reading this chapter in conjunction with Appendix A: Conservation Focus Areas and Refuge Units—Resources Overview and Management Direction, Including Goals, Objectives, and Strategies). We will evaluate most of the strategies further as to how, when, and where we should implement them when we write our refuge step-down plans. We will measure our successes by how well our strategies achieve our objectives and goals.

#### Developing Alternatives, including those not selected

During the planning process we identified a wide range of possible management objectives and strategies that could achieve refuge goals, and then designed management alternatives. NEPA requires Federal agencies to evaluate a full range of reasonable alternatives to a proposed action. Alternatives should be relevant to the purpose and need of the CCP/EIS while minimizing or avoiding detrimental environmental effects. The development of alternatives as a part of the NEPA compliance process allows the Service to work with the public, stakeholders, interested agencies, and other partners to formulate alternatives that respond to issues and concerns identified during the planning process. These alternatives can be described as packages of complementary objectives and strategies.

In developing our draft and final plans, we analyzed four alternatives that characterize different strategies for conservation in the watershed and, specifically, for managing refuge lands over the next 15 years. As required by NEPA, we believe they represented a reasonable range of alternative proposals for achieving the refuge purpose, vision, and goals, and addressing the issues described in chapter 2. The alternatives are described fully in the final CCP/EIS, where we also include maps, tables, and figures to present the alternatives. Appendix P documents the decision and rationale for adopting alternative C for implementation.

A brief description of each alternative we evaluated follows.

**Alternative A–Current Management** satisfied the NEPA requirement of a “No Action” alternative (which we define as continuing current management) and served as a baseline to which all other alternatives were compared. This alternative reflected the management direction and authorities in the 1995 FEIS with amendments and modifications that either underwent a separate NEPA process or were administrative changes. Had alternative A been adopted, refuge staff would maintain the status quo and continue current management for the next 15 years with no expansions or changes.

Under **Alternative B–Consolidated Stewardship**, many of our existing programs would continue, but we focused our effort and attention in geographic areas called CPAs and CFAs. This alternative sought authority to acquire a total of 97,772 acres for the refuge on 16 CPAs distributed throughout the watershed. CPAs were defined as geographic areas of emphasis for refuge staff to support and facilitate the activities of our partners that contribute to regional conservation goals, and refuge purposes and goals, and which complement management of refuge lands. Within CPAs, we proposed nesting 18 CFAs, where we would focus on acquiring a Service interest in land from willing sellers in fee, easement, lease, or cooperative management agreement. The total refuge acquisition acres were similar under alternatives A and B (Final CCP/EIS table 4.5). However, we would reconfigure the refuge’s approved acquisition totals for the SFAs into CFAs. The CPA/CFA configuration would also dramatically improve opportunities to accomplish the Service’s climate change adaptation strategies, priorities of the NALCC, respective state wildlife action plan priorities, and other public and private partner landscape initiatives. This concentration and consolidation of refuge lands would enhance our implementation of the Service’s strategic habitat conservation initiative, and better support other conservation priorities detailed in Service, ecoregional, and State wildlife action plans listed in appendix M.

**Alternative C–Enhanced Conservation Connections and Partnerships** was the Service’s preferred alternative in both the draft and final CCP/EIS, because it expands on alternative B based in large part on our strategy to promote areas more resilient to the stressors associated with climate and land use changes at the CPA levels, as well as within the larger watershed. This approach would approximately double the approved acquisition boundary for the refuge. Alternative C incorporated the same goals, objectives, and strategies as alternative B; however, it significantly increased opportunities to accomplish them by seeking authority to acquire a total of 197,337 acres for the refuge on 22 CFAs encompassed within 19 CPAs. Lands identified would be acquired from willing sellers only. Fee title, easements, leases, and cooperative management agreements would all be acquisition options available.

Compared to alternative B, the CFAs and CPAs under alternative C are generally larger, more diverse, more in number (4 and 3 more, respectively), and more strategically distributed. Importantly, compared to alternatives A and B, this expanded land base makes a more significant and sustainable contribution toward meeting the refuge’s goals, objectives, and legislated purposes, and in supporting respective State WAPs and NALCC priorities.

Please refer to Final CCP/EIS table 4.1 for NEPA decisions that have been incorporated to this alternative, and Final CCP/EIS table 4.4 for the relationship between 1995 FEIS Special Focus Areas (SFAs) and the current CFAs.

**Alternative D–Reduced Management with Emphasis on Backcountry Recreation** proposed the largest refuge expansion of the all the alternatives. We sought approval to expand the refuge boundary to a total of 231,307 acres.

That represented an increase of 133,477 acres over existing approvals under alternative A. Alternative D included the same conservation design concept of CPAs and CFAs as alternative C, but also included additional flexibility (in the form of approximately 33,540 acres more than alternative C) for the Service to acquire lands that connect



Kathy Fournier/USFWS

*Visitor contact station at Nulhegan Basin Division*

CPAs and CFAs. The ecological benefits to the watershed’s conserved lands network would be notably enhanced from those described for alternative C due to the proposed larger land protection strategy. Refuge land management under alternative D would be dramatically different than proposed under the other alternatives. This alternative would significantly reduce active habitat management, and would minimize public access infrastructure. The overriding management philosophy under this alternative was to allow natural habitat functions and processes to proceed on refuge lands without human intervention or impact from human activities, except in response to or prevention of a catastrophic threat. As such, with regard to public use and access on the refuge, alternative D would result in a reduced human footprint, including visitor infrastructure, and would emphasize backcountry, non-motorized and low-density, primitive public use opportunities. Outside of refuge lands, our priorities for engaging in partnerships within CPAs would be similar to alternative C.

**Management Goals, Objectives, and Strategies**

This section describes goals, objectives, and strategies we have developed at the watershed scale. These watershed-level objectives indicate a desired future condition, and/or course of action, that we are recommending as we work cooperatively and collectively with our partners within CPAs to achieve conservation goals. In other words, at the watershed scale, we are presenting one set of goals and objectives to implement to achieve the four broad conservation, environmental education, recreation, and partnership goals we described in chapter 1. We provide a rationale for each objective to show why we think each one is important. It is also important to highlight that our implementation focus for these objectives will be within CPAs, across multiple ownerships, and only in partnership with willing landowners and our conservation partners.

While some guidelines and strategies are included below, appendix A provides more specific details on implementation. In appendix A, we present subobjectives, strategies, and a rationale for managing each refuge division, unit, or CFA (which will ultimately become a refuge division). We indicate how the subobjectives and strategies presented in appendix A tier to the watershed-wide goals and objectives below, but we also provide further details on specific actions we will undertake to implement the subobjectives and strategies on refuge lands. None of the information in appendix A is intended to direct or prioritize management on other ownerships.

## Watershed-wide Objectives

### GOAL 1

**Wildlife and Habitat Conservation. Promote the biological diversity, integrity, and resiliency of terrestrial and aquatic ecosystems within the Connecticut River watershed in an amount and distribution that sustains ecological function and supports healthy populations of native fish, wildlife, and plants, especially Federal trust species of conservation concern, in anticipation of the effects of climate, land use, and demographic changes.**

**Background:** Our emphasis is to work with partners to protect species of conservation concern across the watershed, both on and off refuge lands. Appendix A describes more detailed management objectives and strategies for species and habitats that will be implemented on refuge lands in each CFA. Priority refuge resources of concern, many of which are also North Atlantic LCC representative species, are identified for each CFA and drive our management strategies. Our process for selecting those priority resources is detailed in appendix B. We will develop step-down Habitat Management Plans (HMPs) for each CFA to show how we plan to manage for those resources and how we will inventory and monitor species and habitat conditions. The HMPs will provide more detailed, specific, and quantifiable objectives and clear management strategies. In appendix A, for established refuge divisions (e.g., larger, existing refuge divisions such as the Nulhegan Basin Division in Vermont), we provide a higher level of detail on management objectives and strategies that will be incorporated into HMPs since we already know more about those areas.

Wherever we identify acres for management, these are rough approximations and will be refined in subsequent HMPs.

In CPAs, we will continue to support our partners' land protection efforts with an underlying goal to strive for the protection of important core habitat areas and establish connections

between them. For example, one objective in forest habitats will be to strive to conserve contiguous forest blocks of at least 15,000 acres in the southern half of the watershed, and contiguous forest blocks of 25,000 acres in the northern half of the watershed. These sizes are estimated to be the minimum to retain adequate resiliency and withstand catastrophic events, and big enough to support breeding populations for migratory bird species of conservation concern (TNC 2011). Restoration of riparian and floodplain forest, and removing barriers and improving passage for aquatic species, will be priority activities we will also actively support.

#### **Objective 1.1: Forested Uplands and Wetlands (Including Riparian and Floodplain Forests)**

In cooperation with willing landowners and other partners, protect, manage, and restore forested habitats within the Connecticut River watershed. These forested habitats will help sustain the biological diversity, integrity, and ecological and hydrologic function of the river ecosystem, provide habitat connections and

*Bird banding at Nulhegan Basin Division*



Ryan Haggerty/USFWS



wildlife travel corridors, accommodate anticipated shifts in species' ranges from climate and land use changes and support forest-dependent species of conservation concern, including migratory birds and federally listed endangered and threatened species.

Our guidelines and strategies for working cooperatively with others to help meet the objective and facilitate the protection, management, and restoration of forested uplands and wetlands throughout the watershed, with priority attention to CPAs, include the following:

- **Core Forest Blocks:** Work with partners and willing landowners within the watershed to facilitate the protection and restoration of unfragmented, contiguous blocks of forest to benefit native interior forest wildlife and to sustain natural ecological processes and functions. To protect area-sensitive forest-interior species, these forest blocks should be a minimum of 500 acres in size and within a mile of other large forest blocks.

**Rationale:** Scientists consider habitat fragmentation to be one of the great threats to wildlife survival worldwide. We define habitat fragmentation as a process during which “a large expanse of habitat is transformed into a number of smaller patches of smaller total area, isolated from each other by a matrix of habitats unlike the original (Wilcove et al. 1986).” This transformation has the ability to:

- Reduce the amount of habitat.
- Increase the number of disparate habitat patches.
- Decrease the size of intact habitat patches.
- Increase the isolation of these patches.

We differentiate habitat fragmentation from habitat loss, such as that which results from converting forest land to agricultural and urban uses. Habitat loss (or permanent fragmentation) refers to long-term conversion of forest to urban, residential, agricultural (e.g., forest production, row crops, pasture, hay fields, etc.), or other non-forest uses. Roads, trails, and utility corridors can also create permanent fragmentation. This permanent loss of contiguous forest habitat alters ecological processes and has a negative impact on biodiversity.

One ecological principle, the species-area relationship, has led to an emphasis on contiguous habitat conditions (MacArthur and Wilson 1963). Large forest blocks support more species than small areas because they support larger population sizes of individual species, which reduces the chances of stochastic extinction, promotes genetic diversity within populations, and buffers populations against disturbances. And, forest edges need to be minimized because the effects of habitat alteration extend for some distance beyond the areas directly altered. For instance, studies have documented edge-related habitat changes including: increases in invasive species introductions (Lake and Leishman 2004), altered predator-prey dynamics (Brittingham and Temple 1983, Wilcove et al. 1986, Donovan et al. 1997), and declines in forest biodiversity (Fahrig 2003). The dispersal of plants and wildlife species can be affected if species or their propagules (e.g., seed and spores) cannot cross a disturbed area, find suitable habitat within it, or successfully compete with disturbance adapted species. The simple way to maintain a population of a particular species is to guarantee the existence of a sufficient area of suitable habitat that can be kept free of alien competitors, predators, and diseases. In practice, the design of such habitat areas must take into account the ecological requirements of the species and the minimum size of a population that can sustain itself in the face of environmental variation. As habitat becomes more and more the focus of conservation efforts,

it becomes especially important to identify habitats that are most critical to maintaining species diversity as a whole and to determine the area of habitat required to maintain minimum viable populations of most species.

Recent literature indicates that a complex relationship exists between the relative importance of overall forest habitat acreage versus forest habitat patch size and the ultimate response of individual wildlife species (Lee et al. 2002). In general, the greater the amount of habitat within the landscape mosaic, the better. Empirical studies that have examined the independent effects of habitat loss versus habitat fragmentation suggest that habitat loss has a much larger effect than habitat fragmentation on the distribution and abundance of birds (Fahrig 2003). This is supported by other studies that found forest size and edge effects did not significantly affect either nesting success or the productivity of neotropical songbirds (e.g., Friesen et al. 1999). A further consideration is that landscape-scale effects may be different in largely forested environments in the northern part of the Connecticut River watershed compared to largely fragmented environments in the southern portion of the watershed. It is possible that in large forested areas birds respond primarily to local habitat effects (Lichstein et al. 2002) whereas in fragmented landscapes, landscape-scale forest cover may be critical (Trzcinski et al. 1999).

Generally, the nesting success of forest interior-nesting songbirds has declined as forest habitat loss has increased (Wiens 1989, Askins 2002). Focusing our protection efforts on creating large blocks of forest (more likely in the southern portion of watershed), or protecting existing blocks (more likely in the northern portion of watershed) will help to ameliorate the detrimental impacts of forest habitat loss and fragmentation. Forest blocks of a thousand acres or more increase the likelihood of providing habitat for the greatest number of area-sensitive species (Robbins et al. 1989) by providing a diversity of microhabitat conditions. Robbins et al. (1989) investigated the impact of shrinking forest habitat on forest interior species in the Mid-Atlantic States and showed a marked decline in the density and diversity of species in forest blocks smaller than 240 acres. Highly area-sensitive species were rare or did not occur in forest blocks this small.

Landscape-scale impacts from changes in habitat loss and changes in spatial patterns can result and impact species use and distribution. For example, studies of migratory birds indicate that cerulean warbler, yellow-throated vireo, and hermit thrush require a minimum area of 800 to 2,000 acres (Askins 2002). Other examples include the fact that wood thrush demonstrate higher area sensitivity to smaller patch sizes in the northern portion of their range than further south (Rosenberg et al. 2003a), and the minimum area requirements for the scarlet tanager may depend on the amount of remaining forest and in the landscape (Rosenberg et al. 2003b).

How core forest blocks are organized on the landscape and how they are managed has important consequences for ecological processes as well. We envision a pattern of conserved lands across the watershed that includes both “wildlands reserves” and forests that are sustainably managed to improve wildlife habitat (see Foster et al. 2010). Any landscape-scale conservation within the Connecticut River watershed involves an element of cultural influence. Although the landscape was largely forested prior to European settlement, it was highly dynamic in response to changing climatic conditions, natural disturbance processes, and American Indian activities. European settlement in the 17<sup>th</sup> and 18<sup>th</sup> centuries initiated a dramatic transformation, as much of the land in the watershed was deforested and farmed and the remainder was logged, grazed or burned. Despite the natural appearance of many portions of the modern

landscape, a legacy of intensive past use remains in vegetation structure and composition, landscape patterns, and ongoing dynamics.



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*Cardinal flower*

The appropriate size of a forest block needed to protect ecological processes is difficult to know, and is dependent upon the ecological process under consideration. TNC and others (TNC 2011; Foster et al. 2010) advocate for forest blocks between 5,000 and a million acres in New England. It's thought that conserving and restoring forests of this size in a matrix of other land uses may:

- Temper the impacts of climate change by supporting complex, aging forests that can store twice as much carbon as young forests.
- Provide rare habitats for a diverse array of plants, animals, and microorganisms nested within larger, more robust core areas.
- Safeguard lands of natural, cultural, and spiritual significance.
- Serve as unique scientific reference points for evaluation and improvement of management practices elsewhere.

Further, TNC has recommended that large forest blocks be protected to (1) promote resilient forest ecosystems that can absorb, buffer, and better recover from the full range of natural disturbances; and (2) support enough breeding territories for interior forest species to conserve their genetic diversity over generations (TNC 2011). Combining both of those considerations, and evaluating each ecoregion's forested extent, ecology, and natural disturbance history, they conclude that a core forest block in the Lower New England ecoregion (including Connecticut, Massachusetts, and southern New Hampshire) be 15,000 acres minimum in size. In the Northern Appalachian ecoregion (including Vermont and northern New Hampshire), they recommend a core forest block be 25,000 acre minimum in size (TNC 2011).

As we delineated CFAs, we considered these general parameters in the context of the existing network of conserved lands and the Service's population and habitat objectives.

- **Forest Corridors:** Work with partners and willing landowners to facilitate the protection and restoration of travel and dispersal corridors for plants and wildlife. Special consideration will be given to protecting areas that span elevation, latitudinal, and longitudinal gradients. Forest corridors should be at least 300 meters (approximately 1,000 feet) in width to facilitate species movement, or designed to provide the habitat requirements for a target species. Special consideration should be given to forest corridors that connect forest blocks of at least 500 acres to provide movement opportunities to a suite of species, including those with large home ranges, and interior forest specialists. We will work with our partners to promote these general characteristics within the CPAs, emphasizing connections between the networks of conserved lands.

**Rationale:** Conservation biologists generally agree that landscape connectivity enhances population viability for many species and that until recently, most species lived in well-connected landscapes (Noss 1987, Hunter Jr. 1990). Among the most popular strategies for maintaining populations of both plants and animals in fragmented landscapes is to connect current isolated patches with strips of habitat called corridors. We define corridor as a linear habitat, embedded in a dissimilar habitat type matrix, that connects two or more larger blocks of habitat and that is proposed for conservation on the grounds that it will enhance or maintain the viability of specific wildlife populations in the habitat blocks. Further, our definition of corridor also implicitly includes those linear habitats—such as riparian areas (Naiman et al. 1993) in agricultural



S. Maslowski/USFWS

*Bobolink*

landscapes—that support breeding populations of many species but do not connect larger habitat patches.

Increasing urbanization within the Connecticut River watershed continues to sever connections between habitat blocks. This habitat fragmentation can lead to an overall reduction in species populations and potentially local extirpation of a plant or animal species (Noss 1987, Fahrig and Merriam 1994, Tewksbury et al. 2002, Fahrig 2003). Species affected by habitat fragmentation become increasingly vulnerable to natural disasters (Pickett and White 1986) and predation (Brittingham and Temple 1983). They are also more susceptible to inbreeding (Young et al. 1996), increasing the prevalence of genetic defects.

Perhaps the best argument for corridors is that the original landscape was interconnected. Corridors are an attempt to maintain or restore some of the natural landscape connectivity (Noss 1987). Habitat corridors provide numerous benefits for plants and animals and can play a critical role for endangered species. The protection, and where necessary, the restoration of habitat connectivity through corridors has been shown to increase the exchange of individuals between habitat patches, promoting genetic exchange and reducing population fluctuations. Corridors provide food and shelter for a variety of wildlife

and help with juvenile dispersal and seasonal migrations. The establishment of additional habitat corridors can also benefit people, with underpasses or overpasses for wildlife helping to reduce vehicle collisions with large animals.

Corridor management needs to consider the habitat requirements of the target species, landscape structure and subsequent species response (i.e., movement ability, movement patterns, reaction to boundaries). The utility of these corridors will vary among species; therefore, it is important to determine the function of the corridor (i.e., breeding habitat, dispersal) before management efforts occur. The guideline above is specific for corridors that are to provide species movement opportunities between similar habitats, and act as buffers along riparian and wetland habitats. The distribution of species and the different habitat values within the corridor makes it difficult to determine the precise width. Spackman et al. (1995) suggests a minimum corridor width of 30 to 50 meters (100 to 160 feet) to provide the habitat needs for at least 90 percent of streamside plants, and 75 to 175 meters (245 to 575 feet) for breeding bird species. The suggested terrestrial buffer for amphibians and reptiles ranged from 150 to 290 meters (490 to 950 feet) and 127 to 289 meters (415 to 950 feet), respectively (Semlitsch and Bodie 2003). Based on these studies, a minimum corridor width of 300 meters (985 feet) for species movement is suggested. This minimum guideline is not species specific, nor does it consider the landscape context. A width greater than 300 meters may be necessary, for example, if human disturbances adjacent to corridors are impacting species use.

Maintaining corridors of forested habitat between larger areas of core habitat can create a network of connected conserved lands across the landscape. In the face of environmental stressors such as climate change and other land uses

changes, these networks of core and corridor habitats can help connect not only areas of similar habitats, but also a diversity of habitats across a range of elevations, latitudes, aspects, soil types, and landform types. These connections will facilitate species movement as they migrate and otherwise adapt in response to these stressors.

- **Diversity of Forest Age, Structure, and Composition:** Work with partners and willing landowners to promote a sustainable range of forest age, structure, and composition that benefits resources of conservation concern and encourages a diverse assemblage of native plants and organisms within the landscape. Within a CPA, between 10 to 15 percent of forested habitats should provide the structural attributes common to early successional forests (e.g., dense shrub and herbaceous ground cover layer, soft mast, and low exposed perches) and a minimum of 15 percent of forested habitats should provide the structural attributes common to late successional forests (e.g., vertically differentiated canopies, higher densities of large snags and downed logs, and small gaps). Early successional forest habitat should be strategically located, recognizing the importance of interior forest habitat, and providing the full suite of habitat characteristics for resources of conservation concern. Ideally, targeted successional stages will be well-distributed across respective ecoregions and ownerships within the Connecticut River watershed and in areas where site conditions favor a prolonged stage of early successional forest.

**Rationale:** Many forests seem ancient from the time-scale of human lifespans, but they are not ageless, immutable features of the landscape. Their age is limited by the amount of time that has elapsed since a significant disturbance—hurricanes, fire, logging, agricultural clearing, landslide, ice storm, etc.—last set back the clock of ecological succession. Forest succession is paced by changes in the relative abundance and stature of a handful of conspicuous, dominant plants, but along with these species, thousands of plants and animals come and go too—their populations waxing and waning—as succession proceeds. Because of all these changes, managing forests—whether for biodiversity or for particular focal species—requires managing the patterns of succession that determine the age structure and species composition of the landscape.

Managing forest landscapes for diversity involves managing patterns of succession for two reasons: (1) some successional stages have more species than others; and (2) each stage has a different, although not usually unique, set of species. Forest management is done principally by controlling stand structure (the ages, sizes, and density of trees within a stand) and forest structure (the sizes and spatial arrangement of stands within a forest). Stand and forest structure appears to be generally more important than tree species composition in providing for habitat, although particular species are sometimes important for certain food requirements. Silvicultural treatments (forest management) can be applied most directly to creating particular stand structures for habitat purposes, just as it is done to meet other objectives. The principles of designing forest structure can partly be drawn from traditional concepts of forest management for sustaining timber production, but additional ideas also apply. In situations where individual animals range over very large areas or when the maintenance of a sustainable population of a species requires a large area (even in cases where individuals have limited ranges) the spatial scale of wildlife management differs from that of timber management. To achieve the goals of providing habitat for populations with large land requirements, the management of individual stands within a CPA will be developed considering the larger regional landscape context. This presents one of the more challenging aspects of forest land management requiring economic, social, and political innovations to coordinate efforts and anticipate actions and long-term trends within the region. Under almost all

circumstances, desirable patterns of landscape diversity represent long-term goals toward which foresters and biologists can work, but they are not patterns that can be created in a few years or even a few decades.

An idealized diversity of successional stages across the landscape of a CPA will take the form of approximately 10 to 15 percent of the acreage in an early successional condition; a minimum of 15 percent in a late successional condition; and the balance falling somewhere along a continuum between these two extremes. The role of the refuge in meeting these targets will depend upon successional diversity of the landscape at time of acquisition.

*Late Succession*—There is no generally accepted, or universally applicable, definition of late succession. A simple, more or less idealistic, definition would be a “climax forest that has never been disturbed by humans.” This becomes unrealistic when considering the long history of landuse in New England. Native peoples regularly set the woods on fire (Day 1953; Cronon 1983; Cogbill 2000); land was cleared for agriculture (Raup 1966; Whitney 1996); and intensive logging removed lumber and pulpwood (Whitney 1996). Ecologists have defined the natural disturbance regimes common to the forests of the watershed—the disturbances that would have created a successional mosaic more free from human disturbances. We can use these studies to develop silvicultural analogs that emulate these forest disturbances and move forest succession toward later successional stages (Franklin et al. 2002; Lorimer and White 2003; Keeton 2006).

Small gap openings in the forest were the most common natural disturbance, which led naturally to a forest structure dominated by late-successional, multi-aged stands (Seymour et al. 2002). The structure and composition of late-successional forest ecosystems have been detailed by ecologists (Franklin et al. 1981, 2007, Goodburn and Lorimer 1998, Keeton 2006, D’Amato et al. 2009, Curzon and Keeton 2010). Four major structural attributes of late-successional forests are: living large-diameter trees, standing dead trees (snags), fallen trees or logs on the forest floor, and logs in streams. Additional important elements typically include multiple canopy layers, smaller understory trees, canopy gaps, and patchy understory development. Ecological processes include those natural changes that are essential for the development and maintenance of late-successional forest ecosystems. Although the processes that created the current late-successional ecosystems are not completely understood, they include: (1) tree growth and maturation, (2) death and decay of large trees, (3) low to moderate intensity disturbances (e.g., wind, insects, diseases, and ice) that create canopy openings or gaps in the various strata of vegetation, (4) establishment of trees beneath the maturing overstory either in gaps or under the canopy, and (5) closing of canopy gaps by lateral canopy growth or growth of understory trees.

Many species are dependent on large living trees, large dead trees, or fallen logs, features that are common to late-successional forests but not younger or financially mature forests. These species tend to be small, non-charismatic species, such as mosses, lichens, fungi, and insects (Hagan and Whitman 2004). Few of the charismatic species (e.g., birds and mammals) appear to be as tightly dependent on large old trees, though some do require large trees. On the White Mountain National Forest, Kursic et al. (1996) found that bat activity within the forest was highest in over-mature hardwood stands (greater than 119 years old), and suggest maintaining areas of older forest as roosting sites. Northern myotis, for example, tend to use tall, wide-diameter, partially-dead trees for roosting, and forest openings for feeding (Caceres et al. 1997). These habitat features are often associated with late successional forests. Bald eagles and osprey require tall,

super canopy trees near foraging areas for nesting and roosting. Hollow trees and fallen logs are important den sites for certain mammals, and snags would be used by cavity nesting birds like wood ducks and black-backed woodpeckers. Once old forest elements such as large trees or logs are lost from a stand (e.g., as a result of a clearcut or a selection cut), it can take centuries for the species to return to that location. A species first has to wait for these structural features to redevelop, and then the species must colonize them.

*Early succession*—Forest disturbances were once viewed as an insult to the “balance of nature” and synonymous with habitat destruction (Marsh 1864). Certain forms of disturbance, however, are now held by ecologists and conservation biologists to play a fundamental role in maintaining the natural heterogeneity in environmental conditions that organisms experience. Early successional forest habitats have become critically uncommon in parts of the eastern United States, especially in the Northeast (Askins 2001; Brawn et al. 2001; Brooks 2003; DeGraaf and Yamasaki 2003), largely in response to forest maturation and land-use development. European settlement resulted in widespread clearing of forests for agriculture, timber, and fuelwood (Whitney 1996). Since that time, the amount and distribution of early-successional habitats has generally declined, especially in southern New England where the amount of early successional forest area has declined 31 percent since the 1950s (Brooks 2003).

The forests in the Connecticut River watershed were historically subject to several sources of disturbance. In much of the region, early-successional habitats were continuously produced in pre-settlement times by fire, wind, beaver, flooding, and Native American agriculture and burning. Many fire-prone areas were settled by Europeans and are now largely developed. Beaver, once extirpated but now increasing, cannot modify the landscape to the extent they did in pre-settlement times. Many drainages are confined or channelized now and beaver generally are not tolerated where key woods roads, suburban development, or agriculture occur. Wind still creates small openings in softwood stands, but mid-successional hardwoods, now predominant across much of southern New England, are fairly resistant to wind, even hurricanes (Foster 1988). The net result is that natural disturbances are much reduced compared to pre-settlement times and cannot be relied upon to produce early-successional habitats where and when they are needed. Most early-successional dependent species are not generalist species; rather, they are specialists in vegetation structure or area requirements.

Analysis of bird survey data in the early 1990s identified population declines of numerous species dependent on early-successional habitats (Vickery 1991, Askins 1998). North American Breeding Bird Survey data indicates that 48 percent of shrubland and 100 percent of grassland birds have declined significantly since 1966 in the northeast (Dettmers 2003). Other research has suggested that populations of other species, such as New England cottontail are either declining or would generally benefit from additional early-successional habitat. These include various game birds (DeGraaf and Yamasaki 2003), mammals (Scanlon 1992, Litvaitis 2003), reptiles (Scanlon 1992), and rare plants (Latham 2003).

The Connecticut River watershed is now dominated by human uses, and maintaining early and late successional habitats throughout in proportion to presettlement levels is not possible. However, a mix of successional and developmental stages across forested landscapes of the watershed represents potential habitat for a host of important species. Sustainable forestry practices across managed landscapes can contribute to the maintenance of biological

diversity and ecosystem functioning (Lindenmayer and Franklin 2002). The challenge lies in:

- Determining the mix of management approaches necessary to achieve sustainability objectives.
- Anticipating trends due to economic and social changes.
- Coordinating responses with other landowners in the conserved land networks.

The approach identified throughout our CCP focuses on the architecture of individual forest stands and their spatial arrangement, with consideration given to the aggregate representation of multiple structural (or habitat) conditions at landscape scales. This is partly in response to a call from researchers for an approach where management creates currently under-represented structures and age classes on some portion of the landscape (Franklin et al. 2002, DeGraaf and Yamasaki 2003, Keeton 2004). In the Connecticut River watershed, this will include managing for late and early successional structures, which are geographically underrepresented relative to pre-European settlement conditions (Whitney 1996, Cogbill 2000, Lorimer 2001, Lorimer and White 2003). The proportion of early-successional habitat in northern industrial forests is currently several times that which occurred in presettlement times (Lorimer and White 2003) and in the southern portion of the watershed, mature forests are a disproportionate fraction of the landscape. Strategic partnerships between public and private landowners and managers to create a landscape that accounts for the characteristic successional and developmental stages—with forest stands ranging from small to large—will facilitate the conservation of biodiversity within the watershed. Utilizing silvicultural systems that more closely emulate natural disturbance and stand development processes will aid in sustaining ecological complexity and biodiversity (Seymour and Hunter Jr. 2000, Ontario Ministry of Natural Resources 2001, Franklin et al. 2007).

- **Forest Wetland Integrity:** Work with partners and willing landowners to maintain the important hydrologic functions and wildlife values of forested wetlands by protecting and restoring natural hydrological regimes and vegetative edges and buffers. These vegetated buffers are a critical component of wetland complexes. The buffer or edge habitat is important to wildlife, as well as wetland water quality. The protection of these wetland and waterway edges may include protection and restoration of floodplain forests, and replacement or installation of culverts or bridges. In particular, work with partners to protect existing floodplain forests identified and mapped by TNC (Marks 2011).

**Rationale:** Forested wetlands are common within the Connecticut River watershed where moisture is abundant, particularly along rivers and in the mountains. They are best defined as “an area where water is at, near or above the land surface long enough to be capable of supporting aquatic or hydrophytic (water-loving) vegetation, and which has soils indicative of wet conditions” (Cowardin et al. 1979). Their vegetation community generally consists of an overstory of trees, an understory of young trees or shrubs, and an herbaceous layer. Description of hydrologic characteristics becomes more complicated and requires detailed knowledge of the duration and timing of surface water inundation, both yearly and long-term, as well as an understanding of groundwater fluctuations; forested wetlands generally fall into two categories based on water regimes: tidal and non-tidal. The watershed’s wetlands include marshes, bogs, floodplain forests, wet meadows, and low prairies.



Habitat destruction has been recognized as a universal threat to biodiversity (Soule 1991). Studies continue to reveal that humans have been significantly altering the landscape since prehistoric times (Cronon 1983, Whitney 1996), and in New England, that effect has dramatically reduced wetland coverage. Wetlands have been drained on a widespread basis on inland as well as coastal sites, and changes in local hydrology have left us with distinctly different habitats and vegetation cover than have occurred historically (Tiner Jr. 1984). Increased population densities and suburban sprawl have often converted these drained wetland areas of natural land to urban, industrial, and agricultural use.

Threats beyond simple wetland destruction are prevalent as well. For instance, poor water quality due to low oxygen conditions or the presence of toxic substances may explain why fish and wildlife communities are impaired when other aspects of suitable habitat appear to be present. Some researchers believe that declines in amphibian populations in apparently pristine habitats may be due to factors such as viruses, acid rain, concentrations of nitrates, or increased exposure to ultraviolet B light (UVB). Wetland plant communities are being detrimentally impacted as well through the introduction of nonnative, invasive plants and insects (Orwig et al. 2003), which can displace native plants reducing biodiversity (Silliman and Bertness 2004).



*Multiflora rose*

G.A. Cooper @ USDA-NRCS PLANTS Database

In the Connecticut River watershed, patterns of glacial deposition strongly influence wetland occurrence and function. Many wetlands are associated with permeable soils and owe their existence to groundwater discharge. Whether developed on soils of high or low permeability, wetlands are often associated with streams and appear to play an important role in controlling and modifying streamflow (O'Brien 1988), minimizing harm to downstream areas. Due to dense vegetation and location within the landscape, wetlands are important for retaining stormwater from rain and melting snow entering rivers and lakes. Wetlands that overlie permeable soils have the capacity to store and filter pollutants ranging from pesticides to animal wastes. The flow characteristics of wetland waters allow particles of toxins and nutrients to settle out of the water column. Larger wetlands and those surrounded by dense vegetation are most effective at protecting water quality.

Where these complex hydrological regimes have been altered by man, recurrent negative effects on migratory and resident wildlife have been realized (Tiner Jr. 1984). A high proportion of the Connecticut River watershed's fish and wildlife species inhabit wetlands during part of their life cycle. Forested wetlands provide breeding habitat for species of conservation concern such as Canada warbler, northern parula, wood duck, and American black duck. Forested wetlands adjacent to the Connecticut River mainstem are important for migrating landbirds (Smith College 2006), and during high water events, migrating waterfowl. Wetlands also provide lifelong habitat for some frogs and turtles, as

well as essential habitat for smaller aquatic organisms in the food web, including crustaceans, mollusks, insects, and plankton. Degradation of forested wetlands and riparian areas can also have impacts on water quality and increase the risk of flooding downstream.

- **Climate Change Adaptation:** Work with partners, willing landowners, and other stakeholders to identify the best forested uplands and wetlands to manage for conservation and natural diversity. Identify corridor and stopover locations that will help connect these lands. Use climate change vulnerability assessments, climate models, and ecological models to prioritize and strategically implement forest management that promotes resistance and resilience, or facilitates transition as species' ranges shift over time. Develop and implement adaptation strategies that allow us to achieve our more specific goals within the watershed (e.g., protecting movement corridors, managing forests to support forest-dependent species, restore forested habitats). Participate in and use outputs from the landscape conservation design modeling effort being led by the North Atlantic LCC. Work with partners to identify likely changes in climate variables over 50 years, the likely impacts of projected climate changes on the abiotic and biotic components of the watershed's existing forested uplands and wetlands, and the habitat suitability for these ecosystems into the future. Monitor changes to forested uplands and wetlands over time and measure the effectiveness of climate change adaptation measures, using an adaptive management strategy to evaluate decisions when necessary.

**Rationale:** Climate change is increasing the vulnerability of many forests to ecosystem changes and tree mortality through fire, insect infestations, drought, and disease outbreaks (Glick et al. 2011). Changing climatic conditions may affect the establishment and growth of forest species currently present on the Conte Refuge, leading to a shift over time in forest community structure and composition, which could lead to cascading effects on wildlife and overall ecosystem function. The ability of refuge managers to adapt to future climate change will be enhanced by their capacity to alter management regimes relatively rapidly in the face of changing conditions. The lack of fine-scale information about the possible effects of climate changes on locally managed forests limits the ability of managers to weigh these risks to their forests against the economic risks of implementing forest management practices such as adaptation and/or mitigation treatments. This knowledge gap will impede the implementation of effective management on public or private forestland in the face of climate change (Joyce et al. 2014).

Climate change vulnerability assessments provide two essential contributions to adaptation planning. Specifically, they help in identifying which species or systems are likely to be most strongly affected by projected changes, and in understanding why these resources are likely to be vulnerable, including the interaction between climate shifts and existing stressors. Computer models and biological research are used to assess sensitivity, exposure, and adaptive capacity: the three components of a vulnerability assessment. Models are computer-based programs that may be used to simulate a wide variety of ecological processes, and can incorporate the effects of stochastic or fixed stressors. Those models, in conjunction with vulnerability assessments, can then be used to develop strategies for building resistance to climate-related stressors, enhancing resilience in order to improve the capacity of species and systems to persist during changes, and anticipating and facilitating ecological transitions that reflect the changing environmental conditions (Glick et al. 2011).

Modeling can also occur outside the vulnerability assessment framework. In an effort supported by the USFWS and the North Atlantic LCC, a landscape change, assessment, and design model that assess ecosystems and their capacity to sustain fish, wildlife, and plant populations in the northeastern U.S. in the face of urban growth, climate change, and other stressors is being developed by a coalition of partners representing the federal government, states, and nongovernmental organizations. A landscape conservation design for the Connecticut River watershed has been completed that used this model to develop tools and information the Conte Refuge will use to build resistance, enhance resilience, and facilitate transitions among the natural systems in and around Refuge-managed lands (Schwenk and Mallek 2016).

Monitoring of how species and natural systems are reacting to climate impacts and adaptation actions will be a critical part of reducing uncertainty and increasing the effectiveness of management responses (NFWPCAP 2012). We will work with partners to monitor species range shifts, phenological shifts (e.g., changes in flowering time and lengths of growing seasons), changes in precipitation and related effects of surface and groundwater, invasive species, increased wildfire and storm events frequency and intensity, and sea level rise.

Also see the discussion on “Forest Corridors” above.

**Objective 1.2: Non-forested Uplands and Wetlands (Freshwater Wetlands, Pasture, Hay and Grasslands)**

In cooperation with willing landowners and other partners, protect, manage, and restore non-forested wetlands and uplands within the Connecticut River watershed. These non-forested habitats will help sustain the biological diversity, integrity, and ecological and hydrologic function of the river ecosystem, provide habitat connections and wildlife travel corridors, accommodate anticipated shifts in species’ ranges from climate and land use changes, and support dependent species of conservation concern-including migratory birds and federally listed endangered and threatened species.

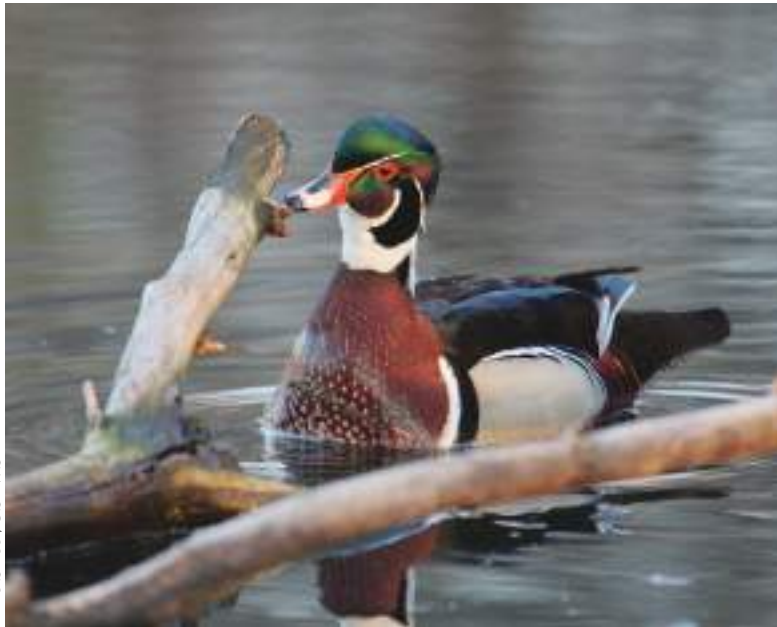
Our guidelines and strategies for working cooperatively with others to help meet the objective and facilitate the protection, management, and restoration of non-forested uplands and wetlands throughout the watershed, with priority attention to CPAs, include the following:

- **Wetlands Integrity:** Work with partners and willing landowners to facilitate the protection and management of wet meadows, shrub swamps, peatlands and emergent marsh, to ensure the health and persistence of these communities. Prioritize the restoration and maintenance of site specific wetland buffers that provide habitat functions for wetland-associated fauna, and filter nutrients and contaminants. We will use the following criteria to prioritize efforts:
- Emphasize rehabilitation of wetlands in headwater areas for groundwater discharge and recharge and floodplains for flood attenuation.
- Focus on the control of invasive plant and animal species, and the restoration of native species.

**Rationale:** Wetlands include a wide range of plant communities that have adapted to being inundated by or saturated with water for varying periods during the growing season. Non-forested wetlands within the Connecticut River watershed include shrub swamps, wet meadows, peatlands, and emergent marsh, and make up only 1.4 percent of the watershed.

Wetlands, overall, are influenced from natural disturbances and succession. However, beavers play an important role in the disturbance regime and

maintenance of non-forested wetlands, especially in mostly forested landscapes where natural openings are uncommon. Beavers are associated with riparian areas, where their dam building activities alter the hydrology and flood low lying areas creating a mosaic of wetlands. These wetlands provide a diversity of vegetation types, are rich with invertebrates, and are valuable for waterfowl, landbirds, amphibians and reptiles (Gauthier and Aubry, 1996, Chandler et al. 2009, Thompson et al. 2000). Regardless whether the habitat has been modified by beaver activity or by some other natural disturbance, non-forested wetlands in the watershed are essential to a variety of species, and provide critical habitat to wildlife throughout various life stages.



Mike Sweet/USFWS

Wood duck

As is the case with many of the habitats in the watershed, development is a threat to the integrity of these wetland types. Commercial and residential development adjacent to wetlands introduces pollutants which decrease water quality. Roads and man-made ditches fragment wetlands and alter the hydrology. Nonnative invasive species are a common occurrence near developed areas, and when introduced to wetland habitats compete with native species.

Wetlands in the Connecticut River watershed are valuable from an ecological and economic view point. Non-forested wetlands contribute to the diversity within the landscape, and provide critical habitat for a variety of wildlife species, some of which are species of conservation concern. American woodcock, for example, is declining across its range, and is dependent on shrub swamps for daytime

cover and feeding (Kelley et al. 2008, Sepik et al. 1993). American black duck rely on the abundance of invertebrates and wetland vegetation to feed their young, and dense wetland vegetation to conceal nesting sites (Longcore et al. 2000, DeGraaf et al. 2001). Wetlands adjacent to the Connecticut River mainstem provide significant stop-over and wintering habitat for a diversity waterfowl species, and feeding areas for migratory shorebirds.

Wetlands adjacent to rivers and streams protect inland areas from flooding by reducing water velocities and peak flows immediately downstream. Wetland vegetation stabilizes shorelines and reduces the risk of erosion. This prevents the loss of property, reduces sediment delivery to water bodies, and helps maintain stream channels. Wetlands also play a significant role in water-quality improvement, by filtering nutrients and contaminants (EPA 2001, Thompson et al. 2000). The protection and management of these wetland communities in the watershed is essential to maintain habitat and wildlife diversity, and local property values.

- **Grasslands, Old Fields, Shrublands, Pasture and Hayfields:** Work with partners and willing landowners to facilitate the protection of open habitats such as grasslands, old fields, shrublands, pasture and hayfields, and to ensure restoration and the long-term management of these important habitats to complement the surrounding landscape. Priority for protection and/or restoration should be given to open habitats that have high development

pressures, are within an active floodplain, or can provide critical habitat for Federal or State listed species, or other species of conservation concern. Continuing support for pasture and hayfield management over the short-term may be warranted to facilitate long-term goals for sustaining grasslands, old field, and shrublands. However, if working pasture and hayfields are incorporated into the refuge, they will be evaluated on a case-by-case basis to evaluate management actions that will support long-term habitat objectives.

**Rationale:** We emphasize that we support the continuation of working agricultural lands and agricultural land protection programs because of their significance to communities in the watershed. However, there may be circumstances when a farmer is selling their farmland and another agricultural landowner is not available. Their only choice may be to either sell to a developer or a conservation landowner. We promote the latter choice if the lands have important conservation values.

Grasslands, old fields, shrublands, pasture, and hayfields are our descriptions of agricultural fields that are no longer in commercial production, but may be currently, or recently, managed to maintain open conditions through grazing, mowing, brushing, or burning. Disturbance adapted plant communities are often present, and typically include forbs, grasses, shrubs, and small trees.

These open habitats are prime areas for commercial or residential development. As development pressure increases in the watershed, many of these areas will be replaced by urban sprawl, impacting the integrity of the watershed's ecosystems. Many agricultural fields within the watershed, for example, are located in floodplains, and development of these areas would not only impact adjacent and downstream riparian habitat and remaining agricultural lands, but also upland habitats through fragmentation and flooding. Development within these areas would introduce pollutants to rivers and streams, increase the number of invasive nonnative species and urban predators, and interrupt ecological functions, such as a floodplain's ability to effectively retain high water levels during a flooding event.

Conservation and restoration of open habitats, especially those located in a floodplain, will not only increase ecological integrity and protect human property, but will also provide habitat for wildlife including species of conservation concern. Blue-winged warbler, American woodcock, and New England cottontail, for example, are declining species that require shrub dominated habitats, and contiguous tracts of grassland habitat would benefit declining grassland dependent birds. The watershed is a major migration corridor. Migrating landbirds concentrate in habitats along the Connecticut River mainstem (Smith College 2006), and protection or restoration of these open habitats would provide important stop-over habitat.

A landscape scale approach is needed to determine the appropriate management objectives for these open habitats. Consistency with adjacent land management and habitat types will provide a more contiguous, resilient, and functional landscape. The management focus should be on restoration of natural communities and providing habitat for species of conservation concern.

- **Climate Change Adaptation:** Work with partners, willing landowners, and other stakeholders to identify the best non-forested uplands and wetlands to manage for conservation and natural diversity. Identify corridor and stopover locations that will help connect these lands. Use climate change vulnerability assessments, climate models, and ecological models to prioritize and strategically implement wetland, agricultural, and grassland management

that promotes resistance and resilience, or facilitates transitions as species' ranges shift over time. Develop and implement adaptation strategies that allow us to achieve our more specific goals within the watershed (e.g., protecting movement corridors, managing freshwater wetlands, agricultural areas, and grasslands to support dependent species, restore wetland and grassland habitats). Participate in and use outputs from the landscape conservation design modeling effort being led by the North Atlantic LCC. Work with partners to identify likely changes in climate variables over 50 years, the likely impacts of projected climate changes on the abiotic and biotic components of the watershed's existing non-forested uplands and wetlands, and the habitat suitability for these ecosystems into the future. Monitor changes to non-forested uplands and wetlands over time and measure the effectiveness of climate change adaptation measures, using an adaptive management strategy to evaluate decisions when necessary.

**Rationale:** Climate change is increasing the vulnerability of many freshwater wetlands, grasslands, and agricultural lands to ecosystem changes and disturbances like invasive species, shifting precipitation regimes, and extreme weather events. Changing climatic conditions may affect the establishment and growth of species currently present on the non-forested uplands and wetlands of the Conte Refuge, leading to a shift over time in community structure and composition, which could lead to cascading effects on wildlife and overall ecosystem function. The ability of refuge managers to adapt to future climate change will be enhanced by their capacity to alter management regimes relatively rapidly in the face of changing conditions. The lack of fine-scale information about the possible effects of climate changes on locally managed non-forested lands limits the ability of managers to weigh these risks against the economic risks of implementing wetland, grassland, or agricultural land management practices such as adaptation and/or mitigation treatments. This knowledge gap will impede the implementation of effective management on public or private land in the face of climate change (Joyce et al. 2014).

Please see Rationale for guideline "Climate Change Adaptation" under Objective 1.1.

**Objective 1.3: Inland Aquatic Habitats (Freshwater Rivers, Streams, Ponds and Lakes)**

In cooperation with willing landowners and other partners, protect and restore in-stream and riparian habitat structure and function, and restore aquatic species passage and water quality within the Connecticut River watershed to improve the ecological integrity and environmental health of the river ecosystem and enhance habitat for migratory and inter-jurisdictional fish, mussels, and other native aquatic species of conservation concern.

Our guidelines and strategies for working cooperatively with others to help meet the objective and facilitate the protection, management, and restoration of inland aquatic habitats throughout the watershed, with priority attention to CPAs, include the following:

- **Habitat Assessments:** Work with partners, State natural resource agencies, and willing landowners to facilitate the development and use of effective and efficient tools to evaluate aquatic habitat conditions and water quality across the watershed in an effort to improve the ecological integrity and environmental health of the river ecosystem. Assessment may include physical, chemical, or biological attributes and results will direct the planning and prioritizing of management and restoration activities.

**Rationale:** Aquatic habitats include streams, rivers, lakes, and ponds. Lakes and ponds are bodies of standing or slow moving water often located in hollows

*Putney Mountain  
wetland*

Rachel Cliche

formed by past glacier, tectonic activities, and by humans. Water levels are influenced by rainwater, groundwater, or most often by streams and rivers. Lakes and ponds provide habitat for a diversity of organisms that perform different ecological functions. Plankton, for example, are microscopic organisms that are food for larger aquatic vertebrates, such as fish and amphibians. Waterfowl rely on lakes and ponds as staging areas during migration, and feeding areas for broods during the breeding season. Mammals, such as bats, rely on these habitats as a source of drinking water. Several federally listed invertebrates also rely on these habitats: the federally threatened Puritan tiger beetle and the federally endangered dwarfwedge mussel.

Streams and rivers are bodies of flowing water confined to a stream channel (consisting of a stream bed and banks) that start from a headwater (i.e., lakes, spring, snowmelt) and move to its mouth (i.e., another body of water). Stream ecosystems extend well beyond the channel, taking in the entire stream corridor. The stream corridor is comprised of the stream channel, streambanks, the hyporheic zone (i.e., region beneath and alongside a stream bed, where there is mixing of shallow groundwater and surface water), and the surrounding riparian and floodplain area. Stream corridors are extremely productive in terms of fish and wildlife resources. The stream ecosystem encompasses, connects, and integrates both aquatic and terrestrial habitat. Healthy stream corridors and floodplains provide tremendous (and sometimes the only) habitat for fish and wildlife. Stream corridors offer all the elements for aquatic life: food, water, shelter, and habitat connectivity (travel lanes). Stream corridors with intact floodplains are subject to flooding and drought but are resilient and quick to recover when the forces of flows and sediment transport are at equilibrium. Equilibrium is maintained by allowing streams access to their floodplains, retaining native vegetation, and retaining the appropriate stream dimension, pattern, and profile (Saldi-Caromile et al. 2004).

On average there are seven dams interrupting every 100 miles of river in the Northeast. Industrial, agricultural, urban and suburban development over the years has resulted in mankind moving, straightening and confining streams and rivers in an effort to force the flows to move in a pattern deemed more desirable to humans. Mankind has destabilized untold miles of river and stream due to our collective lack of understanding that a river must have access to its floodplain to avoid catastrophic flood damage and must move in a specific pattern, width and depth to maintain stable banks and transport water, sediment load, and woody material. Past practices to accommodate land development included re-aligning streams, straightening streams, diking streams (cutting off the river's access to its floodplain), channelizing streams, removal of riparian vegetation (which exposes banks to erosion), creation of fish passage barriers (dams, culverts, pollution, temperature, exposure), narrowing streams and armoring (e.g., riprap, concrete), water diversions, construction in floodplains, construction of impervious surfaces (thus accelerating and intensifying runoff), and eliminating large woody material in channels (Saldi-Caromile et al. 2004, Martin et al. 2011).

We now have a new understanding of how streams and floodplains operate and appreciation of the costs of past practices and benefits of more sustainable approaches. We no longer think of streams as pipes moving water but instead as complicated systems responding to geology, physics, hydrology, hydraulics, and ecology. We now recognize relationships between valley and stream slope, stream shape, stream sediment transport capacity, flow regimes, floodplain function, and stream stability and we can predict how streams will respond to disturbances and restoration efforts.

Stable stream channels with access to their floodplains are resilient to flooding and drought and provide habitat and refuge during a variety of climate conditions. Structural complexity within a stream and floodplain creates an array of microhabitats that provide for the needs of an assortment of species through their various life stages. Structural complexity in the stream consists of riffle and pools, variation in the stream bottom and banks, and large woody material. Structural complexity in the floodplain consists of a variety of plant species at a variety of heights and ages and a complex riparian zone that consists of downed and regenerating trees. The complex channel/floodplain structures generate hydraulic complexity (i.e., varying flow velocity, depth, direction and turbulence) throughout a range of flow conditions. This is critical to meeting the diverse needs of aquatic organisms through all life stages (Saldi-Caromile et al. 2004). Stream corridors provide habitat for priority Federal trust species such as inter-jurisdictional fish, migratory birds, threatened and endangered species, and species of concern.

- **Population Assessments:** Work with the Connecticut River Atlantic Salmon Commission (CRASC), other Service programs, partners, State agencies, and willing landowners to conduct short and long-term inventory and monitoring programs for migratory and inter-jurisdictional fish, rare invertebrates, and other native aquatic species of conservation concern in an effort to restore and maintain healthy populations within each species' historic range. Continue support for aquatic species programs, recovery plans, and other initiatives (e.g., stocking programs, the Connecticut River Diadromous Fish Restoration Program, and the Eastern Brook Trout Joint Venture) (See also goal 4).

**Rationale:** The goal of the Service is to achieve fisheries populations within the watershed that contain desired representative age classes, size classes, sex ratios, and repeat spawners all in adequate abundance to be resilient and self-sustaining. Short and long-term monitoring programs are designed to provide critical information that will inform management options. For example,



assessments may be designed to: detect changes in population size, distribution or range, age structure, health and disease status, virgin vs. repeat spawners, individual growth, fish condition, spawning success or juvenile production, genetic variability, sources of mortality (e.g., impingement and entrainment at power stations), and stocking considerations. Some of these data or metrics are required annually for States to be in compliance with the Atlantic States Marine Fisheries Commission's Fishery Management Plans (e.g., American shad, blueback herring), or fisheries may be closed by Federal law.

Within the watershed, native fish species and other aquatic organisms (including invertebrates such as dwarf wedgemussel, Puritan tiger beetle, and cobblestone tiger beetle) face numerable challenges to survival and reproduction. To flourish, aquatic species must have access to healthy ecosystems and be able to move throughout the river network. Currently, individuals must overcome a variety of challenges: fish passage barriers (e.g., dams, culverts, stream degradation), competition with nonnative species, water quality and quantity, inappropriate commercial and recreational take, stream corridor habitat degradation, disease, hydropower dams and turbines, impingement and entrainment on water diversions.

Diadromous fishes are of particular importance in the watershed. Many migratory fish species are considered Federal trust species and are the focus of large coordinated restoration efforts through the CRASC. These species are often considered keystone species from which we can deduce the health of many associated species based on the presence and health of these migratory species. Diadromous fish species cannot survive unless they migrate. Critical life stages are dependent upon different habitat types (e.g., freshwater and marine environments) and the fish must be able to migrate long distances to and from these habitat types. Due to this critical migratory behavior, the Service and its partners must monitor populations to evaluate the effectiveness and sustainability of fishways at barriers (i.e., are fishways moving adults and juvenile fish upstream and downstream safely?) and assess the impacts of other variables, natural or man-induced, that affect fish health and movement. The fish response to changing environmental conditions can be interpreted through a combination of activities such as fishway counts, tagging and telemetry, studies on rates of movement, studies on short-term and long-term effects related to barriers or fishways. Some of these data or metrics are required annually for states, as outlined in the Atlantic States Marine Fisheries Commission's Fishery Management Plans (e.g., American shad, blueback herring), or fisheries may be closed by Federal law.

- **Stream and Floodplain Functions:** Work with partners, State natural resource agencies, and willing landowners to maintain and restore in-stream, riparian, and floodplain habitats, sustain hydrological connectivity (e.g., restoration of floodplain forest, stream connectivity, or improve aquatic species passage), and improve stream structural features (e.g., increase woody material or restoration of streamside buffers) and water quality (e.g., reduce nutrient run-off) in an effort to improve ecological integrity, environmental health, and aquatic species habitat.

**Rationale:** As mentioned above in the habitat assessment guideline under Objective 1.3, stable stream channels with connectivity to their floodplains are resilient to flooding and drought and provide habitat for wildlife during a variety of climate conditions. Many aquatic resource managers understand the significance of restoration and maintenance of these connected systems, but are hindered with limited staff and funding. This challenge requires a strategic approach to ensure that conservation investments and efforts provide the most

benefit to the resource. Many conservation groups are working in partnership to pull together resources and expertise to accomplish common aquatic ecological goals. TNC, for instance, formed a Northeast Connectivity Workgroup to strategically assess barriers to fish passage in the Connecticut River watershed, and the Eastern Brook Trout Joint Venture is a unique partnership working toward brook trout conservation. The support of such initiatives is essential, especially in the face of climate change and increasing developmental pressures on the Connecticut River aquatic ecosystems.

- **Hydrological Modeling:** Work with partners to support the development of hydrologic models within the Connecticut River watershed. Specifically, models that advance our understanding of existing impacts (e.g., dams and roads) and projected future impacts (e.g., climate and land use change) will serve as valuable planning and prioritization tools. Further, models that characterize the impact of dam operations on water flow regimes within the watershed, and the resulting impacts on fish and other aquatic species populations, riparian vegetation, floodplain vegetation, and river meadows could inform a recommended seasonal and annual flooding regime.

**Rationale:** Models are computer based programs that simulate processes under various stressors. Hydrological models, for example, simulate the hydrological process, and its response to environmental and human induced stressors (i.e., storm surges, dams). Modeling is used as a tool to better understand complex problems, and provide guidance to decision makers. Hydrological models for the Connecticut River watershed are being developed as part of a Northeast Climate Science Center-led project, also co-funded by The Nature Conservancy and the US Army Corps of Engineers. These models will be used by multiple conservation agencies as a tool to assist with strategic habitat conservation efforts. Existing data will be entered into these models to assess current hydrological ecosystem functions and predict how these ecosystems may respond to landscape changes. The study has resulted in a full calibrated hydrology model of the Connecticut River Basin, a set of 112 different future hydrology scenarios associated with climate change, and a simulation and optimization model of the major reservoirs in the basin.

- **Climate Change Adaptation:** Work with partners, willing landowners, and other stakeholders to identify the best instream and riparian habitat to manage for conservation and natural diversity. Identify corridor and stopover locations that will help connect riparian habitats. Identify key aquatic passage locations that will help restore or maintain aquatic connectivity within the watershed. Use climate change vulnerability assessments, climate models, and ecological models to prioritize and strategically implement aquatic and riparian habitat management that promotes resistance and resilience, or facilitates transitions as species' ranges shift over time. Develop and implement adaptation strategies that allow us to achieve our more specific goals within the watershed (e.g., protecting movement corridors, improving aquatic connectivity, managing and restoring aquatic ecosystems and riparian habitats to support dependent species). Participate in and use outputs from the landscape conservation design modeling effort being led by the North Atlantic LCC. Work with partners to identify likely changes in climate variables over 50 years, the likely impacts of projected climate changes on the abiotic and biotic components of the watershed's aquatic and riparian ecosystems, and the habitat suitability for these ecosystems into the future. Monitor changes to these systems over time and measure the effectiveness of climate change adaptation measures, using an adaptive management strategy to evaluate decisions when necessary.

*American woodcock*

Carlos Guindon/USFWS

**Rationale:** Climate change is increasing the vulnerability of many aquatic and riparian ecosystems to ecosystem changes and disturbances like invasive species, shifting precipitation regimes, and extreme weather events. Changing climatic conditions are raising water temperatures and changing stream flows, affecting productivity and decomposition, and disrupting food web relationships. Water temperature affects the physiology, behavior, distribution, and survival of freshwater organisms, and even slight changes can have an impact. Water temperature increases will allow the geographic area suitable for warm-water aquatic species to expand. The number of streams with temperatures suitable for warm-water fish and other freshwater organisms is projected to increase. This would likely mean a concomitant decline of coldwater fisheries habitat. These changes will help some species and hurt others (NFWPCAP 2014). Precipitation changes in the Northeast are expected to occur as higher precipitation and runoff in the winter and spring, which can have a variety of effects. It may create wider floodplains, alter habitat, increase connectivity, displace riparian and bottom-dwelling species, or further distribute invasive species. As the climate warms, altered precipitation patterns may manifest as heavy storms that punctuate extended periods of hot, dry weather, yielding floods. Heavy storms will also cause increased run-off with associated erosion, sedimentation, and pollution (Hayhoe et al. 2008, NFWPCAP 2014).

The ability of refuge managers to adapt to future climate change will be enhanced by their capacity to alter management regimes relatively rapidly in the face of changing conditions. The lack of fine-scale information about the possible effects of climate changes on locally managed non-forested lands limits the ability of managers to weigh these risks against the economic risks of implementing wetland, grassland, or agricultural land management practices such as adaptation and/or mitigation treatments. This knowledge gap will impede the implementation of effective management on public or private land in the face of climate change (Joyce et al. 2014).

Please see Rationale for guideline “Climate Change Adaptation” under Objective 1.1.

**Objective 1.4: Coastal Non-forested Uplands (Coastal Beaches and Rocky Shores)**

In cooperation with willing landowners and other partners, protect, manage, and restore coastal non-forested uplands within the Connecticut River watershed. These non-forested habitats will help sustain the biological diversity, integrity,

and ecological and hydrologic function of the river estuary ecosystem, provide habitat connections and wildlife travel corridors, accommodate anticipated shifts in species' ranges from climate change and land use changes, and support coastal upland-dependent species of conservation concern including migratory birds and Federally listed endangered and threatened species.

Our guidelines and strategies for working cooperatively with others to help meet the objective and facilitate the protection, management, and restoration of coastal non-forested uplands throughout the watershed, with priority attention to CPAs, include the following:

- **Habitat Restoration:** Work with partners and willing landowners to support the Long Island Sound Study (LISS) Habitat Restoration Initiative (HRI) goals and objectives to (1) restore the ecological functions of degraded and lost habitats; (2) restore at least 2,000 acres of coastal habitats and 100 miles of riverine migratory corridor habitat; and (3) to allow for the landward migration of coastal wetlands, and (4) use partnerships to accomplish restoration objectives so as to leverage financial resources from multiple public sources.

**Rationale:** Long Island Sound is an estuary of the Atlantic Ocean located between Connecticut and Long Island, New York. Over eight million people live within the Sound's watershed, and several large cities are situated on its shoreline (Connecticut River Watershed Council 2012). Estuaries are known to be quite diverse ecosystems, and the Long Island Sound is no exception. It was designated by Congress as an Estuary of National Significance for providing habitat for thousands of species, as well as numerous opportunities for commercial and recreational activities (Long Island Sound Study 2012).

Unfortunately, this estuary has also been heavily impacted from past and current land uses. Increased development has introduced pollutants, including sewage, industrial toxins, pathogens, and man-made debris that has impacted the Sound's water quality. The Environmental Protection Agency and the states of New York and Connecticut recognized the need to focus on improving the overall health of the Sound's ecosystem. They formed a partnership in 1985 called the LISS that consists of Federal and state agencies, user groups, citizens and organizations interested in the restoration and protection of the Sound. The LISS wrote a Comprehensive Conservation and Management Plan (1994) that provides goals and management recommendations to restore the Sound. Since 1998, the LISS partners have focused on hypoxia (oxygen depletion), habitat restoration, public involvement and education, and water quality monitoring (Long Island Sound Study 2012).

The Connecticut River enters Long Island Sound near Lyme, Connecticut, and provides almost 70 percent of the freshwater to this estuary (Connecticut River Watershed Council 2012). The health of Long Island Sound is directly tied to the health of the Connecticut River. Restoration efforts of Long Island Sound should not only focus at the mouth of the Connecticut River, but within the entire Connecticut River watershed. The LISS partnership provides an opportunity to pull together resources and expertise to accomplish this goal.

- **Public Use Management:** Provide information to partners and willing landowners to support informed decisions about balancing human use of shorelines with the needs of nesting birds of conservation concern and sensitive dune habitats. Promote the use of signage and fencing, the planting of dense vegetation such as beach plum, and construction of permanent pathways over sensitive dunes to encourage access that minimizes habitat damage. In highly sensitive and/or dynamic areas, work with partners and landowners to eliminate dune access, and identify alternative access points.

**Rationale:** Coastal beaches and dunes are located at the mouth of the Connecticut River, where erosion, water movement, and wind current influence the creation of these habitat types. These coastal systems are not a prominent feature within Long Island Sound, however, due to the absence of significant wind and water activity, and the available source of erodible sand. Many of the beaches formed in Long Island Sound are from sand that is deposited in long strips parallel to the shoreline, and often extend across the mouth of rivers (Long Island Sound Study 2003). These coastal habitats are dynamic systems, and are often characterized by vegetation that withstands constant wind and wave action, fluctuating temperatures, and salt spray. Species such as beach plum and American beach grass, have adapted to this harsh environment, but are sensitive to disturbances such as constant foot traffic. Beaches and dunes also provide critical habitat for a diversity of wildlife, including rare, endangered and threatened species. Piping plover, for example, is a federally listed species that nests on non-vegetated beaches in Long Island Sound, including at the mouth of the Connecticut River. These habitats are also important for providing protection to inland areas from coastal storms, dissipating effects from strong winds and tide surges.

Residential development of these areas has created a more static system by impeding the natural movement of sand. This affects species of native wildlife that depend on the more dynamic, natural coastal processes. Development also increases erosion as native beach vegetation is removed, or sometimes a portion of a dune is removed to improve the view for residents. Sensitive beach vegetation can be trampled from the creation of foot paths, or vehicle use. Recreational activities can also disturb wildlife species that are nesting or feeding in these habitats. The presence of nonnative species tends to increase with residential development and recreational activities. Nonnative plants are competing and replacing native beach vegetation and increased predation from domestic pets are impacting nesting wildlife species. Other threats include oil spills, and rising sea levels attributed to climate change.

Protecting and restoring this dynamic ecosystem is critical to maintaining the ecological and economic integrity of Long Island Sound. Coastal beaches and dunes provide vital habitat for rare, endangered and threatened species; many of which have adapted to and require this sometimes harsh and shifting environment. In addition, these coastal systems provide protection to inland habitats from coastal storms, and provide numerous recreational activities. An economic study, commissioned by the LISS, determined that beach recreation in Long Island Sound contributed millions of dollars to the local economy (Long Island Sound Study 2003). The value of these coastal habitats to provide reliable recreational opportunities and shoreline protection to local communities is contingent on the ecological strength and integrity of these ecosystems.

- **Climate Change Adaptation:** Work with partners, willing landowners, and other stakeholders to identify the best coastal non-forested uplands to manage for conservation and natural diversity. Identify corridor and stopover locations that will help connect these lands. Use climate change vulnerability assessments, climate models, and ecological models to prioritize and strategically implement management of coastal beaches and rocky shores that promotes resistance and resilience, or facilitates transition as species' ranges shift over time. Develop and implement adaptation strategies that allow us to achieve our more specific goals within the watershed (e.g., protecting movement corridors, managing beaches and rocky shores to support coastal upland-dependent species, sustain the river estuary ecosystem). Participate in and use outputs from the landscape conservation design modeling effort being led by the North Atlantic LCC, sea level rise models in development by USGS, and other research that can inform the development of adaptation strategies. Work with partners to identify likely changes in climate variables over

50 years, the likely impacts of projected climate changes on the abiotic and biotic components of the watershed's existing coastal non-forested uplands, and the habitat suitability for these ecosystems into the future. Monitor changes to coastal non-forested uplands over time and measure the effectiveness of climate change adaptation measures, using an adaptive management strategy to evaluate decisions when necessary.

**Rationale:** Climate change is increasing the vulnerability of many non-forested coastal uplands to ecosystem changes. Sea level rise is a key driver of vulnerability because it causes coastal geomorphologic change. The immediate effects of sea level rise are the submergence and increased inundation of coastal land and increased salinity in estuaries and coastal rivers. Additional physical effects include increased erosion, changes in geomorphology, and saltwater intrusion in groundwater and into tidal freshwater marsh systems. Sea level rise also will exacerbate flooding events ranging from spring tides to tropical or extratropical storms, and will cause inland penetration of storm surge into areas not accustomed to inundation. These areas will likely experience flooding more often. Increased coastal flooding and inundation may result in release of contaminants from coastal soils, sediments, and infrastructure and increased exposure of fish, wildlife, and plants to these pollutants. While sea level changes have occurred repeatedly in the geologic past, changes of similar magnitude have not occurred since construction of modern human infrastructure along coastal areas, and the accelerated pace of sea level rise in the 20th and 21st centuries raises questions about how coastal ecosystems will respond (NFWPCAP 2014).

Increased storm wind strength due to elevated sea surface temperatures could lead to increases in wave height and storm surge and would be magnified by a higher sea level. The primary impacts associated with more intense storm systems include increased flooding and erosion. More intense storms, coupled with common manmade ecosystem alterations such as shoreline stabilization measures that impede or eliminate long-shore transport could lead certain beaches (and their habitats) to fragment and disappear instead of migrating and rebuilding. Impacts to coastal and estuarine beaches would affect biota such as: microscopic invertebrates that are critical to the food web; horseshoe crabs that rely on beaches for egg deposition; and migratory shorebirds that feed on the eggs, such as the red knot. Shifts in the seasonal distribution of major storm events could also affect plants, wildlife, and fish. For example, an increase in the number or intensity of storms during the spring and early summer could substantially affect breeding success of coastal birds such as the piping plover. More infrequent but intense precipitation events can also lead to scouring of sediment and vegetation during peak flows, redistribution of sediment, resuspension of contaminated sediments, as well as increased pollutants from events such as combined sewer overflows (NFWPCAP 2014).

The ability of refuge managers to adapt to future climate change will be enhanced by their capacity to alter management regimes relatively rapidly in the face of changing conditions. The lack of fine-scale information about the possible effects of climate changes on locally managed coastal non-forested uplands limits the ability of managers to weigh these risks to their forests against the economic risks of implementing adaptation and/or mitigation treatments. This knowledge gap will impede the implementation of effective management on public or private beaches or rocky shores in the face of climate change (Joyce et al. 2014).

Please see Rationale for guideline "Climate Change Adaptation" under Objective 1.1.

Salt marsh



© Chuek Fullmer

**Objective 1.5: Coastal Wetlands and Aquatic Habitats (Tidal Salt Marsh and Estuary)**

In cooperation with willing landowners and other partners, protect, manage, and restore coastal wetlands and other coastal aquatic habitats within the Connecticut River watershed. These coastal aquatic habitats will sustain the biological diversity, ecological integrity, and hydrologic function of the river ecosystem, provide habitat connections and wildlife travel corridors, accommodate anticipated shifts in species' ranges from climate and land use changes, and support coastal wetland-dependent species of conservation concern including inter-jurisdictional fish, native aquatic species, waterfowl and wading birds and Federally listed endangered and threatened species.

Our guidelines and strategies for working cooperatively with others to help meet the objective and facilitate the protection, management, and restoration of coastal wetlands and aquatic habitats throughout the watershed, with priority attention to CPAs, include the following:

- **Habitat Restoration:** Work with partners and willing landowners to support the LISS HRI goals and objectives to (1) restore the ecological functions of degraded and lost habitats, (2) restore at least 2,000 acres of coastal habitats and 100 miles of riverine migratory corridor habitat, and (3) use partnerships to accomplish restoration objectives so as to leverage financial resources from multiple public sources. Work with partners to restore salt and brackish marshes by remediating drainage ditches; remove water control structures such as tide gates to restore natural tidal flows; and control invasive species populations like common reed (*Phragmites*) to improve species diversity and habitat function.

**Rationale:** Please see Rationale for guideline “Habitat Restoration” under Objective 1.4.

- **Population Assessments:** Work with partners, State natural resource agencies and willing landowners to conduct short and long-term monitoring programs for migratory and inter-jurisdictional fish, mussels, and other native aquatic species of conservation concern.

**Rationale:** Please see Rationale for guideline “Population Assessments” under Objective 1.3.

- **Climate Change Adaptation:** Work with partners, willing landowners and other stakeholders to identify the best coastal wetlands and aquatic habitats to manage for conservation and natural diversity. Identify corridor and stopover locations that will help connect these areas. Use climate change vulnerability assessments, climate models, and ecological models to prioritize and strategically implement management of tidal salt marshes and estuaries that promotes resistance and resilience, or facilitates transition as species’ ranges shift over time. Develop and implement adaptation strategies that allow us to achieve our more specific goals within the watershed (e.g., protecting movement corridors, managing tidal salt marshes and estuaries to support coastal upland-dependent species, sustain habitat for waterfowl and wading birds).

Work with partners to develop and use coastal system models in the watershed that would advance our understanding of existing impacts (e.g., stormwater and contaminants runoff) and projected future impacts (e.g., climate change, sea level rise, and marsh migration) and support local decisions on land use. For example, develop a model to characterize the role of storm water and other sources of contaminants runoff in degrading coastal habitats and help identify where best to locate sediment control structures to prevent further deposition, or use the Sea Level Affecting Marshes Model (SLAMM), a web browser-based application that visually shows the modeling of sea level rise predictions, and other analyses to predict where inland migration of tidal marsh and other tidally influenced habitats may occur. Implement habitat protection and management in accordance to the recommendations of such modelling. Participate in and use outputs from the landscape conservation design modeling effort being led by the North Atlantic LCC, sea level rise models in development by USGS, and other research that can inform the development of adaptation strategies.

Work with partners to identify likely changes in climate variables over 50 years, the likely impacts of projected climate changes on the abiotic and biotic components of the watershed’s existing coastal wetlands and aquatic habitats, and the habitat suitability for these ecosystems into the future. Monitor changes to coastal wetlands and aquatic habitats over time and measure the effectiveness of climate change adaptation measures, using an adaptive management strategy to evaluate decisions when necessary.

**Rationale:** Climate change is increasing the vulnerability of many coastal wetlands and aquatic habitats to ecosystem changes. Sea level rise is a key driver of vulnerability because it causes coastal geomorphologic change. The Connecticut River watershed is tidally influenced from Long Island Sound to Hartford, Connecticut. In general, the immediate effects of sea level rise are the submergence and increased inundation of coastal land and increased salinity in estuaries and coastal rivers. Additional physical effects include increased erosion, changes in geomorphology, and saltwater intrusion in groundwater and into tidal freshwater marsh systems. Sea level rise also will exacerbate flooding events ranging from spring tides to tropical or extratropical storms, and will cause inland penetration of storm surge into areas not accustomed to inundation. These areas will likely experience flooding more often. Increased coastal flooding and inundation may result in release of contaminants from coastal soils, sediments, and infrastructure and increased exposure of fish, wildlife, and plants to these pollutants.



Steve Hillebrand

Great blue heron



While sea level changes have occurred repeatedly in the geologic past, changes of similar magnitude have not occurred since construction of modern human infrastructure along coastal areas, and the accelerated pace of sea level rise in the 20<sup>th</sup> and 21<sup>st</sup> centuries raises questions about how coastal ecosystems will respond. To preserve the current acreage of tidal wetlands, either wetlands need to keep pace with sea level rise or migrate inland to adjacent lands that are undeveloped. The success of wetland migration depends on the availability and slope of an upland corridor, the pace of the sea level rise, erosion rates, and the potential for wetland accretion. Because the Connecticut River is free-flowing from Long Island Sound to Holyoke, Massachusetts, there is an opportunity for the landward migration of tidally influenced coastal wetlands (e.g., salt, brackish, and freshwater wetlands) as sea levels rise.

Other important factors that affect wetland response to sea level rise are salinity, sediment dynamics, nutrient input, and the habitats and species present. In populated coastal areas, wetland migration is often constrained by land development and shoreline stabilization measures. These conditions can result in the crowding of foraging and bank-nesting birds and the loss of crucial coastal habitat. In addition, the degradation and loss of tidal marshes affect estuarine habitat, production of commercially important fish and shellfish species, and flood attenuation, key ecosystem services for coastal communities. Sea level rise may also result in the inland movement of seawater, shifting the tidal influence zone of streams and rivers upstream and permanently inundating downstream riparian/coastal portions with brackish water. Salinity increases in formerly fresh or brackish surface waters and saltwater intrusion of shallow coastal groundwater aquifers will also result from sea level rise. This may threaten systems such as tidal freshwater forested wetlands that support a variety of wildlife species and critical drinking water sources (NFWPCAP 2014). Research is currently underway by The Nature Conservancy<sup>1</sup> and the USGS<sup>2</sup> to evaluate how sea level rise is likely to affect this watershed. This and other decision support tools can assist refuge managers in making decisions on how to best address climate change impacts in their geographic area.

Changes in precipitation will primarily impact coastal systems through changes in quantity, timing, intensity, and quality of freshwater flow into estuarine systems. The quantity of freshwater will affect salinity gradients and nutrient inputs, while changes in peak flow timing could affect phenology and migration cues. Changes in the timing and amount of freshwater, nutrient, and sediment delivery will also impact estuarine productivity. For example, changes in flow regimes may affect the abundance and distribution of suspension feeders, such as mussels, clams, and oysters, which could in turn alter food web dynamics as well as water clarity. Increases in flow, turbidity, and eutrophication could also impact submerged aquatic vegetation due to reduced light penetration, as well as organisms that rely on this habitat for food and shelter. These impacts of precipitation changes in estuaries will likely be exacerbated by non-climate stressors such as freshwater demand and extraction, eutrophication, and hypoxia (NFWPCAP 2014).

Increased storm wind strength due to elevated sea surface temperatures could lead to increases in wave height and storm surge and would be magnified by

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<sup>1</sup> See [www.coastalresilience.org](http://www.coastalresilience.org) for project updates.

<sup>2</sup> See [http://woodshole.er.usgs.gov/project-pages/coastal\\_response/](http://woodshole.er.usgs.gov/project-pages/coastal_response/) for updates on the USGS project, Coastal Landscape Response to Sea-Level Rise Assessment for the Northeastern United States.

a higher sea level. The primary impacts associated with more intense storm systems include increased flooding and erosion. More intense storms, coupled with common manmade ecosystem alterations such as shoreline stabilization measures that impede or eliminate long-shore transport could lead some salt marshes to fragment and disappear instead of migrating and rebuilding. Shifts in the seasonal distribution of major storm events could also affect plants, wildlife, and fish. More infrequent but intense precipitation events can also lead to scouring of sediment and vegetation during peak flows, redistribution of sediment, resuspension of contaminated sediments, as well as increased pollutants from events such as combined sewer overflows (NFWPCAP 2014).

The gradual temperature increase due to climate change is correlated with increasing nearshore water temperatures. While coastal salt marshes and forested wetlands could experience increased growth due to warmer temperatures, they could also cause expansion of invasive species and disease pathogens. In estuarine environments, increased water temperature will affect water column stratification and eutrophication; and could cause range shifts. Extreme changes may also stress organisms to the point of mortality. In addition, warmer temperatures will exacerbate low summer oxygen levels due to increased oxygen demand and decreased oxygen solubility (NFWPCAP 2014).

The ability of refuge managers to adapt to future climate change will be enhanced by their capacity to alter management regimes relatively rapidly in the face of changing conditions. The lack of fine-scale information about the possible effects of climate changes on locally managed coastal non-forested uplands limits the ability of managers to weigh these risks to their forests against the economic risks of implementing adaptation and/or mitigation treatments. This knowledge gap will impede the implementation of effective management on public or private beaches or rocky shores in the face of climate change (Joyce et al. 2014).

Please see Rationale for guideline “Climate Change Adaptation” under Objective 1.1.

## GOAL 2

**Education, Interpretation, and Outreach. Inspire residents and visitors to actively participate in the conservation and stewardship of the exceptional natural and cultural resources in the Connecticut River watershed, and promote a greater understanding and appreciation of the role of the Silvio O. Conte National Fish and Wildlife Refuge in conserving those resources.**



M. Poole

*Fishing education*

**Background:** Our emphasis is to expand the education, interpretation, and outreach initiatives currently underway. Emphasis will be added to continuing existing educational programs within all four States on a community by community basis, but especially making refuge programs more relevant to urban communities through the Refuge System’s Urban Initiative. Several refuge programs that will continue include the WoW Express, Adopt-a-Habitat program, the BAT, and Conte Corners. The BAT trailer will become fully operational soon and the WOW Express, Conte Corners, and the Adopt-a-Habitat programs will all be expanded to support our education, outreach, and interpretation goals and objectives. We will make refuge environmental education assets, strategies, and curriculum available on a community basis by visiting schools, fairs, summer camps, and special events.

We will also continue our beneficial relationship in partner-owned visitor facilities including the Great Falls Discovery Center, the Great Northwoods Center, and the Montshire Museum of Science. We will also continue existing partnerships with organizations such as Vermont Institute of Natural Science, Springfield Museums, and Connecticut River Museum, and develop new

partnerships as appropriate. We will augment these efforts subject to the availability of funds, and by the establishment of a Partners position and/or by a reinvigorated Challenge Cost Share program, and by working with partners to pursue indoor and outdoor environmental education curriculum development that will meet respective State education standards.

The expanded and well-distributed land base will increase opportunities for, and connections with, more communities and their residents. Implementing the Refuge System's Urban Initiative will be a major focus, as will maintaining our existing relationships with partner-owned environmental education and interpretive facilities, and expanding such efforts to new partners

**Objective 2.1: Environmental Education**

In collaboration with public and private educators from all four States in the watershed, lead or facilitate the implementation of structured, high quality, natural and cultural resource curricula. The focus will be on guiding educators and students to: develop an awareness of, and concern about, natural and cultural resources and associated challenges; appreciate our conservation history; make informed decisions and work individually or collectively toward solutions; and model responsible environmental stewardship in their everyday lives.

Our guidelines and strategies for working cooperatively with others to help meet the objective and facilitate high quality environmental education programming throughout the watershed, with priority attention to activities within CPAs and urban areas, include the following (also see "Urban Wildlife Refuge Partnerships" discussion under General Refuge Management Direction):

- **Environmental Education Planning and Training:** Work with all four watershed State fish and wildlife agency environmental education coordinators, non-profit organizations, and private educational organizations to facilitate and develop high quality, model environmental education curricula, as well as develop highly trained environmental educators to conduct environmental education. Curricula will:
  - \* Take into account student and teacher needs.
  - \* Incorporate each state's education standards, national learning standards, and next generation learning standards.
  - \* Incorporate nationally recognized education initiatives, when appropriate.
  - \* Be designed with specific goals and objectives.
  - \* Promote refuge missions.
  - \* Promote refuge and partner-conserved lands and facilities as environmental education resources.

We will also work with our partners to improve coordination among educators through the following actions:

- \* Host an annual meeting with the four States fish and wildlife agency environmental educators to share respective program priorities and look for opportunities to share resources.
- \* Coordinate with existing State and national environmental education programs.

- \* Seek ways to support each States outdoor education program and events.
- \* Develop and implement high quality professional development for educators, to promote the training of refuge staff and volunteers in the knowledge, skills, and abilities of environmental education.
- \* Use our volunteers, including Friends members, to enhance environmental education opportunities.
- \* Identify and engage a diversity of audiences, with an emphasis on urban and non-traditional audiences, but not excluding others within the watershed.

**Rationale:** See rationale for entire objective below.

■ **Environmental Education Delivery:** In collaboration with all four watershed states, other government agencies, non-profit organizations, private educational organizations, staff, volunteers, and members of Friends groups, offer high quality environmental education programs at existing refuge lands and facilities, at partner lands and facilities, and at schools within the watershed. The refuge will seek to:

- \* Use the WoW Express and the BAT to deliver high quality, environmental education at schools and at environmental-based camps within the watershed.
- \* Formally partner with local schools within the watershed and to conduct environmental education to these audiences multiple times per year.
- \* Promote partner lands as outdoor classrooms, and to help deliver priority educational programs.
- \* Facilitate the use of refuge and partner lands by educator-led classes, by teachers, and by students.
- \* Implement an Adopt-a-Habitat initiative and a traveling mobile environmental education classroom to help individuals learn about and connect with their local environments.
- \* Develop an evaluation system to measure the effectiveness of environmental education programs.
- \* Continue cooperative relationship with the State of Massachusetts at the Great Falls Discovery Center in Turners Falls, Massachusetts (See appendix A for more detailed information on our environmental education, interpretation, and outreach objectives and strategies at this facility).

**Rationale:** The Conte Refuge shares its jurisdictional boundaries of the 7.2 million acre Connecticut River watershed with over 2.3 million individuals from urban, suburban, and rural areas. These residents make up a diverse demographic with varying attitudes and interests. Environmental education is a key tool that the refuge can use to reach out to, to partner with, and to share important messages with these residents about wildlife conservation and watershed concerns, and to inspire them to become stewards of their communities; consequently, the Connecticut River watershed. Given ever changing environmental concerns, it will be important to work with partners to develop quality environmental education experiences and to offer different tools and experiences that meet the needs of, and engage various audiences.

The importance of environmental education was recognized by the Refuge System when it was identified as one of the six priority public uses legislatively mandated in the 1997 Refuge Improvement Act and further detailed in Refuge System Policy (605 FWS 6). Further, environmental education was identified as an important strategy for the refuge when it was identified within one of the six legislative purposes guiding the establishment of the refuge (1995 FEIS).

The North American Association for Environmental Education states that “environmentally literate” persons know:

- Their daily choices affect the environment.
- How those choices can help or harm the environment.
- What they need to do—individually or as part of a community—to keep the environment healthy and sustain its resources, so that people can enjoy a good quality of life for themselves and their children (<https://naaee.org/about-us/about-ee-and-why-it-matters>; accessed August 2016.)

Through environmental education, interpretation, and outreach, we are striving to help individuals throughout the watershed become environmentally literate, to develop a sense of connection with the environment, and to build a sense of stewardship toward the environment. Our intent is not to direct environmental education priorities or be redundant with the high-quality educational programs offered by the States and non-governmental organizations; rather, we are striving to support those programs, and share new models, or recommend other improvements and efficiencies, as we discover them.

## Objective 2.2: Interpretation

Develop, lead, and facilitate interpretive programs that emotionally and intellectually connect the audience to natural and cultural resources in the watershed.

Our guidelines and strategies for working cooperatively with others to help meet the objective and facilitate high quality natural and cultural resource interpretation, with priority attention to activities within CPAs and urban areas, include the following:

- **Natural and Cultural Resource Interpretive Planning and Training:** Collaborate with partners to develop high quality interpretive programming, facilities, and other media on and off refuge lands within the watershed that identify and relate natural history and refuge management strategies of the watershed’s natural systems. The information will forge emotional and intellectual connections between the interests of the audiences and the habitats and wildlife that exist, and will instill stewardship values. The refuge will also work to develop relationships with constituent cultural groups such as Tribes and historical societies to create programming on cultural and historic resources on the refuge and in surrounding communities. The development of highly trained interpreters will be encouraged by offering interpretive training to permanent and temporary refuge employees, as well as Friends members, partners, and volunteers on a regular basis. A system of monitoring and evaluation will be developed to test interpretive tools for effectiveness.

**Rationale:** See rationale for entire objective below.

- **Interpretive Program Delivery:** Collaborate with partners to deliver high quality interpretive experiences within the Connecticut River watershed. With partners the refuge will strive to:



USFWS

Barred owl at festival

- \* Provide interpretive opportunities throughout the watershed, on and off refuge lands.
- \* Establish partnerships at interpretive facilities (see goal 4 for existing partnerships).
- \* Use the WoW Express to deliver interpretive programs throughout the watershed.
- \* Create interpretive messages to be included in region-wide media.
- \* Incorporate thematic messages into partners' interpretive programming and other interpretive media.
- \* Provide programming, signs, publications, and digital media when consistent with public use and management strategies.
- \* Train refuge staff, Friends, and other volunteers to initiate discussions with visitors and deliver interpretive messages and programs.
- \* Work with local commercial vendors to offer on-refuge interpretive programs. Vendors will operate under a special use permit and may be charged a fee.

**Rationale:** The National Association of Interpretation states that interpretation is a mission-based communication process that forges emotional and intellectual connections between the interests of the audience and the meanings inherent in the resource ([http://www.interpnet.com/nai/About/What\\_We\\_Believe/nai/About/Mission\\_Vision\\_and\\_Core\\_Values.aspx?hkey=ef5896dc-53e4-4dbb-929e-96d45bdb1cc1](http://www.interpnet.com/nai/About/What_We_Believe/nai/About/Mission_Vision_and_Core_Values.aspx?hkey=ef5896dc-53e4-4dbb-929e-96d45bdb1cc1); accessed August 2016). Interpretation is a communication tool used by Federal and State agencies, non-governmental organizations, and the private sector to encourage the public to become better stewards of the environment. Well designed and well communicated interpretive messages have the opportunity to educate individuals, including the 2.3 million residents of the Connecticut River watershed about: watershed concerns; the habitats and wildlife that share the watershed; the refuge, and human connections to the watershed and the environment. Ideally, quality interpretive experiences will take into account the needs of the audience, have relevance to people's lives, and inspire individuals to take an active role in the stewardship of the Connecticut River watershed; and, consequently, the refuge.

The importance of interpretation was recognized by the Refuge System when it was identified as one of the six priority public uses in the 1997 Refuge Improvement Act. The importance of quality interpretation was further recognized by Refuge System Policy (605 FW 7) that addresses interpretation as a management tool with the following direction: "Well-designed interpretive programs can be effective resource management tools. For many visitors, taking part in an interpretive program may be their primary contact with a refuge, the Refuge System, and the Service. It is their chance to find out about refuge resource management objectives and could be their first contact with conservation and wildlife. Through these contacts, we have the opportunity to educate visitors about natural resources, refuges, the Refuge System, and the Service and to influence visitor behavior when visiting units of the Refuge System.

**Objective 2.3: Public and Community Outreach**

Support, promote, and coordinate a wide range of outreach tools and activities to facilitate and improve communications and relationships with the American

*Nulhegan  
Basin Division  
wildlife festival*



public and to articulate the importance of local conserved lands, including the refuge, to the watershed. Target audiences include: community members, adjacent landowners, and elected officials in the Connecticut River watershed. Citizens will be empowered to recognize and resolve local natural resource issues and promote conservation and the responsible use of natural resources.

Our guidelines and strategies for working cooperatively with others to help meet the objective and conduct effective public and community outreach, with priority attention to activities within CPAs and urban areas, include the following:

- **Local Community Residents and Officials:** Through effective outreach to local community residents and officials, refuge staff will:
  - \* Work directly with respective Chambers of Commerce, Rotary Clubs, and other civic and non-profit organizations.
  - \* Keep landowners informed of land management activities on the refuge that may affect neighboring properties through personal contacts, direct mailings appearing on cable TV, writing articles for local newspapers and press releases.
  - \* Inform and educate community members on refuge regulations and management practices to prevent miscommunication and/or conflict between the refuge and its neighbors. Tools could include newsletters, media, and public meetings.
  - \* Disseminate economic benefit information of the refuge to the local community.
  - \* Support and participate in community celebrations and events.
  - \* Develop and publicize locally focused events and programs held at the refuge.

- \* Support outreach activities of all refuge Friends groups, community groups, and partners.
- \* Develop and implement an outreach plan for communicating with landowners to inform and educate them on their role within the watershed and how they can contribute. Plan will include tools and strategies. Possible tools will include landowner workshops, behind the scene tours, special open houses, and publications oriented toward them specifically.
- \* Write issue-driven outreach plans to keep elected officials informed of refuge and partner accomplishments and of issues within the watershed that have possible impacts to the refuge.
- \* Pro-actively schedule consistent meetings with elected officials to share and update each other on constituent concerns and opportunities.
- \* Develop messages and actions that frame refuge units as an asset to the local community. Example benefits that the refuge provides the community include: environmental education and interpretation programming, special events hosted for the community, employment for local youth through YCC, and mutual aid agreements..
- \* Learn how to coordinate effectively with partners to spread the Conte message to their membership (e.g., Audubon, TNC, Trust for Public Land).
- \* Develop at least 10 Conte Corners well-distributed in the watershed with at least two in each state.
- \* Create special programming that will draw local residents and media (e.g., participating in community events and festivals).
- \* Implement an Adopt-a-Habitat program to be used in part as an outreach tool for schools and community residents to learn about and become stewards of their local environment.
- \* Institute regular meetings with community leaders and citizens with the goal of making the refuge more relevant to host communities. These could take the form of an annual meeting in which we present our management plans for the coming year, open houses to welcome the public to see new exhibits or learn about new refuge initiatives, and listening sessions for us to receive community feedback about operations at each of the refuge's divisions.

**Rationale:** See rationale for entire objective below.

- **National and State Elected Officials:** Through effective outreach to relevant elected officials, refuge staff will meet regularly with local political leaders and officials to inform them of management practices occurring in their districts. Meetings will highlight potential areas of interest, conflict, and other topics of mutual interest.

**Rationale:** See rationale for entire objective below.

- **Media:** Through effective outreach to media, refuge staff will:
  - \* Develop a media outreach plan with consistent refuge messages.



- \* Communicate often with media outlet representatives to highlight important watershed and refuge specific issues, concerns and opportunities.
- \* Develop relationships with media representatives by inviting and hosting reporters at refuge sites on a regular basis. This will assure that correct messages and information appear in media throughout the watershed.

**Rationale:** See rationale for entire objective below.

- **Greater Watershed Community:** Through effective outreach to the greater watershed community, in an effort to articulate the importance of conserved lands, including the refuge, to the watershed, refuge staff will:
  - \* Attract visitors on a regional, national and international scale by linking the refuge and the watershed to regional tourism, birding and recreational programs.
  - \* Encourage citizen participation in activities throughout the watershed.
  - \* Maintain a well-written and informative web site that provides current information on refuge programs and resources.
  - \* Create displays promoting the refuge for placement at major regional points of entry such as airports.
  - \* Use the refuge's mobile exhibits to participate at regional environmentally and recreationally themed shows, conferences and special events.
  - \* Offer the WoW Express exhibits and an interpreter to partners when feasible. Also, establish partnerships across the watershed to jointly deliver WoW Express interpretive programs.
  - \* In cooperation with partners, seek to interpret messages with the expansion of the Connecticut River Birding Trail to a Source-to-Sea birding trail.
  - \* Work with non-traditional venues (e.g., airports, shopping malls, etc.) to install interpretive media appropriate for general audiences.

**Rationale:** The refuge is unique with its jurisdictional boundaries encompassing the entire watershed. The more than 2.3 million residents of the Connecticut River watershed live in urban, suburban, and rural areas, and comprise a diverse demographic with varying attitudes and interests. When Congressman Silvio O. Conte proposed the creation of the Conte Refuge, he stated his desire was to "...restore and maintain a swimmable, boatable, and fishable Connecticut River for his children and his children's children." This dream is still a primary guiding factor for management at the refuge; yet, the full dream can only be realized through the cooperation and combined effort of watershed residents, Federal, State, and local agencies, non-profit organizations, and other community organizations. Strategic, quality outreach targeted at specific audiences is vital to communicate with individuals about watershed and refuge concerns, to work toward a shared vision for the watershed and to gain support for refuge activities.

Facilitate the collection and exchange of information that increases the knowledge and understanding of natural and cultural resources, addresses climate and land use changes and other conservation issues, and provides land managers with better information to make management decisions affecting resources.

Our guidelines and strategies for working cooperatively with others to help meet the objective and support effective scientific and technical outreach, with priority attention to activities within CPAs, include the following:

- **Institutes of Higher Learning:** Collaborate with institutes of higher learning to share knowledge, resources, and research. The refuge will seek to:
  - \* Develop relationships with institutions of higher learning and other partners conducting relevant conservation research.
  - \* Keep current on knowledge and experience generated by managers throughout the refuge system, particularly from refuges that are managed primarily for the same trust species as are managed by the Conte Refuge.
  - \* Promote the SHC framework. Monitor on-the-ground impacts of management practices and amend those practices as necessary.
  - \* Develop and maintain strong relationships with regional institutions of higher education, and encourage use of refuge lands for environmental research. Take advantage of partners' scientific based resources and engage partner input in the preparation of SHC plans and other resource protection activities.

**Rationale:** See rationale for entire objective below.

- **Technology and Information Exchange:** Collaborate with technical experts within governmental agencies, conservation organizations, academia, and individuals to facilitate the sharing of knowledge, resources, and research. The refuge will seek to:
  - \* Host workshops and seminars at rotating strategic locations throughout the Northeast on an annual basis to bring together experts for information and technology transfer on important topics.

*White-tailed  
deer*



Steve Hillebrand/USFWS

- \* Participate in professional conferences within the watershed to present information and experience on adaptive management practices to counter the effects on wildlife and habitat of climate change and other environmental challenges.
- \* If demonstration areas are created on the refuge, ensure lessons learned are shared. Ensure that the refuge outreach materials convey the most current scientific and technical knowledge.
- \* Work with the NALCC to share scientific information and tools (e.g., spatial data, technical papers, webinars, etc.) with interested landowners, municipalities, organizations, and agencies.
- \* Assure that technical experts are aware of the refuge's willingness to use refuge lands for research, inventorying and monitoring of natural occurrences, and management effects.

**Rationale:** See rationale for entire objective below.

- **Mentoring Students:** Collaborate with institutes of higher learning to mentor individuals hoping to enter a natural resource related field. The refuge will:
  - \* Seek opportunities to work with students at all levels on a regular basis. Examples include student chapters of professional societies, such as The Wildlife Society and the American Fisheries Society.
  - \* Participate in working with students through other professional associations like the National Association of Interpretation and The National Association of Environmental Educators.

**Rationale:** One of the six legislative purposes guiding the establishment of the refuge is “to provide opportunities for scientific research, environmental education, and fish and wildlife-oriented recreation and access to the extent compatible with other purposes...” Conte Refuge is situated in the “Five College” area of western Massachusetts and is surrounded by approximately 45 universities and colleges in the New England States. The number of nearby local colleges, as well as the abundance of natural and cultural resources in the watershed makes the refuge a key resource for students looking to conduct research projects relating to conservation, wildlife management, resource protection, and human dimensions. Similarly, student research will benefit the refuge by answering management questions, and helping to guide management strategies.

### GOAL 3

**Recreation. Promote high quality, public recreational opportunities in the Connecticut River watershed that are complementary between ownerships and provide regional linkages, with emphasis on promoting wildlife-dependent activities that connect people with nature in the outdoors.**

**Background:** We will continue to provide recreational access opportunities at all refuge divisions, which represents a much larger land base than under current management. We will provide a level of development at each refuge division (e.g. contact facility, parking area, trails, kiosk, interpretation, education facilities or stations, etc.) commensurate with the level of use we anticipate and can accommodate, which will represent an overall increase. We will increase our commitment to provide access to refuge lands for people of all abilities to engage in compatible recreational uses. Providing public access to the Connecticut River for responsible use and enjoyment will be a priority. Table 4.6 summarizes objectives for priority public uses and other recreational activities that will be offered. The maps (maps 4.41 to 4.49) at the end of the chapter depict the

proposed public use on Pondicherry and Nulhegan Basin Divisions, the two largest existing refuge divisions. There are additional public use maps for other divisions included in appendix A.

### **Objective 3.1: Hunting**

Support quality public hunting opportunities in the Connecticut River watershed in cooperation with willing landowners to promote a unique understanding and appreciation of natural resources and their management, including the role of the Service and other public lands in resource conservation, while also protecting a traditional outdoor pastime deeply rooted in America's natural and cultural heritage and conservation history.

Our guidelines and strategies for working cooperatively with others to facilitate quality hunting opportunities throughout the Connecticut River watershed, with priority attention to CPAs, include the following:

- **Hunting Opportunities, Access, and Infrastructure:** Work with partners and willing landowners to facilitate quality hunting opportunities across ownerships and promote and support investments in hunter access and infrastructure. Quality hunting opportunities will promote resource stewardship, safety, and responsible behavior, and minimize conflicts with other recreationists and neighboring landowners. We will emphasize hunting opportunities that are accessible to a wide array of the American public and provide a reasonable opportunity to experience wildlife.

We will seek out and promote programs, often in partnership with state fish and wildlife agencies, that encourage diverse opportunities, especially among urban residents, women, and youth. We will consider infrastructure to support the needs of disabled individuals on refuge lands, as well as, the establishment of parking areas and pullouts, and we will maintain formal (i.e., signed and mapped as part of a network) and informal access trails. Through our involvement in the establishment of Connecticut River access sites, we will work to see that consideration is given to waterfowl hunters.

**Rationale:** See rationale for entire objective below.

- **Hunter Education and Outreach:** Work with partners to promote a knowledgeable hunting public and increase interest in this traditional pastime through support of hunter training, education, and demonstration programs. State fish and wildlife agencies will be among our important partners in accomplishing this work. We will also work with fish and game clubs and individuals interested in providing hunting/outdoorsman-type learning experiences to the general public, both through our staff's participation in training seminars, as well as, hosting such events at our refuge facilities. We will also collaborate with the respective States to promote the use of nontoxic (e.g., lead-free) ammunition to reduce impacts to fish and wildlife. We will also provide refuge visitors with general information on the hunting program and refuge-specific and State regulations through the refuge website, information signs, and hunting brochures. In all materials related to the hunting program, promote and encourage the use of lead-free ammunition. We will also identify the impacts associated with requiring the use of non-toxic ammunition for hunting on refuge lands.

**Rationale:** We recognize hunting as a healthy, traditional outdoor pastime, deeply rooted in our American heritage and we will support this activity where it can safely occur on refuge lands and by permission of private landowners. Hunting is one of the six priority wildlife-dependent public uses of the Refuge System as established in the 1997 Refuge Improvement Act. In addition, Presidential Executive Order #113443-Hunting Heritage, "...directs Federal

agencies to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat.” Service policy (601 FW 7) establishes procedures for working with state fish and wildlife agency representatives to implement hunting and other programs of interest to both agencies on refuge units. Generally, the guidance is to implement hunt programs that are consistent with respective State hunting regulations. The Refuge System maintains a website with additional information on hunting on refuges, including refuge-specific regulations ([http://www.fws.gov/refuges/hunting/featured\\_articles.cfm?heid=12](http://www.fws.gov/refuges/hunting/featured_articles.cfm?heid=12); accessed August 2016)

Hunting opportunities on the refuge can provide wildlife-dependent recreational opportunities which help accomplish population management objectives while promoting visitors’ understanding and appreciation for wildlife and their habitats. Prior to allowing hunting on refuge lands, we must determine that the use is compatible. This determination considers public safety and impacts among user groups. The compatibility determination also ensures that refuge hunting programs are biologically sound and support healthy wildlife population levels. Where found compatible, we will complete all administrative requirements to formally open refuge lands to hunting. Please see appendix D for our compatibility determinations for hunting.

Opportunities for hunting have been in decline due to land use and ownership changes, with more southerly areas in the Connecticut River watershed incurring greater development and northerly areas increasingly posted against hunting. In the face of these declining opportunities, national wildlife refuges can provide important public hunting opportunities and contribute to continuation of a traditional use. On the refuge, hunting is a well-established and valued public use on several divisions. Some of these areas were hunted for decades prior to refuge establishment and visitors continue to come from all over the Northeast to hunt refuge lands.

We will continue to work with the states and our partners to educate and inform hunters about the impacts to fish, wildlife, habitats, and human health associated with the use of lead ammunition. For example, we will continue to distribute materials providing hunters with information on those impacts on fish and wildlife; encourage visitors to use cost-effective, lead-free ammunition; and, describe actions that can be taken to protect wildlife from contamination when lead ammunition are used. In addition, we will work with the States to identify the impacts associated with requiring the use of non-toxic ammunition for hunting on refuge lands. This will include identifying, quantifying, and evaluating the impacts of lead exposure to wildlife on refuge lands, as well as considering the impacts of lead restrictions on hunters. Any proposed actions or changes to the status quo will be vetted in a public forum, consistent with NEPA and specific to the refuge opening package and the other Service administrative and legislated requirements.

We will continue to work closely with respective state fish and wildlife agencies to ensure the provision of quality public programs, including hunting. The Service defines quality public use as programs that (605 FW 6, 1.6):

- Promotes safety of participants, other visitors, and facilities.
- Promotes compliance with applicable laws and regulations and responsible behavior.
- Minimizes or eliminates conflict with fish and wildlife population or habitat goals or objectives in an approved plan.

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

### Objective 3.2: Fishing

Support quality public fishing opportunities in the Connecticut River watershed in cooperation with willing landowners to promote an understanding and appreciation of natural resources and their management, including the role of the Service and other public lands in resource conservation, while also protecting a traditional outdoor pastime deeply rooted in America's natural heritage and conservation history.

Our guidelines and strategies for working cooperatively with others to facilitate quality fishing opportunities throughout the Connecticut River watershed, with priority attention to CPAs, include the following:

- **Fishing Opportunities, Access, and Infrastructure:** Work with partners and willing landowners to facilitate quality fishing opportunities across ownerships and promote and support investments in fishing access and infrastructure. Quality fishing opportunities will promote resource stewardship, safety, and responsible behavior, and minimize conflicts with other recreationists and neighboring landowners. We will emphasize fishing opportunities that are accessible to a wide array of the American public and provide a reasonable opportunity to experience wildlife. We will seek out and promote programs, often in partnership with state fish and wildlife agencies, that encourage diverse opportunities, especially among urban residents, women, and youth. We will consider infrastructure to support the needs of disabled individuals on refuge lands, as well as, the establishment of parking areas and pullouts, and we will maintain formal (i.e., signed and mapped as part of a network) and informal access trails. Through our involvement in the establishment of Connecticut River access sites, we will work to see that consideration is given to anglers.

**Rationale:** See rationale for entire objective below.

- **Angler Education and Outreach:** Work with partners to promote a knowledgeable fishing public and increase interest in this traditional pastime through support of angler training, education, and demonstration programs. State fish and wildlife agencies will be among our most important partners in accomplishing this work, both through demonstration programs and in the development of outreach materials. We will also work with fish and game clubs and individuals interested in providing angling/outdoorsman-type learning experiences to the general public, both through our staff's participation in training seminars, as well as, hosting such events at our refuge facilities. We

will also collaborate with the respective States to promote nontoxic (lead-free) tackle and reduce impacts to fish and wildlife.

**Rationale:** We provide the Refuge System definition of a “quality” recreational program under our rationale for hunting.

Similar to hunting, we recognize fishing as a healthy, traditional outdoor pastime, deeply rooted in our American heritage and support this activity where it can safely occur on refuge lands and other lands when permitted by landowners. Fishing is also viewed as an initial means of engaging and connecting people, particularly children, in outdoor pursuits. Access to fishing is often a challenge due to private ownerships; thus we actively promote public opportunities for this recreational activity on refuge lands. Fishing is one of the six priority wildlife-dependent public uses of the Refuge System as outlined in the 1997 Refuge Improvement Act. The Refuge System maintains a Web site with additional information on fishing on refuges, including refuge-specific regulations (<http://www.fws.gov/refuges/fishingguide/>; accessed August 2016).

Opportunities for fishing have been in decline due to lack of access and competition for space with other recreational uses. Because of this, allowing fishing on the refuge can provide and protect important opportunities. Fishing is a well-established and valued public use on several refuge divisions. Fishing occurred in some of these areas for decades prior to refuge establishment, some of which are especially prized for trout fishing.

Fishing opportunities on the refuge can provide wildlife-dependent recreational opportunities which help accomplish population management objectives while promoting visitors’ understanding and appreciation for wildlife and their habitats. Prior to allowing fishing on refuge lands, we must determine that the use is compatible. This determination considers public safety and impacts among user groups. The compatibility determination also ensures that refuge fishing programs are biologically sound and support healthy wildlife population levels. Where found compatible, we will complete all administrative requirements to formally open refuge lands to fishing. Please see appendix D for our compatibility determinations for fishing.

We will continue to work with the states and our partners to educate and inform anglers about the impacts to fish, wildlife, habitats, and human health associated with the use of lead tackle (See also “General Refuge Management Direction: Hunting and Fishing” below).

We will continue to work closely with respective state fish and wildlife agencies to ensure the provision of quality public fishing opportunities.

**Objective 3.3: Wildlife Observation and Photography**

Support quality, public opportunities to observe and photograph wildlife in a variety of natural habitats in the Connecticut River watershed in order to connect a broad spectrum of people with nature.

Our guidelines and strategies for working cooperatively with others to facilitate quality opportunities for wildlife observation and photography throughout the Connecticut River watershed, with priority attention to CPAs, include the following:

- **Wildlife Observation and Photography Opportunities, Access, and Infrastructure:** Work with partners to encourage these activities through the provision of parking areas, trails, and observation blinds necessary to facilitate access and enhance opportunities for wildlife viewing and photography. Quality



Paul Erickson

Visitors to Mollie Beattie Bog, Nulhegan Basin Division

wildlife observation and photography opportunities will promote resource stewardship and a conservation ethic. We will emphasize wildlife observation and photography opportunities that are accessible to a wide array of the American public and provide a reasonable opportunity to experience wildlife, such as migratory songbirds in breeding plumage, and resident, charismatic species, such as white-tailed deer and moose.

**Rationale:** See rationale for entire objective below.

- **Aids to Support Wildlife Observation and Photography on Refuge Lands:** Work with partners to develop and promote both traditional resources, such as paper maps and brochures, as well as, emerging technologies, like phone applications and QR codes (Quick Response codes used with a cell phone to learn about a site), as information sources related to wildlife observation and photography.

**Rationale:** See rationale for entire objective below.

- **Watershed-based Initiatives to Support Wildlife Observation and Photography:** Work with partners and willing landowners to develop and promote watershed-wide viewing opportunities, such as the Connecticut River Birding Trail, Connecticut River Byway, and the Adopt-a-Habitat Initiative, which helps landowners, organization, and schools adopt an area and restore and manage its as habitat for wildlife and for wildlife viewing.

**Rationale:** We provide the Refuge System definition of a “quality” recreational program under our rationale for hunting. Wildlife observation and photography are an important way to connect people to the outdoors and nature—and a means to help people recognize their own role in the environment. We actively promote public opportunities for this recreational activity on refuge lands. Wildlife observation and photography are two of the six priority wildlife-dependent public uses of the Refuge System as outlined in the 1997 Refuge Improvement Act. The Youth in the Great Outdoors Secretarial Initiative promotes programs that connect people with nature (<http://www.fws.gov/northeast/cpwn/>; accessed August 2016).



While more opportunities exist for wildlife observation and photography, than perhaps hunting and fishing, the challenge is instead to make these uses more accessible to a changing demographic (i.e., increasingly urban, diverse, and minority audiences). These audiences may possess a different relationship to nature than the traditional, and often more rural, refuge audience—and yet, it is equally important to engage all potential users. Wildlife observation and photography is a valued public use on certain refuge divisions, especially those within particularly scenic landscapes and containing a good public road/trail network.

As desired by the respective state fish and wildlife agencies, we will partner with them to promote the provision of quality, public programs that enhance opportunities for wildlife observation and photography.

**Objective 3.4: Other Recreational Activities**

Support compatible, non-priority, outdoor recreational opportunities and public access that provide quality, nature-based experiences throughout the Connecticut River watershed to facilitate and improve community relationships, raise awareness and an appreciation for conserving natural resources, and garner support for the National Wildlife Refuge System.

Our guidelines and strategies for working cooperatively with others to facilitate other appropriate and compatible outdoor recreational opportunities throughout the Connecticut River watershed, with priority attention to CPAs, include the following:

- **Regional Water-based Trail Initiatives and Opportunities:** Work with partners and willing landowners to support compatible, water-based trail initiatives within the Connecticut River watershed that promote a conservation/land ethic and quality outdoor experiences for people of all abilities. As opportunities arise, work with partners to establish a series of campsites and launches to ensure a fully functioning Connecticut River Paddlers’ Trail throughout the full 410-mile length of the Connecticut River. Use our website and other outreach efforts to promote the Paddlers’ Trail and Northern Forest Canoe Trail.

*Rationale:* See rationale for entire objective below.

- **Regional Land-based Trail initiatives and Opportunities:** Work with partners and willing landowners to support compatible, land-based trail initiatives within the Connecticut River watershed that promote a conservation/land ethic and quality outdoor experiences for people of all abilities. When appropriate and compatible, use refuge lands to provide linkages for existing, established regional or statewide trails. Where refuge ownership interests coincide with regional hiking trails, such as the Appalachian National Scenic Trail and New England National Scenic Trail; assist in the long-term protection of their continuity and quality by working with existing or prospective conservation owners to maintain trail and habitat connectivity. Deploy outreach methods to engage users of other land-based trails, such as equestrian, rail trail, cycling, and snowmobile trails in the mission of the refuge system, when they occur adjacent to refuge lands and support a conservation ethic.

*Rationale:* See rationale for entire objective below.

- **Unit-specific Land-based Trail Initiatives and Opportunities:** Work with partners to support land-based trail initiatives within or adjacent to refuge units to promote outdoor, nature-based activities, and strive to instill a

conservation and land ethic. When appropriate and compatible, allow access across refuge lands to maintain, and provide new linkages for, existing established trails open to the public. In general, users will already have a nearby and logical connection to refuge lands and refuge lands will constitute a minority of the trail network's length (e.g., for example, less than 25 percent). The trail, and its associated use, will not be allowed if it is exclusive to anyone, or any club or organization. Site-specific compatibility determinations will be required in response to a request for any such trail segments.

**Rationale:** Although many people participate in the wildlife-dependent activities described above, we recognize that a large and diverse array of outdoor recreational trail pursuits occurs within the Connecticut River watershed and

that many of these activities do not necessarily fit our definition of priority, wildlife-dependent recreational uses, such as hunting, fishing, and bird watching. Examples of trail activities we are aware of on nearby lands include equestrian riding, snowmobiling, cross-country skiing, and sled dog mushing. Nonetheless, engaging these users where it can be done within our compatibility standards represents an opportunity to build a connection with a new constituency — and a means to help people recognize their own role in the environment. In addition, we are pleased to be able to provide public opportunities for varied recreational activities on refuge lands.

As desired by various user groups and organizations, we will collaborate with them to promote the provision of such quality, public programs that enhance connections and develop a rapport with a new demographic. For example, we will cooperate with others to implement the recommendations in the Connecticut River Recreation Management Plan, to the extent practical.

As we support trail development and protection on either refuge or private lands, we will encourage managing for “soft” edges along a trail corridor to benefit both visitors and wildlife. Soft edges are those where the trail corridor perimeter is not an abrupt, straight-line vegetation change, but is one where the corridor has vegetation edges that are more gradual or undulating (e.g. soft). Soft edges are more aesthetically appealing, but they also buffer against disturbances better than those with straight and abrupt (hard) edges. This concept is most important in providing a transition between urban or agricultural land uses and natural areas. Soft edges especially help minimize the diverse disparities between

urban and natural areas, such as the difference between highly lit (at night) and louder urban areas and the low-light, more quiet natural areas.



Sharon Lindsay

*Puddles at Mollie Beattie Bog at Nulhegan Basin Division*

#### GOAL 4

**Partnerships. Enhance the conservation, protection, and stewardship of natural and cultural resources, and promote wildlife-dependent recreation, throughout the Connecticut River watershed by initiating, supporting, and promoting partnerships with other Federal, State, and local agencies, Tribal governments, and private organizations.**

**Background:** We will continue the valuable partnerships we currently have, but will also look to seek new ones, or expand existing ones in CPAs that will advance our goals and those of our priorities. Our emphasis will be on looking

for opportunities to coordinate, collaborate, and leverage Federal resources in accomplishing conservation, education, and recreation goals. We will make a concerted effort to engage other Federal agencies in order to maximize opportunities to assist State and private landowners in meeting mutually beneficial conservation priorities. We will also actively seek opportunities to enhance research, inventories, and monitoring that will advance our understanding of the watershed's resources on a landscape basis, and support science-based decision-making. We will work with partners to implement priorities identified by the NALCC and State WAPs, and coordinate efforts to respond to the challenges associated with a changing climate, land uses, and other landscape-level issues such as invasive species. The capacity of refuge lands to influence conservation in the watershed, and the visibility and relevancy of the refuge as a partner across the 396 communities and 2.4 million residents in the watershed will be greatly enhanced with the larger land base. See goal 4 below for further detailed partnership discussion.

**Objective 4.1: Strategic Habitat Conservation Partnerships**

Create, enhance, and facilitate partnerships to plan, design, deliver, and evaluate SHC in the Connecticut River watershed, such as the *Connect the Connecticut* Landscape Conservation Design (LCD), with an emphasis on promoting action in CPAs. Special effort will be made to coordinate with the NALCC partnership, the four State fish and wildlife agencies, the *Connect the Connecticut* LCD partnership, and other partners advancing conservation in the watershed.

Our guidelines and strategies for working cooperatively with others to facilitate strategic habitat conservation throughout the watershed, with priority attention to CPAs, include the following:

- **Habitat Restoration and Management:** Work with partners and willing landowners to restore, manage, and enhance habitat values for Federal trust resources and other species of conservation concern. Identify, with other Federal and State partners, programs and funding sources for projects and the availability of technical assistance regarding project feasibility and design. Service project priorities will include riparian and floodplain habitat restoration along the mainstem Connecticut River and its tributaries, reestablishing aquatic connections for migratory fish and other aquatic species (e.g., aquatic species barrier removal), restoring wetland functions and values, protecting federally listed and other Federal trust species, and treating invasive species that threaten important habitats for those species.

Many Federal, state, and regional and local partners, such as regional conservation partnerships, local land trusts, and regional and local watershed committees, are already actively engaged in restoration and management activities. We will continue to support those planning and implementation endeavors, both on and off refuge lands. Our intent will be to complement the great work already established by those partners. Refuge staff could also facilitate the sharing of ecological, GIS, and other information and technical resources, support fieldwork, and provide assistance in grant writing to support priority projects.

Coordination among Federal and state agencies will be particularly important to address major hydrologic and aquatic issues in the river. We will support the Service's Connecticut River Coordinator's Office in pursuing discussions with the USACE and other partners to identify opportunities to manage water resources (e.g., flood risk reduction infrastructure) in order to promote the structure, function, and flows (e.g. velocity and duration) of water resources in the watershed in a manner that is more natural. CRASC Commissioners and the Technical Committee, who have recognized for decades the importance

of working on a landscape scale, will continue to be important partners in addressing aquatic passage issues and in implementing restoration projects across the watershed.

Generally, we will work with our Federal, state, regional and local partners to:

- \* Review and, as warranted, assist in the implementation of quality plans already in place consistent and compatible with refuge goals.
- \* Prioritize habitat conservation needs for Federal trust resources and other species of conservation concern, including prioritizing opportunities for restoration and management.
- \* Develop specific management and implementation strategies for those priorities, and identify and address limiting factors.
- \* Implement management strategies through existing and new partnerships.
- \* Develop and implement evaluation measures for management strategies as needed; and adapt management in response to what is learned through monitoring.

**Rationale:** See rationale for entire objective below.

- **Private Lands Program Coordination:** Use the Service's Partners for Fish and Wildlife Program (Private Lands program) to facilitate private landowner assistance among all four States, Federal agencies, and conservation organizations who are working with private landowners to protect and manage valuable fish and wildlife habitats. This program is guided by four objectives:
  - \* Promote and implement habitat improvement projects that benefit Federal trust species.
  - \* Provide conservation leadership and promote partnerships.
  - \* Encourage public understanding and participation
  - \* Work with the USDA to implement conservation programs.

This program details priority actions in regional strategic action plans. An updated plan for the Service's Northeast Region for years 2017-2021 is currently in development. Program emphases include improving and restoring degraded wetlands and riparian habitat, improving and restoring aquatic connectivity, and improving and managing young forest and pollinator habitat.

We believe this Service program should complement partners' programs, implement the *Connect the Connecticut* LCD, and support the purposes of the refuge by:

- \* Working with landowners to identify specific habitat improvement opportunities.
- \* Assisting landowners in finding and preparing grants or other funding and cost-sharing opportunities, sponsored by State and Federal agencies or private organizations, to accomplish conservation work. In particular, connect these landowners with Federal programs and funding.

- \* Assisting landowners with their grant submissions.
- \* Sharing scientific knowledge and best management practices for designing and implementing projects.
- \* Where appropriate and practical, implementing cooperative management agreements on private lands around refuge units and divisions to support work consistent with refuge purposes.
- \* Where it helps meet mutual goals, cooperating with local communities on projects such as trail work, access improvements, and drainage and water control structures.

The Private Lands program is our most effective way to outreach and create partnerships with private landowners to achieve shared regional habitat and wildlife conservation goals. Currently, the refuge staff includes one full-time employee who helps administer the Private Lands program serving as a permanent presence in the watershed—bringing people together, getting the right people talking to each other, helping partners prepare grants and other funding documents, and complementing Federal and State programs with similar aims. We will work with other organizations with land management expertise in developing and implementing the program.

**Rationale:** See rationale for entire objective below.

- **Land Protection:** Advance conservation in the Connecticut River watershed through a strategic, public-private land protection program. Our land conservation goal is to assemble a well-distributed conserved lands network in the watershed that contributes to sustaining ecological function, supports healthy populations of native fish and wildlife, especially those of conservation concern, is respectful of the working landscape, and anticipates the effects of climate and land use changes. This is primarily represented by the core areas and connectors in the *Connect the Connecticut* LCD. We have identified a network of lands (e.g., CPAs and CFAs), supported by the LCD, that we believe have high ecological and Federal trust conservation value that will be priority areas for us to work with partners to protect. However, that focus will not exclude the very important conservation work of our partners being done elsewhere. Rather, we believe these are complementary actions. The focus of our refuge land protection design is to protect high Federal trust value habitats, promote connectivity in aspect, substrate, and process, and to insure representation and redundancy of ecosystems in order to sustain resiliency in natural systems in light of predicted climate and land use change.

The Service will take a lead, but not exclusive role in land conservation within CFAs. We will also work in cooperation with partners on their initiatives in both CFAs and CPAs, and facilitate as practical and appropriate, other conservation projects led by others elsewhere in the watershed consistent with refuge goals and objectives. Refuge support could include the sharing of ecological data, grant writing, and technical field support, as needed and appropriate, to encourage land protection activities by partners within the CPAs.

Refuge staff will work in close cooperation with Federal and State agencies, land trusts, and other conservation partners, to foster a climate of cooperation and shared goals when pursuing land protection. In particular, we will ensure close coordination with State agencies by holding regular land acquisition coordination meetings to keep mutual agency interests moving forward and

to avoid duplicative efforts. Refuge staff will facilitate a Federal acquisition process that is as efficient and responsive as possible.

Appendix C represents the Service's refuge acquisition plan. Refuge staff will also share ecological and other GIS data, support grant writing, provide technical field support, as needed and appropriate, to encourage land protection activities by partners.

As we have emphasized, we only acquire land from willing sellers. Also, we do not expect to purchase any lands already permanently conserved by others, except under extenuating circumstances.

**Rationale:** The 1991 Conte Refuge Act legislatively mandated a refuge be established in the Connecticut River watershed for six different purposes related to conservation; the purposes include conservation for specific species, as well as ecosystems, natural diversity, wetlands protection, and a charge to support scientific research, environmental education, and wildlife-dependent recreational access. Supporting language for the legislation included the recognition that partnerships among the Service, other Federal agencies, State agencies, and the conservation community will be critical to fulfilling these purposes.

In particular, the Service would like to facilitate the leveraging of the various Federal agency's funds and grants, to State and private conservation partners, working in the watershed to implement the *Connect the Connecticut* LCD conservation priorities. Objective 4.11 discusses this in some detail. A recent acknowledgement of Federal agencies collaborating to achieve conservation is established in the Service's Directors Order 217, dated August 9, 2016. This order ensures that Service personnel place a priority on working with the USDA/NRCS to promote voluntary conservation actions by non-Federal landowners and managers through Working Lands for Wildlife (WLFW) and other wildlife conservation-focused programs. The goal is to leverage conservation on private lands through WLFW and other wildlife conservation-focused programs in collaboration with NRCS that support the Service's mission, with a particular focus on conserving listed, candidate, and other at-risk species (at-risk species).

All four watershed States, the Forest Service, land trusts, and conservation organizations have identified lands of high conservation value, and most have identified specific priority areas for protection respective to their agency's mission. Collectively, they collaborated on priorities in the *Connect the Connecticut* LCD. There is already a valuable exchange of resource information among the States, Federal agencies, and organizations that helps this process and continues to help each partner update and refine their priorities. In addition, when identified lands become available from willing sellers, there is often communication among partners to assess who is best suited and has available resources to acquire the property. Maintaining this networking is critical for meeting land conservation and collaboration goals over the long term in the watershed.

We will continue to work closely with the NALCC partnership, the States, and other stakeholders to implement the *Connect the Connecticut* LCD over the long term. We will also work with the NALCC partnership and other stakeholders to consider conservation priorities identified in the initiative currently named "Regional Conservation Opportunity Areas" (RCOAs). This effort, scheduled for public release in 2017, builds upon *Connect the Connecticut* and expands the work across the entire Northeast region. Updated science and information exchanges provided by partners will help inform and prioritize our future biological planning within the watershed, and help direct assumption-driven research

and monitoring necessary to shape decisions about conservation delivery within an adaptive management framework. Through this coordination, refuge management can be adapted in a timely manner as new information arises. Furthermore, working together with conservation partners, the refuge could serve as a demonstration area for implementing projects, or testing models and tools, that are developed.

**Objective 4.2: Terrestrial Species Protection, Restoration, and Management Partnerships**

Create, enhance, and facilitate partnerships to protect, restore, and manage populations of terrestrial species of conservation concern, including federally listed species, species proposed for listing, and migratory birds, throughout the Connecticut River watershed, with an emphasis on promoting action in CPAs.

Our guidelines and strategies for working cooperatively with others to conserve species populations throughout the Connecticut River watershed, with priority attention to CPAs, include the following:

- **Federally Listed Terrestrial Species Conservation:** Support the protection of federally listed and candidate species in the watershed, and minimize the listing of new species, by collaborating with Federal and State agencies, local towns, non-governmental organizations, and willing landowners. Work in partnership to develop and implement species recovery plans, spotlight action plans, species conservation strategies and targets, habitat conservation plans, State wildlife action plans, and other conservation measures with a goal to avoid new species listings. Those measures may include land protection, public use and access management, and invasive species control. Work closely with other Service programs to mobilize agency resources toward coordinated conservation work in the watershed with priority given to the following federally listed, candidate, and proposed species:
  - \* Puritan tiger beetle (federally threatened) Recovery Plan 1993—  
*<http://www.fws.gov/chesapeakebay/endsppweb/beetle/PDFs/1993RecoveryPlan.pdf>* (accessed August 2016).
  - \* Jesup's milk-vetch (federally endangered) Spotlight Species Action Plan 2009—*<https://www.fws.gov/northeast/Endangered/pdf/Jessup's%20milk-vetch%20SSAP.pdf>* (accessed August 2016).
  - \* Northeastern bulrush (federally endangered) Recovery Plan 1993—  
*[http://www.fws.gov/northeast/pafo/pdf/NB\\_Recovery\\_Plan.pdf](http://www.fws.gov/northeast/pafo/pdf/NB_Recovery_Plan.pdf)* (accessed August 2016).
  - \* Canada lynx (federally threatened) Recovery Outline 2005—*[http://ecos.fws.gov/docs/recovery\\_plan/final%20draft%20Lynx%20Recovery%20Outline%209-05.pdf](http://ecos.fws.gov/docs/recovery_plan/final%20draft%20Lynx%20Recovery%20Outline%209-05.pdf)* (accessed August 2016).
  - \* Piping plover (federally threatened) Revised Recovery Plan 1996—*[http://www.fws.gov/northeast/pipingplover/pdf/entire\\_plan.pdf](http://www.fws.gov/northeast/pipingplover/pdf/entire_plan.pdf)* (accessed August 2016).
  - \* Small whorled pogonia (federally threatened) Recovery Plan 1992—*[http://ecos.fws.gov/docs/recovery\\_plans/1992/921113b.pdf](http://ecos.fws.gov/docs/recovery_plans/1992/921113b.pdf)* (accessed August 2016).
  - \* Red knot rufa subspecies (federally threatened) Spotlight Species Action Plan 2010—*[https://www.fws.gov/northeast/endangered/PDF/red\\_knot\\_action\\_plan.pdf](https://www.fws.gov/northeast/endangered/PDF/red_knot_action_plan.pdf)* (accessed August 2016).

- \* Northern long-eared bat (federally threatened) Northern long-eared bat interim conference and planning guidance January 2014 — <https://www.fws.gov/northeast/virginiafield/pdf/NLEBinterimGuidance6Jan2014.pdf> (accessed August 2016).
- \* Roseate tern (federally endangered) Roseate Tern Northeastern Population Recover Plan 1998 — [https://www.fws.gov/ecos/ajax/docs/recovery\\_plan/981105.pdf](https://www.fws.gov/ecos/ajax/docs/recovery_plan/981105.pdf) (accessed November 2016).
- \* Indiana bat (federally endangered) Indiana Bat Five-Year Review Summary and Evaluation 2009 — [https://ecos.fws.gov/docs/five\\_year\\_review/doc2627.pdf](https://ecos.fws.gov/docs/five_year_review/doc2627.pdf) (accessed November 2016).
- \* Northern bog turtle (federally threatened) Bog Turtle Northern Population Recovery Plan 2001 — [http://ecos.fws.gov/docs/recovery\\_plan/010515.pdf](http://ecos.fws.gov/docs/recovery_plan/010515.pdf) (accessed November 2016).
- \* Cobblestone tiger beetle (species under review) <https://ecos.fws.gov/ecp0/profile/speciesProfile?sId=8134> (accessed November 2016).
- \* Monarch butterfly (species under review) <https://ecos.fws.gov/ecp0/profile/speciesProfile?sId=9743> (accessed November 2016).
- \* Yellow-banded bumble bee (species under review) <https://ecos.fws.gov/ecp0/profile/speciesProfile?sId=10403> (accessed November 2016).
- \* Wood turtle (species under review) <https://ecos.fws.gov/ecp0/profile/speciesProfile?sId=6997> (accessed November 2016).

**Rationale:** See rationale for entire objective below.

- **Migratory Bird Conservation:** Work with partners to plan, develop, and implement ecoregional migratory bird conservation programs to ensure the long term ecological sustainability of migratory birds and their habitat, and to increase awareness of the value of migratory birds and their habitats for their intrinsic, ecological, recreational, and economic significance within the watershed.

Support migratory bird ecoregional plans and priorities developed through the NALCC for migratory birds, through actions such as:

- \* Population monitoring, assessment, and management.
- \* Habitat restoration, management, and protection.
- \* Private lands coordination and grants writing and funding support.
- \* Communications and outreach.
- \* Recreational opportunities.

**Rationale:** See rationale for entire objective below.

- **Other Terrestrial Species of Conservation Concern Identified by the Service, NALCC Partnership, or States:** Work with partners to plan, develop, and implement other species' ecoregional conservation programs to ensure the long term ecological sustainability of species of conservation concern and



their habitat, and to increase awareness of the value of those species and their habitats for their intrinsic, ecological, recreational, and economic significance.

**Rationale:** Partnerships and collaborations are essential to successful conservation of all species, particularly those that migrate or have large home ranges. No one partner has all the lands and resources necessary to meet a migratory species' goal. There are numerous species and habitat-focused regionally based partnerships comprising Federal and State government agencies, non-profit organizations, corporations, Tribal governments, and individuals who work to implement conservation plans in the watershed. For example, we are actively engaged in a New England cottontail conservation partnership. The science provided by the NALCC and other conservation partners will help inform existing ecoregional conservation plans and other strategic plans developed for conservation lands in the watershed, including the refuge. We indicate above some of the federally listed species plans (e.g., recovery plans), which will guide our management actions to benefit these species. Existing bird plans developed by the Service and partners include the BCR 14 and 30 plans, the North American Waterfowl Plan, the Waterbirds for the Americas Plan, the U.S. Shorebird Plan, PIF plans, and the Black Duck Joint Venture. We will also work with the four States to coordinate State WAP, especially with actions that support conservation of Federal trust resources.

We will continue to support and help implement the *Connect the Connecticut* LCD, initiated by the NALCC. As noted previously, this project is a collaborative effort among 30 partners, including the Service, to develop and implement a strategic plan for the watershed that will sustain habitat for fish, wildlife, and plants within a working landscape. It is intended to guide collective conservation actions within the watershed and connect to broader regional conservation goals for conserving sustainable fish and wildlife populations and their habitat for people within a working landscape. Science-based tools were developed that will serve to facilitate a conservation design for other geographies in the entire Northeast Region (<http://connecttheconnecticut.org/>; accessed October 2016).

**Objective 4.3: Aquatic Species Protection, Restoration, and Management Partnerships**

Support the conservation of migratory fish and other aquatic species of conservation concern by collaborating with Federal and State agencies, local towns, and non-governmental organizations in the implementation of fish and other aquatic species conservation plans.

Our guidelines and strategies for working cooperatively with others to conserve fish and other aquatic species populations throughout the Connecticut River watershed, with priority attention to CPAs, include the following:

- **Federally Listed Aquatic Species Conservation:** Support the protection of federally listed and candidate species in the watershed, and minimize the listing of new species, by collaborating with Federal and State agencies, local towns, non-governmental organizations, and willing landowners. Work in partnership to develop and implement species recovery plans, species conservation strategies, habitat conservation plans, State wildlife action plans, and other conservation measures with a goal to avoid new species listings. Those measures may include land protection, public use and access management, and invasive species control. Work closely with other Service programs to mobilize agency resources toward coordinated conservation work in the watershed with priority given to implementing the following plans:

- \* Recovery Plan (1993) for the dwarf wedgemussel—  
<http://www.fws.gov/northeast/nyfo/es/dwm.pdf> (accessed August 2016).

- \* Recovery Plan (1998) for the shortnose sturgeon—  
[http://www.nmfs.noaa.gov/pr/pdfs/recovery/sturgeon\\_shortnose.pdf](http://www.nmfs.noaa.gov/pr/pdfs/recovery/sturgeon_shortnose.pdf)

Beaver



Steve Hillebrand

(accessed August 2016); and [http://www.fws.gov/r5crc/shortnose\\_sturgeon\\_program.htm](http://www.fws.gov/r5crc/shortnose_sturgeon_program.htm) (accessed August 2016)

- \* The Service's Region 5 Strategic Fisheries Plan for the Connecticut River watershed (Service 2009)—  
[https://www.fws.gov/northeast/fisheries/pdf/FAC\\_StrategyPlan\\_2016\\_2020.pdf](https://www.fws.gov/northeast/fisheries/pdf/FAC_StrategyPlan_2016_2020.pdf) (accessed August 2016).
- \* Atlantic States Marine Fisheries Commission numerous species plans—  
<http://www.asmfc.org/fisheries-management/program-overview> (accessed August 2016) Connecticut River Atlantic Salmon Commission priorities—  
<http://www.fws.gov/r5crc/who/crasc.html> (accessed August 2016)
- \* The Nature Conservancy and Northeast Association of Fish and Wildlife Agency's Northeast Aquatic Connectivity, An Assessment of Dams on Northeastern Rivers (TNC 2011)—  
[http://cw-environment.usace.army.mil/restore/fishpassage/pdfs/NEAquaticConnectivity\\_Report.pdf](http://cw-environment.usace.army.mil/restore/fishpassage/pdfs/NEAquaticConnectivity_Report.pdf) (accessed August 2016).

Support the CRASC's diadromous fish restoration efforts, the Service's Connecticut River Coordinator's Program, State fish and wildlife and transportation agencies, NOAA Fisheries, TNA, TU, and other stakeholders in identifying, assessing, and removing fish and other aquatic species passage barriers, and restoring streams to natural channel designs where possible. Where barrier removal is not feasible, support efforts to design an appropriate fish passage facility. Promote the use of clear ecological criteria to prioritize work (e.g., amount and quality of habitat upstream of barrier, size, and status of affected populations) among partners. These prioritizations could apply to a single species, but would be most useful when all species of concern are evaluated together.

**Rationale:** See rationale for entire objective below.

- **Other Aquatic Species of Conservation Concern Identified by the Service, the NALCC Partnership, or States:** We will work with Service programs, Atlantic States Marine Fisheries Commission, Connecticut River Atlantic Salmon Commission, other Federal agencies, and State agencies to advance conservation of other aquatic Federal trust species, NALCC aquatic representative species, or State aquatic species of greatest conservation need. Information on species of concern and associated management plans can be accessed at:
  - \* American shad ([http://www.fws.gov/r5crc/american\\_shad\\_program.htm](http://www.fws.gov/r5crc/american_shad_program.htm); accessed August 2016)
  - \* River herring ([http://www.fws.gov/r5crc/river\\_herring\\_program.htm](http://www.fws.gov/r5crc/river_herring_program.htm); accessed August 2016)
  - \* American eel ([http://www.fws.gov/r5crc/american\\_eel\\_program.htm](http://www.fws.gov/r5crc/american_eel_program.htm); August 2016)
  - \* Eastern brook trout (<http://easternbrooktrout.org/>; accessed August 2016)
  - \* Sea lamprey ([http://www.fws.gov/r5crc/sea\\_lamprey\\_program.htm](http://www.fws.gov/r5crc/sea_lamprey_program.htm); accessed August 2016)

- \* Striped bass ([http://www.fws.gov/r5crc/striped\\_bass\\_program.htm](http://www.fws.gov/r5crc/striped_bass_program.htm); accessed August 2016)

We will also consult the numerous species plans developed by the Atlantic States Marine Fisheries Commission which can be reviewed at <http://www.asmfc.org/fisheries-management/program-overview> (accessed August 2016)

Promote the conservation measures on fish passage that are noted above for federally listed species. Work with States, NOAA Fisheries, TNC, and other partners to identify and prioritize these and other conservation actions, actively seek funding, and implement on-the-ground projects and monitoring with the goal to restore and maintain these native species to their historic range in the watershed.

**Rationale:** The Connecticut River and its tributaries provide important habitat for a wide range of aquatic species, including Federal trust resources, such as migratory fish and federally listed species. The refuge will continue to work with partners, including the Service's Connecticut River Coordinator's Office, to help protect and restore aquatic habitats for these species. In particular, we will work with partners to address threats to aquatic species, such as removing barriers to aquatic species passage.

**Objective 4.4: Invasive Species Management Partnerships**

Plan and implement coordinated and strategic actions among conservation partners and private landowners to reduce the ecological threat from invasive exotic plants and wildlife species in the Connecticut River watershed. Work with those partners to design and implement strategies for controlling the spread of established invaders, preventing new invasions, and in the early detection and rapid response to control new invaders.

Our guidelines and strategies for working cooperatively with others to facilitate invasive species management throughout the Connecticut River watershed, with priority attention to CPAs, include the following:

- **Cooperative Invasive Species Management Areas and Other Invasive Species Partnerships:** Work with the Friends of Conte Science and Stewardship Committee to develop an organizational framework or network that will incorporate the invasive species control program into priority stewardship activities at all levels within the watershed, including watershed-wide, in subwatersheds, and at local levels. The goal is to create an organization that is well-integrated with other conservation partnerships and would result in on-the-ground invasive species inventories, monitoring, education, and management activities in priority habitats. Specifically, we will:
  - \* Take a leadership role in formalizing and continuing the work undertaken from 2012-2013 to set up a watershed-wide invasive species management partnership using the CISMA model partnerships. The pilot group formed under this grant goes by the name "Connecticut River Watershed Invasive Species Partnership." To continue its work, this watershed-wide CISMA will function as a subgroup of the Friends of Conte Science and Stewardship Committee and coordinate closely with other stewardship activities deemed important by the group. This organization will also network existing invasive species partnerships and take recommended next-steps from the 2014 report "Identifying Priority Areas for Invasive Plant Management in the Connecticut River Watershed" written by the Strategic Planning Subcommittee of the Connecticut River Watershed Invasive Species Partnership. This report gives guidance in identifying the most important areas to undertake invasive species work, including the establishment of

subwatershed CISMAs and/or partnerships at the local level. If Federal funding for CISMAs becomes available, the group could apply for funds to coordinate the umbrella CISMA and, using our legislative authority to administer a small grants program, distribute funds to the smaller groups for projects meeting umbrella group objectives.

- \* Work with existing partnerships, including the six CISMAs and other local watershed associations, to continue to identify priorities, and develop invasive species management objectives and strategies that support local efforts while fulfilling watershed-wide objectives; ensure that the partnership considers all taxa of invasive species, in addition to plants.
- \* Help develop invasive species partnerships in CPAs where none currently exist, with priority given to those CPAs falling within priority areas identified in the report specified above and additional analyses stemming from that report.

**Rationale:** See rationale for entire objective below.

- **Invasive Species Outreach:** Provide target audiences and concerned citizens with the information they need to take meaningful actions to control or prevent species spread on their own lands or through their recreational and/or professional activities. Specifically we will:
  - \* Inform the public about the importance of each person doing their part and supply them with the information to take wise action.
  - \* Provide targeted outreach to public agencies that may have a role in the spread of invasive plants through their management actions, such as highway maintenance departments.
  - \* Prioritize actions by considering which species are of highest threat to biodiversity, are threatening rare species, or can most successfully be eradicated; as well as which areas are especially important to restore due to important natural resources; educate partners and public about these priorities.
  - \* Help groups successfully plan and implement volunteer control days in their communities for plants that are easy to control by hand such as garlic mustard.
  - \* Develop a list of volunteer opportunities at Refuge treatment areas, CISMAs, or adopted habitats.

**Rationale:** See rationale for entire objective below.

- **Early Detection and Rapid Response Control:** Work with partners to design and implement strategies for prevention, early detection, and rapid control response to new invaders, especially those deemed to pose a serious threat to native species populations or biodiversity. Specifically we will:
  - \* Seek a seat on the Northeast Aquatic Nuisance Species Panel or regularly attend meetings, becoming active in its work to advance prevention, early detection and rapid response within the Northeast.
  - \* Work with the State invasive species groups to develop lists of the species that would pose serious threats to biodiversity if they enter the watershed

and develop a protocol for early detection and rapid response. Focus first on priority species already known to be in New England such as zebra mussel, Asian longhorn beetle, monk parakeet, hemlock wooly adelgid, emerald ash borer, mute swan, hydrilla, mile-a-minute vine, and Japanese stiltgrass.

- \* Continue water chestnut spread control actions by assisting to find funds for large populations, leading groups to hand-pull smaller populations, and inspecting other water bodies for this species. Locate groups willing to “adopt a water body for water chestnut control” to further the refuge’s efforts.

**Rationale:** See rationale for entire objective below.

- **Invasive Species Inventories and Mapping:** Work with partners to ensure that inventory results are documented and shared in a timely manner, and to coordinate inventory efforts where possible.
  - \* Research how much of the watershed is covered in the EDDMapS/ IPANE (Early Detection and Distribution Mapping System/Invasive Plant Atlas of New England) inventory project and what gaps exist, especially on refuge and other conservation lands.
  - \* Work with partners and volunteers to fill the gaps of the IPANE data within the watershed, (with a special focus on the CPAs and refuge-owned lands) and institute a procedure for the refuge to be notified if any invaders new to the area are discovered.
  - \* Work with EDDMapS staff to include existing refuge data on invasive plants into the EDDMapS/IPANE database.

**Rationale:** Addressing invasive plants has been a Service priority since refuge establishment. Much of the refuge’s cost share grant program focused on funding invasive plant control projects. The refuge has one full time staff person dedicated to working with partners to control invasive species on both refuge lands and other ownerships in the watershed. We discussed many of the accomplishments of the program in chapter 3. This objective will build off of the existing program to include control work on other high priority invasive species problems within the watershed, including forest pests, aquatic organisms, and problematic wildlife species.

**Objective 4.5: Special Designation Areas Partnerships**

Support existing Federal and State designated special areas, and work with partners and willing landowners to promote additional designations that enhance the protection and/or recognition of natural, cultural, and recreational resources of significance within CPAs.

Our guidelines and strategies for working cooperatively with others to promote special designations that benefit natural, cultural, and recreational resources of concern throughout the watershed, with priority attention to CPAs, include the following:

- **Eligibility:** Work with partners to share information with willing landowners on eligibility requirements for, and the benefits of, special designation areas.
- **Monitoring:** Work with partners and willing landowners to establish a monitoring program, or implement ones already developed, and pool resources to accomplish that monitoring, in an effort to ensure that the special designation areas maintain their characteristics.

**Rationale:** Special designation areas in the watershed include, but are not limited to: Research Natural Area; Federal and State Wild and Scenic River; American Heritage River; National Recreation Trail (land and water trails); National Scenic Trail (land and water trails); National Historic Trail; National Natural Landmark; National Historic Landmark, Site, or Monument; National Register of Historic Places site; National Wilderness Preservation System Area; Important Bird Area; National Blueway; Scenic Byway; and Ramsar Wetlands of International Importance.

Each of these designations has distinctive criteria for qualifying, and many have specific guidelines for their maintenance and management. Some are designated by Congress or State legislatures and thereby supported by laws and regulations, while others are identified by conservation organizations or individuals and are voluntary programs. Establishing these areas promotes their uniqueness, and for those that are regulated, ensures their protection under law. In addition, a special designation can provide an advantage when seeking grants or other special funding opportunities for management and maintenance.

We will continue to work with partners to protect existing special designation areas and the characteristics that make them unique. Important to that effort will be cooperatively establishing and implementing monitoring protocols that evaluate the condition of special areas. In addition, we will support the designation of new areas that are of natural, cultural, or recreational significance in the watershed. For example, on refuge lands we are currently working with the Service's Regional cultural resources staff, the Connecticut State SHPO, members of Congress, and other stakeholders to evaluate what type of special designation is appropriate for the Venture Smith property on the Salmon River Division. We will also expand the existing National Natural Landmark on the refuge's Pondicherry Division.

**Objective 4.6: Research and Demonstration Partnerships, Particularly in Support of Climate Change Adaptation**

Create, enhance, or facilitate partnerships that advance conservation research in the Connecticut River watershed, leveraging resources among partners, with an emphasis on advancing our understanding of climate change and land use impacts and pursuing adaptation strategies in response, to ensure the long-term sustainability of native fish, wildlife, plants, and associated habitats found in the CPAs.

Our guidelines and strategies for working cooperatively with others to facilitate deliberate research and demonstration projects in support of climate change adaptation throughout the watershed, with priority attention to CPAs, include the following:

- **Conservation Science Partnerships and Information Exchanges:** Promote research and development of applied management practices in the Connecticut River watershed to sustain and enhance the natural and cultural resources in concert with partners whose mission is to advance science. Seek opportunities that engage research institutions and organizations such as universities and colleges and non-governmental organizations. Working with the NALCC and other partners, develop, implement, and support cooperative research programs that address priority conservation and management needs or which provide basic information on species' populations, their habitat needs, and response to climate change.

Facilitate use of the refuge to apply science tools and information and implement projects identified by the NALCC and other science partners in an effort to advance our collective understanding of natural systems and to address specific conservation challenges found in the watershed. Sponsor the

development and implementation of a landscape conservation design project for the watershed in partnership with the NALCC members. Encourage opportunities on the refuge for research, inventory and monitoring, and the demonstration of management practices.

**Rationale:** See rationale for entire objective below.

- **Inventory and Monitoring Program:** Support cooperation among partners involved in inventorying and monitoring resources of common conservation concern. Promote the efforts of the NALCC partnership to identify common inventory and monitoring needs and help the NALCC with sharing resources to accomplish priority work. Refuge staff can demonstrate to partners existing inventory and monitoring protocols that are implemented on refuge lands, as well as share the results of the Service's Regional Refuge IMP. Refuge experiences can serve as a practical application of what information is collected, how it is collected and used, and to help establish baseline ecological conditions across a larger land base. Similarly, we will support the Service's Land Management Research and Demonstration program (LMRD) and the inventory and monitoring priorities identified for the watershed.

**Rationale:** See rationale for entire objective below.

- **Climate Science and Adaptation:** Work with partners at the federal, state, and local levels to identify threats from, and to promote adaptations for addressing, climate change. Promote planning by watershed communities for resilient landscapes in an effort to minimize the impacts of climate and land use changes, and to derive the full potential of ecosystem services benefits. Promote the work of the NALCC to model land use and climate change and the projected impacts on fish, wildlife and habitats. We will particularly encourage actions to restore floodplain forests and riparian buffers that protect public and private property from increased incidents of severe weather events, and any actions that will improve water quality in rivers and streams. We will continue to promote within the watershed the particular skills and resources that some partners have to address climate change. Examples of these capacities include Trout Unlimited's skill at restoring fish passages and reconnecting tributaries to the mainstem of the river, TNC's floodplain restoration program, NRCS's grassland restoration program, Southern

New England-New York Bight Coastal Program's expertise on saltmarsh restoration, and the climate change programs in each of the four States respective university systems.

The Northeast Climate Science Center (NECSC) is part of a Federal network of eight Climate Science Centers across the country created to provide scientific information, tools, and techniques that managers and other parties interested in land, water, wildlife and cultural resources can use to anticipate, monitor, and adapt to climate change. The NECSC is hosted at the University of Massachusetts in Amherst, Massachusetts. Service staff will be active members of this important scientific community, and we will encourage other partners to be as well.

*Lupine restoration*



USFWS

The Service plans to develop a system-wide set of best practices for adaptation to the effects of climate change. The refuge's responsibility will be to share this knowledge with partners, and implement and monitor those practices

on units and divisions under our management at the refuge level. We will encourage partners to pursue these practices as well, and to share their results, local knowledge, practical experience, and observations.

**Rationale:** Because of the watershed's diversity of species and habitat types, it is an ideal landscape to research and monitor the effectiveness of species, habitat, and climate models developed through the NALCC and NECSC, as well as to apply adaptive land management practices. The watershed represents a north-south migration corridor for many species, with tremendous habitat diversity in terms of land cover, altitude, latitude, and aspect. It is a living laboratory to support research on fish, wildlife, and plant adaptation to the effects of climate change. Refuge lands can play a key role in research, inventories, monitoring, and evaluating land management practices attempting to address conservation issues. A list of our current scientific partnerships, and some of the major plans generated that we used for this plan, is in appendix M.

#### **Objective 4.7: Community-based Partnerships**

Create, enhance, or facilitate partnerships within watershed communities that enhance the Service's ability to make positive contributions to civic life and local economies, and enrich community connections to a healthy, vibrant watershed (see objective 4.8 for those partnerships specifically dedicated to education, interpretation, and recreation).

Our guidelines and strategies for working cooperatively with others to facilitate community partnerships throughout the watershed, with priority attention to CPAs, include the following:

- **Economic Vitality within the Watershed:** In conjunction with the strategies described under goal 2—Education, Interpretation, and Outreach, above—enhance the economic vitality of communities in the Connecticut River watershed through nature-based and ecotourism initiatives, agriculture and forest protection programs, and recreational activities that both advance strategic conservation and improve broad-based visitation to the refuge. Meet with local community officials and leaders to establish how the Service can make a positive contribution to local economies consistent with the Service and Refuge System missions, and refuge purposes where refuge lands are involved. Also, communicate with local businesses when refuge staff are contemplating contracts that have the potential for economic opportunity, including timber harvest, and construction and maintenance activities.

**Rationale:** See rationale for entire objective below.

- **Historic and Cultural Resources:** As appropriate, support the protection, management, and restoration of cultural resources in the Connecticut River watershed and promote opportunities to connect people to the area's rich history. Identify and develop working partnerships with academic institutions, museums, and Tribal governments with the goal of identification, protection, and interpretation of historic and cultural resources, particularly land-based features, archaeological sites and artifacts, Native American history and contemporary lives, historical buildings and sites. The refuge will not lead on projects involving the acquisition, restoration, and interpretation of historic structures, but where practical and appropriate on such projects within CFAs that include a significant land protection component, we will work to be an effective partner in the overall protection effort.

**Rationale:** See rationale for entire objective below.



- **Public Safety and Wildland Law Enforcement and Emergency Response:** Whenever needed and appropriate, create law enforcement partnerships of mutual benefit to communities and the refuge. For example, the refuge's Federal wildlife officer will work collaboratively with State game wardens responsible for lands within CPAs in all four states. We will also offer to enter into mutual aid agreements to provide personnel and equipment resources to those municipalities bordering CFAs for the purpose of responding to natural disasters and other emergencies.

*Rationale:* See rationale for entire objective below.

- **Shared Facilities:** Whenever practical and appropriate, look for opportunities to treat the refuge land base and facilities as community assets. Make refuge buildings available for community meetings and other appropriate events. Consider opportunities to provide office space to State natural resource and other conservation partners in order to better serve the public interest. Share maintenance equipment and other resources with a wide range of partners when possible.

*Rationale:* See rationale for entire objective below.

- **Easements, Leases, Cooperative Agreements, and Special Use Permits:** Employ a wide variety of agreement types to facilitate projects and other opportunities advancing conservation, environmental education, and recreation goals shared with partners in local communities. Ensure the most appropriate agreement is created for each opportunity given expected outcomes and responsibilities. For example, encourage easements to provide additional public access or manage habitats, or to protect important habitat from land development. The Service may pursue low or no-cost leases to facilitate the construction of capital improvements such as Conte Corner installations, boardwalks, trails, and interpretive kiosks. These amenities draw visitors to the area who may spend money in local communities. The Service may issue special use permits to local individuals or organizations for appropriate and compatible uses of the refuge. Cooperative agreements are also an important tool to engage partners in mutually beneficial projects where funding and resources in-kind are exchanged.

*Rationale:* See rationale for entire objective below.

- **Constituent Organizations:** Promote relationships with bird clubs, outdoor recreation and sportsmen's clubs, and other constituent organizations to cultivate their support for the refuge's public use objectives, and to encourage constituent involvement in the formation and implementation of those objectives.

*Rationale:* Healthy watersheds are the foundation of sustainable communities and economies, in addition to benefitting fish and wildlife habitat. Among the many human benefits derived from healthy watersheds and functioning natural ecosystems are clean air and water, food, waste assimilation, medicinal compounds, outdoor recreation and spiritual renewal (Daily et al. 1997a, 2007b). The economic value of such natural "goods and services" is significant and has been estimated to be twice the world's gross national product (Costanza et al. 1998). These social, economic, and ecological realities emphasize the importance of watershed based approaches to restoring and sustaining critical land and water resources, with support and recognition of the working landscape and the human communities that depend on them.

The refuge has a presence within multiple communities throughout the watershed by virtue of our management of a growing number of refuge units and divisions, and community outreach efforts. At the core of the rationale to create and maintain strong community partnerships is the requirement that we be good citizens and environmental stewards. We will continue to strive to play a positive role in the well-being of these cities and towns by managing the refuge in ways that improve the quality of the local environment, making refuge units, divisions and facilities attractive and welcoming to visitors, and capitalizing where practical and appropriate on local partnership opportunities from civic events to land management issues. A list of current partners important to our efforts to build and sustain strong community partnerships is included in appendix N.

There are many formal ways for the Service to show commitment and support for these partnerships, both monetary and non-monetary. Cooperative agreements with communities and private organizations can provide a means to share goals, such as the development and delivery of refuge-specific environmental education programming. Special use permits allow for compatible activities on refuge lands and are used to allow economic activities that enhance a visitor's experience, such as guided interpretive outings for hire. Through MOUs with other Federal agencies, state agencies, local municipalities, community groups and conservation organizations, the refuge and its partners can pool resources for important land protection projects, habitat management efforts, and recreational initiatives. Previously, the Service and NRCS shared the cost of an employee housed at the refuge, dedicated exclusively to advancing partnership opportunities between NRCS and the Service within the watershed.

**Objective 4.8: Educational and Interpretation Partnerships**

In conjunction with the strategies described under Goal 2—Environmental Education, Interpretation, and Outreach, above—coordinate our educational, outreach, and interpretive conservation programs with those of our partner agencies and organizations so that a consistent public message fosters respect for the natural world and gets more people motivated to promote conservation in their daily lives.

Our guidelines and strategies for working cooperatively with others to facilitate connections between people and nature throughout the watershed, with priority attention to CPAs, include the following:

- **Educational Partnerships:** Work with each of the four State environmental education program coordinators and other partners to identify effective education programs, to integrate curriculums where appropriate, and to promote consistent standards of excellence for educational programs offered in the watershed.

*Rationale:* See rationale for entire objective below.

- **Integrated Messaging:** Work with environmental education partners to clearly communicate respective missions, goals, and priority programs and activities to minimize redundancy and facilitate targeted outreach and responses to constituent groups. Develop a common language about the goals of the education partnership as an effective way of attracting financial, organizational, and human resources to the refuge and our partners. Develop and deliver integrated interpretive messages about natural, cultural, and historic resources along regional land and water trails and scenic byways that connect refuge lands with conserved properties owned by state and private partners. Contribute interpretive information regarding the refuge to partner programs such as Vermont's Scenic Byways publications. Reinforce the refuge as a location for educational programs.

**Rationale:** See rationale for entire objective below.

- **Facilities Partnerships Designed to Connect People and Nature:** Continue and enhance those partnerships based in facilities that are effective in reaching a wide and diverse demographic with consistent and productive messages about the refuge and the Service's contribution to conservation in the watershed. Continue to seek new opportunities where this same goal can be met. The existing partnerships include:
  - \* **MOU/Cooperative Agreement between the refuge and Vermont Institute of Natural Science:** This relationship provides for the development and delivery of refuge-specific programming, such as a watershed-learning module and staffing the refuge's WoW Express.
  - \* **Cooperative Agreement between the refuge and Montshire Museum:** The Montshire constitutes the refuge's Vermont "visitor center." This relationship allows the refuge to have exhibits in the museum.
  - \* **Cooperative Agreement between the refuge and Springfield Museum:** The Museum provides space to host and maintain a Conte Corner exhibit and partners with the refuge in outreach programs involving the WoW Express.
  - \* **Cooperative Agreement between the refuge and Northwoods Stewardship Center:** The Northwoods Center provides for staffing and supervision of YCC crews at several refuge divisions. YCC participants assist with trail construction and maintenance, and habitat management projects. The program informs participants about refuge goals and resources and contains an environmental education element.
  - \* **Cooperative Agreement between the refuge and Siskin Ecological Adventures:** This collaboration reaches out to those communities surrounding the Nulhegan Basin Division, engages participants in activities at the division, and informs participants about the division's conservation role and recreational opportunities.
  - \* **MOU between the refuge and Cabela's:** The Cabela's outfitter store in East Hartford, Connecticut, provides space to host and maintain a Conte Corner exhibit and support other outreach and interpretive activities in partnership with refuge staff.
  - \* **MOU between the refuge and Putney Mountain Association:** This collaboration provides for designation and management of a shared hiking trail network across ownerships, as well as, trail enhancements and publications.
  - \* **MOU Between the refuge, the Massachusetts Department of Conservation and Recreation, and the town of Montague Economic Development and Industrial Corporation:** The partnership supports the operations of the Great Falls Discovery Center in Turners Falls, Massachusetts. The purpose of the center is to provide opportunities for the study, understanding, and enjoyment of fish and wildlife in their native habitat. The center interprets the cultural, geological, and ecological history of the watershed and encourages visitors to get involved in conservation activities. (See appendix A for more details on our environmental education, interpretation, and outreach objectives and strategies for this facility).

**Rationale:** The 7.2 million acres of the watershed offer an extraordinary range of active and passive opportunities to observe, interact with, and recreate

in the natural world. Accentuating the refuge's relevance to our constituents and their communities allows us to maintain a position of environmental leadership and enhances our ability to deliver the outcomes envisioned under the four broad goals of this CCP. Though our fundamental mission is wildlife conservation, we recognize that to be successful, we must inspire the people of the watershed to connect with the abundant natural resources and participate as stewards of the refuge. As an integral part of local communities, the refuge is a great umbrella under which to build a broader conservation constituency. The refuge will work with schools, civic groups, and individuals to share our passion for the environment and our mission. We must push ourselves to reach out to those who are yet unfamiliar with who we are and what we do. Part of our mission is ensuring that all citizens within the watershed benefit from the refuge, and this will help sustain strong support for the refuge and Refuge System as a whole. Our goal must be to inspire all Americans to become part of a conservation constituency.

Work with partners to promote and provide outdoor recreational opportunities in the watershed that facilitates connecting people with nature in a meaningful way, and encourages those connections over their lifetimes. Promote the development of a

landscape based recreation strategy within the watershed to connect, protect, and enhance a network of aquatic and terrestrial trails.

Our guidelines and strategies for working cooperatively with others to facilitate recreational opportunities throughout the watershed, with priority attention to CPAs, include the following:

- **Federal and State Agency and Local Community Strategic Recreation Plans:** Support Federal and State agency partners in their recreational planning and implementation efforts. Those include Forest Service plans, respective States Comprehensive Outdoor Recreation Plans, and Federal and state agency transportation plans. Also, support implementation of other recreation plans developed and adopted by local communities.

**Rationale:** See rationale for entire objective below.

- **Making Connections Outdoors:** Promote activities that connect people with the outdoors through improving coordination with other Federal and State agencies, including the Federal Interagency Council on Trails, the Connecticut River Recreational Management Plan (2009), educational and recreational organizations, and user groups. Help sustain regional trails that connect



Sharon Lindsay

*Black Branch of the Nulhegan River*

people with nature, such as the Northern Forest Canoe Trail, Connecticut River Birding Trail, Connecticut River Paddlers' Trail, and the "Source to the Sea" birding trail. Engage with partners to develop concept plans, interpretive materials, and conduct inventories of infrastructure to support these trails and initiatives.

**Rationale:** Public recreation and enjoyment of the outdoors has been part of the culture of the watershed for centuries. The range of opportunities in the area allow for visitors seeking solitude and inspiration in its forests and mountains, water-based challenges afforded by one of the nation's great rivers, and more developed opportunities. The 2009 Connecticut River Recreation Management Plan notes that the significance of the region for public recreation is growing, as evidenced by the many special designations bestowed on the region, including scenic byways and blueways, and heritage and historic water and hiking trails. These are in addition to the thousands of acres providing public recreation on Federal and State lands. We can only expect greater public use of the river and the valley which will provide both opportunities and challenges. The challenges include encouraging the use and enjoyment of public lands, while also protecting the region's natural resources, beauty, and quality of life.

**Objective 4.10: Friends Groups**

Develop and nurture active and vibrant Friends groups through formal, strategic support programs, and by strengthening communication, collaboration, and cooperation. Include them as full partners in the mission delivery of the refuge and the Refuge System. Implement national guidance on mentoring Friends groups designed to ensure each group's effectiveness in supporting the refuge, as well as to provide training and organizational resources, and encourage networking among Friends groups across the Refuge System. Provide guidance to partners who want to create Friends groups on other ownerships.

Our guidelines and strategies for working cooperatively with others to facilitate the creation and support for Friends groups include the following:

- **Friends of Conte Refuge:** Encourage and cultivate the incredibly effective "Friends of Conte" group and promote them as a model for how other groups around the country can support landscape-scale conservation. Support the Friends of Conte in their work on the ground as individual organizations, and in their collective advocacy role as a regional and national voice on environmental issues and matters of importance to the Refuge System and the Service. Continue to use the Friends Steering Committee recommendations to help evaluate refuge policies and priorities for all aspects of refuge operations.

**Rationale:** See rationale for entire objective below.

- **Friends Groups for Refuge Units and Divisions:** Develop, promote, and support existing Friends groups at each of the refuge's divisions. As the refuge begins to form new divisions within CFAs, help develop and grow new Friends groups modeled on the success of the Friends of Pondicherry. Strong community outreach by refuge staff in new host communities will be the key to forming new groups, as well as being responsive to community needs and interests. Annual planning will occur to set goals and objectives for projects and programs in support of the refuge and the Friends group for the coming year, as well as to evaluate the past year's activities. We will formalize each group's relationship with the Service through a written agreement. We will also encourage each Friends groups to pursue status as a 501(c)(3) organizations (under the Service's new Friends group policy, official refuge Friends groups must have nonprofit status under Section 501(c)(3) Title 26 of the Internal Revenue Service code; 633 FW 1).

**Rationale:** See rationale for entire objective below.

- **Support for Friends Groups on Other Ownerships:** Continue to promote and support the Friends of the Great Falls Discovery Center and provide resources to conservation groups, landowners, neighbors, and others interested in establishing a Friends group on other ownerships.

**Rationale:** Friends groups have become a vital component of the work we do on the refuge. Members serve as advocates for refuge resources, partners in refuge initiatives across all four broad goals, providers of science and research on issues affecting habitat and wildlife conservation at the refuge, and volunteers at individual refuge divisions or units. They provide support for specific essential services to our sites and programs, including community outreach, coordinating special events, developing and delivering educational, interpretive, and other visitor services programs, coordinating volunteers, conducting habitat restoration and biological program support, and assisting in maintenance projects. Friends groups are an essential and irreplaceable resource to refuge management and visitor opportunities. The Service adopted policy for Friends groups in 2014. This policy (633 FW 1-4) recognizes the values Friends groups provide in achieving the Service and Refuge System mission and provides policy, guidance, and administrative procedures for Service employees to establish partnerships and working relationships with Friends organizations.

The Friends of Conte is an “association of organizations” that has become a leading advocate for conservation, environmental education, wildlife- and fish-related recreation, and stewardship in the Connecticut River watershed. This Friends organization is comprised of more than 70 of the country’s most accomplished national, regional, and local land conservation, recreation, sustainable economic, and environmental advocacy organizations. Drawing upon the broad local experience and national prominence of group members such as TNC, Audubon Society, and the Trust for Public Land, this group has effectively supported a wide variety of refuge initiatives.

The refuge is also fortunate to have the support of strong and dedicated Friends groups at its Pondicherry and Nulhegan Basin Divisions, and at the Great Falls Discovery Center. Members of these Friends groups interact with visitors, identify and assist in maintenance needs, monitor wildlife, conduct educational workshops, and provide other valuable support activities. Other Friends groups that are forming include the Connecticut River Paddlers’ Trail, Friends of Roger Tory Peterson Unit, and Friends of Salmon River.

In promoting and supporting Friends groups across the country, the Service has developed many resources to assist others in that endeavor. These materials are available to our partners who may be interested in developing a similar group. In addition, if there is interest, we could help identify mentoring opportunities whereby a refuge Friends group could assist a partner group.

**Objective 4.11  
Intergovernmental  
Partnerships**

Pursue strategic and synergistic intergovernmental partnerships at all levels of government to achieve specific, shared, and compatible landscape-level goals for conservation, education, and recreation within the watershed. Work within existing Federal and State programs to the full extent possible to help leverage funding and staff resources, information, and expertise among public and private partners. Formalize agreements through MOUs, Memorandums of Agreement (MOAs), or other written, intergovernmental agreements, as warranted, when the identification of roles, responsibilities, and measures of success will enhance the likelihood of successful implementation.

Our guidelines and strategies for working cooperatively with others to develop strategic, intergovernmental partnerships, with priority attention to benefitting CPAs, include the following:

- **Existing Intergovernmental MOUs:** Continue to support existing MOUs and other intergovernmental agreements that are facilitating the Service and Refuge System missions, Conte Refuge goals, or other conservation priorities in the watershed. Work with partners to monitor and evaluate MOUs prior to their renewal; continue, modify, or drop MOUs as warranted. The following provides a brief overview of MOUs' currently in place.
- \* **MOU with Natural Resources Conservation Service:** This MOU, entered into in 2011, created a "Connecticut River Partnership" between the Service and NRCS to pool human and financial resources where appropriate in pursuit of the Refuge's legislative purposes and the objectives of the Obama administration's AGO initiative.
- \* **MOU establishing the Connecticut River and Watershed National Blueway:** The purpose of this MOU (May 2012) between the Departments of the Interior, Agriculture, and Army, is to identify and create opportunities to work together as partners to accomplish shared, compatible, and priority conservation, restoration, outdoor recreation, and environmental education objectives. A principle goal of this partnership is the pursuit of a comprehensive and integrated management approach to conserving the Connecticut River's s land and water resources.
- \* **MOU Between the Connecticut River Watershed Council, the Friends of Conte Refuge, and Conte Refuge:** This MOU (April 2012) commits the partners to actively pursue opportunities with Federal agencies to recognize, value, and obtain the necessary resources for conservation, recreation, and education opportunities in furtherance of the refuge's legislative purposes.
- \* **MOU Establishing the Connecticut River Watershed as a Large Landscape Demonstration Project under the America's Great Outdoors Presidential Initiative:** This MOU (December 2012) was established under existing authorities, including the President's Memorandum of April 16, 2012: *A 21st Century Strategy for America's Great Outdoors*. This MOU recognizes the overlapping and complementary conservation interests of nine Federal agencies. It also recognized the "...great potential for mutual benefit from enhanced cooperation and synergies, especially in the area of large landscape conservation where alignment of multiple resources will result in strategic and effective conservation outcomes." Three guiding principles were identified relating to the importance of integrated planning and implementation, shared capacities, and shared science and information. Nine goals and objectives identify action items agreed upon.

**Rationale:** See rationale for entire objective below.

- **Federal Agency Coordination:** In addition to those relationships noted above, continue to engage Federal agencies in shared conservation goals and priorities for the watershed, and to expand, expedite, and enhance the deployment and desirable impacts of Federal programs through public and private partnerships. Seek opportunities, to the extent possible, to share financial and staff resources, information, expertise, and otherwise leverage multi-agency investments in the watershed to accomplish shared goals and attract other investors. Utilize the AGOs framework to catalyze and bolster

local, community-driven conservation efforts and demonstrate how a strong Federal agency partnership can more effectively align, target, and leverage public resources across a large landscape to accomplish shared goals and objectives.

Specifically, expand on opportunities to partner with:

- \* The USDA and its existing agencies and programs that contribute toward the planning, managing, and sustainability of fish and wildlife habitat, water quality and watershed health, working landscapes (including agriculture and forestry), recreational opportunities, and land protection. The NRCS has eight landowner assistance programs. As mentioned under objective 4.1 above, there is a 2016 Service Director's Order #217 detailing a partnership with NRCS to assist private landowners through their Working Lands for Wildlife and other programs and achieve agency conservation goals. The Forest Service supports land protection, management, and public access on other ownerships through their Forest Legacy, Community Forest, and Forest Stewardship programs. Additional private lands assistance is offered through the Farm Service and Rural Development agencies.
- \* The Department of Transportation (DOT) and its programs that facilitate public access to public lands, improve byways, develop and maintain trails, and address problematic fish barriers and wildlife crossings caused by transportation infrastructure. Public Lands Highway, Surface Transportation, National Scenic Byways, and Federal Highway Administration Recreational Trails Grants, are all DOT programs with potential funding to support projects by public and private partners.
- \* The Department of Labor and its programs that implement youth employment opportunities in the field of conservation. The Employment and Training Administration Program, pursuant to the Workforce Investment Act, supports grant opportunities to fund work for youth who could be employed and trained in work related to conservation.
- \* The Department of Commerce, NOAA, and its programs related to dam removal, aquatic species passage, and coastal wetlands restoration. Their Community-based Restoration grants and other related programs support grant opportunities for these types of projects.
- \* The Department of Housing and Urban Development, and its programs to help develop green open spaces in cities, restore habitats, and enhance water quality. Grants and other funding sources are available in support of these programs.
- \* The EPA and its programs to protect, preserve, and promote water quality, urban revitalization, habitat enhancement, and environmental stewardship. Grant funding opportunities are available for public-private partnerships through their Urban Waters Federal Partnership Initiative, Brownfields pilot program, Watershed Planning and Implementation program, Wetlands Program Development, as well as grants for monitoring and assessments, environmental education, and community watershed restoration projects.
- \* The USACE and its programs that manage water resources infrastructure to coordinate on fish passage concerns, opportunities to promote more natural riverine flows and function, and support outdoor recreational opportunities.



- **Tribal Government Coordination:** Refuge staff will continue to coordinate with federally recognized Tribal governments in areas of mutual interest, including hunting and fishing opportunities and access, wildlife and aquatic habitat management, federally listed species management, wildlife and fish habitat projects, and land protection. Federally recognized tribes we will coordinate with include: Mashantucket Pequot Tribal Nation, Mohegan Tribe of Indians of Connecticut, Stockbridge-Munsee Band of the Mohican Nation, Narragansett Indian Tribe (Connecticut River Valley), Mashpee Wampanoag Tribe, Wampanoag Tribe of Gay Head (Aquinnah).

**Rationale:** As noted above, there are multiple Federal agencies with conservation missions or conservation-related programs that offer valuable contributions to the conservation community. Each can bring significant resources in pursuit of the four Conte Refuge goals related to conservation, education, recreation, and partnerships.

The AGO's initiative provides a framework within which to work together to meet those goals. The framework provides a catalyst for Federal agencies to lead or facilitate efforts promoting the watershed as nationally significant for conservation, education, and recreation. The design is to work within current Federal authorities and funding, and leverage those resources to attract other public and private partners to "invest" their resources consistent with their own priorities. This collaboration, as described in the America's Great Outdoors MOU will serve to "...bind together the many existing and complimentary visions for the River, held by a wide array of governmental and NGOs to stimulate new achievements and energize existing creative public and private partnerships in the spirit of the America's Great Outdoors Initiative."

While some beneficial programs are listed above, there are likely more to be explored, and some new programs have potential for the near future. For example, under consideration in Congress is a new Water Resources Development Act (WRDA) which would authorize the USACE, as managers of the nation's largest water resources program, to develop cost-effective, nature-based solutions to water problems and modernize our water infrastructure.

The status of the Farm Bill is always noteworthy. A 5-year reauthorization was recently enacted. Some argue that this Act represents the nation's largest investment supporting the voluntary and successful conservation, restoration, and management of America's private lands. It provides incentives to farmers, ranchers, and other private landowners that result in cleaner water, improved soil conservation, enhanced wildlife habitat and outdoor recreation opportunities, reduced flood risk, and stronger local communities.

With regards to federally recognized Tribal governments, the U.S. has a unique legal relationship with these governments as set forth in the Constitution, and in treaties, statutes, executive orders and court decisions. The U.S. recognizes these tribes as domestic dependent nations under its protection and has enacted numerous statutes and promulgated numerous regulations that establish and define a trust relationship with Indian tribes.

Due to this unique and distinctive political relationship, the Service maintains government-to-government relationships with federally recognized Tribal governments. In particular, the Service works directly with Tribes when planning and implementing natural resource programs, and to protect and respect Native American values.

## **General Refuge Management Direction**

Close coordination with federally recognized Tribes supports all four refuge goals.

Below we list management actions that relate to multiple goals and objectives, or represent general administrative or compliance activities, and thus do not align with the hierarchical structure of goals, objectives, and strategies presented above. These actions are nonetheless critical to achieving the refuge's purposes, vision, and goals.

Actions listed below may be required by law or policy, or represent NEPA decisions that have already gone through public review, agency review, and approval. Others may be administrative actions that do not necessarily require public review, but we want to highlight them in this public document. Though they are not listed below, the existing NEPA decisions listed in the final CCP/EIS chapter 4, table 4.1, are incorporated in our general management direction.

Following the list below is a narrative description of each.

- Partnerships.
- State Fish and Wildlife Agency Coordination.
- Community Relations.
- Grants Program.
- Urban Wildlife Refuge Partnerships.
- Land Stewardship Outreach.
- Land Conservation and Protection.
- Agricultural and Forest Lands Protection.
- Rare and Exemplary Natural Communities.
- Adaptive Management.
- Research.
- Inventory and Monitoring Program.
- Integrated Pest and Invasive Species Control.
- Refuge Staffing and Administration.
- Youth Conservation Corps.
- Volunteers.
- Refuge Operating Hours.
- Refuge Step-down Plans (e.g., Habitat Management Plans, Visitor Services Plans, Fire Management Plans, etc.).
- Environmental Education, Interpretation, and Outreach.

- Hunting and Fishing.
- Appropriateness and Compatibility Determinations.
- Activities Not Allowed.
- Permitting Special Uses.
- Commercial and Economic Uses.
- Removing Unnecessary Structures and Site Restoration.
- Cabin Leases at Nulhegan Basin Division.
- Boating Access.
- Furbearer Management.
- Fire Management.
- Expanding the Pondicherry National Natural Landmark.
- Cultural Resource Protection.
- Endangered Species Act Section 7 Consultations.
- Wilderness Review.
- Wild and Scenic Rivers Review.
- Distributing Refuge Revenue Sharing Payments.
- Silvio O. Conte Refuge Advisory Council.

## **Partnerships**

We will continue to maintain the existing partnerships identified in appendix N, while 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 compatible wildlife-dependent recreation. Their importance is so paramount, we have dedicated goal 4 to highlight the present and future partnerships. The respective State wildlife agencies and partners comprising the Friends of Conte have been particularly important and valued conservation allies. We will continue to work collaboratively with existing partners and pursue new relations in areas of mutual interest that benefit refuge priorities. We highlight several partnership elements below. Implementing this program supports all refuge goals, with particular emphasis on goal 4 and the conservation and management of wildlife resources through partnerships.

## **State Fish and Wildlife Agency Coordination**

Refuge staff will continue to coordinate with the four respective State wildlife agencies in areas of mutual interest, including the protection of Federal and State listed species and other species of concern, hunting and fishing seasons and regulations, wildlife and aquatic habitat management projects (including aquatic species passage) both on and off refuge lands, environmental education, and land protection. This close coordination is grounded in the 1997 Refuge Improvement Act and Service policy (601 FW 7) directing “early and close coordination and cooperation” with our State counterparts in a “timely and effective manner.” State coordination and cooperation is an emphasis in the recommendations from

*Northeastern bulrush*



USFWS

the 2011 Refuge System vision conference, “Conserving the Future: Wildlife Refuges and the Next Generation.”

It is a clear imperative that refuges should coordinate with States when involved in planning efforts of mutual interest, including CCPs, habitat management plans, and hunting and fishing plans, as examples. The CCP process is specifically mentioned in 601 FW 7 policy as a Service action requiring close collaboration with affected States. Furthermore, the policy directs we ensure that Refuge System regulations and management plans are, to the extent practicable, consistent with respective similar State laws, regulations, and management plans. We will also continue to work with the States as they develop and implement their respective wildlife action plans. Finally, Presidential Executive Order #13443–Facilitation of Hunting Heritage and Wildlife Conservation, directs the Service to work with state fish and wildlife agencies to manage wildlife and habitats to foster healthy and productive populations and provide appropriate opportunities for hunting those populations. Close coordination with State agencies supports all four refuge goals.

We will continue to meet and work with community leaders, elected officials, local landowners, and the public. This remains a challenge given the small staff and landholdings spread across more than 300 miles in four states. However, we will continue to strive to maintain a good line of communications within each of the communities where the refuge is working. Enhanced community relations will help support all refuge goals. The WoW Express, BAT, Adopt-a-Habitat, open houses, and a range of public access facilities and opportunities will be employed to accomplish refuge purposes and strengthen community ties to the refuge.

The administrative capability to implement a grants program will remain in place so that refuge staff can award grants through the Partners program or through other grant funds should funds become available. At this time, no funding is available and the forecast for future funding is very uncertain. The 1995 FEIS included an important program for awarding CCS grants and Partners program monies to fund projects for conservation, education, recreation, and land stewardship. Funding both public and private projects to manage and restore wildlife populations and habitats, and support environmental education programs, was the major focus of the grant program identified in the 1995 EIS. In its early years, approximately \$100,000 was available for distribution in the CCS budget for the refuge. In its last 2 years of implementation, years 2000 and 2001, 22 projects were funded by the refuge each year, with an annual budget of approximately \$89,000 and \$75,000, respectively. Both years prioritized awarding projects on partner lands.

Unfortunately, after 2001, the refuge was never able to secure a stable, annual funding source and the available funding declined to zero dollars. In fact, due to budget issues, the Service put the entire CCS program on hold nationally in fiscal year 2011. Despite this setback, refuge staff seek to retain the authority and administrative framework to implement a CCS or other Federal grant program should funding become available, and continue to maintain a Partners program, because of the immeasurable benefits of leveraging funding among partners to achieve all four refuge goals.

The Service’s most recent guidance on CCS grants was developed by the Department in 2010 (DOI Guidance Release 2012-05). The Service’s manual chapter 055 FW 6, prepared in 1992, has not been updated to reflect this new guidance, but we will remain compliant with all current guidance. An active grants program will support all refuge goals, as well as the legislated refuge purposes.

### **Urban Wildlife Refuge Partnerships**

The Refuge System's Urban Wildlife Conservation Program, and the refuge's current contributions to that program (e.g. establishing Urban Wildlife Refuge Partnerships), are described in chapter 3. As noted in chapter 3, opportunities for urban partnerships are particularly relevant for Conte Refuge due to the refuge's proximity to several major cities and many urbanized areas, such as the Springfield, Massachusetts and Hartford, Connecticut metropolitan areas. These refuge partnerships aim to engage students and community members in environmental education and urban restoration projects to create a network of conserved habitats in the Connecticut River watershed.

We will continue to support our existing urban wildlife refuge programs in Springfield and Hartford, and pursue new ones. Implementation of the urban programs can also occur through existing refuge programs such as Adopt-a-Habitat, Conte Corners, WOW Express, YCC, SCA crews, and volunteers. Working with partners to protect important habitats and engage urban audiences in conservation contributes to all refuge goals.

### **Land Stewardship Outreach**

We will continue to encourage landowners and conservation organizations within the watershed to consider all opportunities to benefit wildlife and aquatic habitats when they are evaluating management options. This outreach will take many forms, including personal landowner contacts, community forums, and supporting their efforts to secure funding for restoration projects and for habitat and farmland protection, such as easements. Further, we will seek opportunities to support sustainable recreational and economic practices. By working collaboratively where refuge priorities are an important consideration, and by sharing the most current science, research, and management practices with landowners and partner organizations, we hope to sustain the excellent standards of stewardship that are the hallmark of the region's strong land ethic. This program will support goals 1, 2, and 4.

### **Land Conservation and Protection**

An important partnership is focused on land conservation in the watershed. The decision document establishing the refuge (USFWS 1995) emphasized that the refuge was part of a larger conservation mosaic to protect and manage wildlife and fish habitat in the four-state watershed. We carry that emphasis forward to 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 Connecticut River watershed. An important component of this goal is an objective to improve connectivity between existing and future conservation tracts, while preserving working landscapes, and public access. The refuge's conservation partnerships in the region have evolved into a dynamic, landscape-level, multi-partner effort, led primarily by the Friends of Conte. As an association of organizations, the total list of engaged partners is long and includes the Service, other Federal agencies, State agencies, private conservation organizations, local communities, private landowners, and private businesses. A list of partnerships we are involved with is included as appendix N. Chapter 3 and the LPP (appendix C) include descriptions of some of the important refuge acquisition accomplishments to date, as well as some current land conservation projects. In our discussion of CPAs and CFAs under the alternative B summary above, we discuss that our land acquisition focus for the refuge will be in CFAs. Elsewhere in CPAs and the greater watershed, we will work to actively support partner-driven land protection initiatives, with a priority to facilitate connections among conservation lands, especially those that will build biological continuity with the refuge and watershed.

When the Service acquires land from willing sellers in full, fee-simple ownership in the future, our intent is to allow public access for compatible public recreation and other compatible refuge uses, consistent with what we currently allow.

When a conservation easement, or a partial interest, is purchased, the Service's objective is to obtain all rights determined necessary to ensure protection of Federal trust resources on that parcel. Typically, at a minimum, the purchase will include development rights. However, we may also seek to obtain the rights to manage and enhance habitats, and/or to manage public use and access, if the seller is willing and funding is available. Implementing a land conservation and protection program helps to achieve all refuge goals.

### **Agricultural and Forest Lands Protection**

We support the protection of high-value and productive working farms and forests. We will seek opportunities to facilitate and support the enrollment of these lands into voluntary landowner incentive programs, and once enrolled, consider those lands conserved. The refuge does not intend to target these lands for acquisition. Instead, our priority will be to work with individual landowners, organizations, states, and other Federal agencies to protect these lands and ensure they continue to be part of an integrated, working landscape. There are many state and Federal programs that focus on protecting working farms and forests and help promote economically viable practices that benefit wildlife and help protect water quality. Through our private lands program, we will help landowners who are interested in these programs connect with the proper state and Federal agencies and programs.

Occasionally, we may acquire agricultural lands (in fee-title) from willing sellers, when other agricultural programs are not available to keep the land in agricultural production. Unfortunately, in certain economic times the costs to farmers to sustain agricultural protection are prohibitive, and the value of the lands for development is very high. In these situations, we may purchase agricultural lands to prevent development and ensure wildlife habitat conservation.

Working with partners to protect agricultural land from development will help achieve goals 1, 3, and 4.

### **Rare and Exemplary Natural Communities**

This plan strives to protect, maintain, and restore rare and exemplary natural communities across the watershed, and particularly on refuge lands. Natural communities are an assemblage of plants and animals within a particular physical environment that are affected by natural processes such as soils, hydrology, topography, and climate (Thompson et al. 2000, Sperduto et al. 2004, Garland 2011). Species composition, vegetation structure, and environmental conditions are distinguishing characteristics used to classify natural community types (Thompson et al. 2000, Sperduto 2004). Natural Heritage Programs evaluate these communities and assign them a quality rank based on the ecological integrity of the community relative to other examples of that community type. Rare and exemplary ranked communities are a conservation concern due to their minimal presence on the landscape. A community may be considered rare due to natural influences (e.g., edge of range), or from human disturbances. Exemplary communities are high quality examples of more common community types, and tend to have a high biological diversity (Thompson et al 2000, Sperduto et al. 2004).

Exemplary and rare natural communities in the Connecticut River watershed, such as vernal pools, are vitally important to the health, integrity, and biodiversity of the watershed and contribute to our understanding of natural systems and their functions. Despite the small size, patchiness, and ephemeral nature of some of these habitats, their value is disproportionately significant. This plan recognizes their importance and promotes their conservation and restoration, where feasible.

Our objective is to conserve and maintain all rare and exemplary communities identified by respective State natural heritage programs to maintain the integrity, amount, and distribution of these community types across the watershed. On other ownerships, we will work with willing landowners to protect and restore these areas, and seek special designations as appropriate. Within 10 years of CCP completion, and in coordination with the respective States and other conservation partners, we will:

- Assist partners in completing inventories and mapping for known rare or exemplary communities within the watershed.
- Assist partners with assessing habitat conditions in mapped areas and identify any threats to those conditions.
- Evaluate the potential occurrence of rare or exemplary communities on refuge lands before refuge activities are initiated, and if they are located, ensure best management practices are followed to protect them.
- Facilitate the development and use of a decision support tool to prioritize any needed restoration efforts for these community types on refuge lands and use active restoration (e.g., tree plantings, tree girdling, non-commercial thinning, and removal of invasive species), as warranted.
- Help monitor species' response to restoration and protection efforts.
- Cooperate with willing landowners to promote special designation areas for these natural community types, as warranted, to support their protection.
- Implementing this program supports refuge goal 1 relating to wildlife and fish habitat conservation.

## **Adaptive Management**

This plan will continue to utilize an adaptive management approach on refuge lands that allows flexibility in management to respond to new information and spatial and temporal changes and environmental events, whether foreseen or unforeseen, or any other factors that influence our decisions. Our goal is to be able to respond in a timely manner to any new information or events. The need for flexible or adaptive management is compelling today because our present information on refuge species and habitats is incomplete, provisional, and subject to change as our knowledge base improves.

One example of how we will implement adaptive management is in response to the regional impacts of climate change. Our watershed-level partnerships with state agencies, numerous conservation organizations, private and other public landowners, coupled with our refuge expansion plans, will result in more resilient habitats across the landscape, and help reduce other non-climate stressors. Conserving and connecting protected lands provides wildlife migration corridors, maintains refugia 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. As funding permits, 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 within a scientifically rigorous framework, and tracking critical resources and indicators of forest ecosystem health, is a fundamental component of an adaptive management strategy. As appropriate, the refuge manager, in consultation with

stakeholders, will be responsible for changing management actions and strategies on refuge lands if they do not produce the desired conditions. As we develop HMPs and a variety of other public access and operation plans that build off this CCP, any significant changes 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. Implementing an adaptive management strategy will support all refuge goals (goals 1 through 4).

## Research

Research on Federal trust and other priority species and their habitats will continue to be an important aspect of refuge administration and also encouraged through partnerships on lands throughout the watershed. Generally, we will continue to approve special use permits for research on refuge lands that provide a direct benefit to the refuge by informing decisions on managing natural resources on the refuge and throughout the watershed. The refuge manager may also endorse and support study proposals throughout the watershed that contribute to the conservation or enhancement of native species and biological diversity, inform climate change predictions, or support ecoregional conservation information needs, such as those identified by the NALCC, Joint Ventures, species recovery plans, or Friends of Conte Stewardship Committee.

All researchers operating on refuge lands will continue to be required to submit detailed research proposals following the guidelines established by Service and refuge policy. Special use permits will also identify the schedules for progress reports, the criteria for determining a completion date, and the requirements for publication of interim and final reports. All publications will acknowledge the Service's role as a key partner and in funding and/or operations. Researchers will be required to take steps to ensure that invasive species and pathogens are not inadvertently introduced to the refuge or the greater watershed, nor transferred from one part of the watershed to another. We will continue to ask our refuge biologists 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. We may also ask other divisions of the Service, USGS, select universities or recognized experts, or representatives from the four states to help review project proposals and publications.

Some projects, such as banding studies, require additional Service permits. The refuge manager will not approve those projects until all required permits are received and for those projects that may affect federally listed species, not until the consultation requirements under the ESA have been met.

An active research program will support refuge goals 1, 2, and 4.

## Inventory and Monitoring Program

Establishing a baseline of refuge resource information 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, if anything, are threats. Unfortunately, there is not enough time or funding to compile all the information that we would like to know. There are several studies that we have conducted recently, or plan to initiate, as soon as funding is available. These include:

- Breeding songbird baseline inventories (Pondicherry Division collected data in 2004 to 2006, and 2009 to 2011, and Nulhegan Basin Division collected data from 2000 to 2007).
- Puritan tiger beetle monitoring and population management (initiated in 1997).





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### Integrated Pest and Invasive Species Control

- Habitat inventories (which we completed at Nulhegan Basin and Pondicherry divisions) in all refuge divisions, including forest health assessments; to be completed when enough lands are acquired to warrant an inventory effort.
- Breeding woodcock surveys conducted at Nulhegan Basin Division since 2000.
- Other top priority activities we have identified as funding allows include:
  - In conjunction with development of an Inventory and Monitoring Plan (IMP), identify inventory methods, priorities, and schedules to evaluate the status of other priority species and habitats identified in this CCP.

Other projects may arise as we develop our refuge HMPs and work cooperatively with partners to identify conservation priorities across the watershed and as funding becomes available. We will adjust our priorities listed above in response, as warranted, and update our IMP accordingly. Implementing this program supports refuge goal 1 relating to the conservation of wildlife and fish habitats.

The Refuge System has adopted an Integrated Pest Management approach to eradicate, control, or contain invasive species on refuges (517 DM 1 and 7 RM 14). This refuge has a long history of collaborative control both on- and off-refuge lands. Our objectives are to develop criteria that will help us identify priority species for control, react quickly to reduce the chance that new invasive species become established, or pose a threat to susceptible resources, and control the spread of what does exist.

In partnership with others, we will identify and respond to invasive plant and animal species that pose a threat to the native diversity of the watershed, particularly where refuge lands are threatened. Of particular concern on the refuge are Japanese stiltgrass, Japanese knotweed, purple loosestrife, pale swallowwort, water chestnut, mile a minute vine, didymo (also known as “rock snot”), zebra mussels, mute swans, etc. We will continue to train staff and partners to identify, watch for, and report those species deemed by state and regional experts as posing the highest threat and warranting “Early Detection/ Rapid Response” status. These species will be the highest priority to control, if found. Another priority will continue to be eradicating new or very small occurrences of any invasive species before they have a chance to establish in order to keep areas weed-free.

We will continue to focus on controlling, and preventing the establishment of, invasive plants species that are the greatest threat to priority resources. On refuge lands, to the extent possible, we will physically remove invasive species. Chemical control on refuge lands will be assessed on a case-by-case basis. Any chemicals determined by the refuge manager to be necessary will only be used following the mandated internal review and approval, as well as complying with all applicable regulations and laws.

In conjunction with the HMP and IMP, we will develop a list of invasive species of greatest concern on the refuge, identify priority areas with which to be vigilant, and establish monitoring and treatment strategies. We will also consult States and their respective lists of prohibited and targeted invasive species. We will reference 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 complemented 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). Additionally, in 2011, researchers completed an inventory of invasive plant species on a

few refuge divisions (Edvarchuk et al. 2012). This inventory also included recommended actions to help control and prevent the spread of invasive plants on the refuge. Based on these reports and refuge-specific information, we have developed the following strategies in support of goal 1:

- Continue to support efforts by Friends groups to hand-control invasive plants on refuge lands where feasible and effective.
- Institute proper care and cleaning of all refuge equipment to avoid introduction or transport of invasive plants; require researchers and contractors on the refuge to take steps to prevent transport of invasive plants and pathogens.
- Implement outreach and education programs, including signage, where appropriate, to enlist the help of refuge visitors and actively support state initiatives on this topic.
- Ensure all management activities minimize disturbance to soils where invasive plants occur that benefit from disturbance.
- Use clean mulch, gravels, and other materials for all refuge projects.
- Use native species for soil erosion control and restoration purposes. If native plants are not available or suitable, at a minimum, use species with no known invasive tendencies.
- Provide outreach to refuge users, including hunters, anglers, and paddlers and visiting public, to inform them of the risks they pose to accidentally introducing invasive species through their use of the refuge. For example, consider constructing boot brush stations at trailheads of trails that pass through high priority habitat to further prevent the introduction of new seed sources and raise awareness among visitors. Consider encouraging visitors to avoid heavily infested areas to prevent the spread of seeds.

We describe additional actions to combat invasive species that we will conduct in partnership with others under the goal 4 discussion.

## **Refuge Staffing and Administration**

The management direction outlined in this document does not constitute a commitment for staffing increases, funding for operations and maintenance, or future land acquisition. Congress determines our annual budgets, which our Washington headquarters and regional offices distribute to the field stations. Chapter 3 presents our levels of staffing and operating and maintenance funds for the refuge in 2016. The activities we describe below pertain to staffing, administration, and operations.

We will continue to administer and staff the refuge as efficiently and effectively as possible. Below we describe activities related to staffing and administration; some are new, others are on-going. Implementing these activities supports the four refuge goals.

### **Permanent Staffing and Operational Budgets**

Our objective is to sustain annual funding and staffing levels that allow us to achieve our refuge purposes and goals. Currently, the refuge maintains a permanent workforce of 9.5 full time equivalents. This core staff is supplemented by term appointments, and Pathways Program students, within the constraints of the refuge's discretionary operating budget.

In response to Refuge System operational funding declines nationwide, our region initiated a new base budget approach in Fiscal Year 2007. The goal is to have a maximum of 75 percent of a refuge station's budget cover salaries and benefits, while the remaining 25 percent or more will be operations dollars. The intent of this strategy is to improve the refuge manager's capability to do the highest priority work and not have the vast majority of a refuge's budget tied up in inflexible, fixed costs. This strategy was successful for a few fiscal years; however, we now anticipate a level or declining budget environment, which will impact flexibility in managing financial resources and may have implications for the level of permanent staffing. A new round of workforce planning began in 2013 in response to the sequester and anticipated future budget reductions.

In 2011 the refuge entered into a Memorandum of Understanding (MOU) with the four State directors of NRCS. Funding derived from NRCS under this agreement supported a refuge term biologist position. This position was funded by NRCS in FY 2012 and the refuge has since funded it out of declining discretionary operational funding. The role of this position varies by state, but the primary responsibility is to assist NRCS, in coordination with the state wildlife agencies, to implement conservation projects on the property of willing landowners seeking opportunities to bridge gaps in assistance to private landowners. Every effort will be made to avoid competing or duplicating the efforts of partners, especially other state and Federal agencies. A private lands biologist will become a permanent, full-time position.

Appendix G lists our Refuge Operations Needs System (RONS) and Service Asset Management and Maintenance System (SAMMS). We include currently listed projects, staffing, and maintenance needs in those databases, and also indicate their refuge ranking. The SAMMS projects are a list of backlogged maintenance needs that we report to Congress. We also include in appendix G any new projects not yet in the databases, but planned under this CCP management direction. If funding is not available through annual budget requests, we will continue to seek alternate means of accomplishing our projects; for example, through our volunteer program, Service regional grants, or other partnership grants, and internships.

Within the guidelines of the budget allocations, we will seek to fill positions approved in this CCP to accomplish our highest priority projects. Additional staff will provide depth in our biological, visitor services, law enforcement, and maintenance programs. We identify our recommended priority order for new staffing in the appendix G RONS tables. Appendix H portrays staffing requests.

Providing adequate staffing to manage refuge programs supports all refuge goals.

### **Facility Maintenance**

This management direction includes 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 the Nulhegan Basin, Pondicherry, Blueberry Swamp, Salmon River, and Fort River divisions, the refuge office/visitor contact station at the Nulhegan Basin Division. Visitor facilities to be maintained include: the road network and hiking trails at Nulhegan Basin Division, the hiking trails at Pondicherry Division, trailhead parking areas at Nulhegan Basin and Pondicherry divisions, and information kiosks, signs, boardwalks, and viewing platforms on several divisions. The North Branch Trail at the Nulhegan Basin Division and the Mud Pond Trail at the Pondicherry Division will also require periodic maintenance. Any new facilities recommended in the CCP, once

constructed, will be placed on the maintenance schedule. All facilities and fleet maintenance and upgrades will incorporate ecologically beneficial technologies, tools, materials, and practices. We will also continue to remove unnecessary buildings whenever feasible, such as buildings at the Fort River and Dead Branch divisions.

Maintaining facilities and buildings that are necessary for refuge management supports all refuge goals.

### **Energy Efficiency and Reducing our Carbon Footprint**

The Service and Refuge System are working to increase the energy efficiency of our buildings and reduce our carbon emissions. We will continue to replace, as needed, our current fleet of vehicles and equipment with more fuel-efficient models (e.g., hybrid cars and trucks). All new facilities that we construct will incorporate green building technologies (e.g., the use of recycled materials). Trails and related structures will be designed to be easily maintained. We will also explore alternative energy sources and look for ways to upgrade current facilities to be more energy efficient and (e.g., installation of solar panels).

### **Youth Conservation Corps**

Dependent upon annual funding, we will continue the YCC program. The YCC is a summer youth employment program that gives local youth the opportunity to work on refuge biological and visitor services programs. Typically YCC crews are comprised of four to six persons (15 to 18 years old), and two crew leaders. In the past, the refuge has had YCC crews located at the Nulhegan Basin, Pondicherry, Blueberry Swamp, and Fort River divisions. This has been a popular program in the local communities because of limited youth employment opportunities, especially in rural areas. If enough funding can be secured, we will continue to offer this program and expand this program to support additional crews near other divisions as they become established. Supporting the YCC program helps achieve all refuge goals.

### **Volunteers**

Volunteer opportunities will continue to exist under this management direction. Volunteerism has long been a tradition within the Refuge System and has served a critical role on this refuge. The 1997 Refuge Improvement Act and the 2010 National Wildlife Refuge System Volunteer Improvement Act encourage and promote meaningful volunteer services. Assistance by volunteers is recognized as key to successful management of public lands and vital to implementation of refuge programs, plans, and projects, especially in times of declining budgets. Working with volunteers builds personal and community relationships, and promotes a shared stewardship of refuges and their associated natural and cultural resources to be treasured and enjoyed by both present and future generations. Refuge staff will stay apprised of the Refuge System's development of a strategic plan for volunteers, Friends Organizations, and Community Partners.

Refuge staff will continue to cultivate existing volunteers and recruit prospective new volunteers so that more citizens may work successfully to help steward refuge lands and resources. Staff will endeavor to connect with a wider cross section of the American public to increase the diversity of volunteers. Further, staff will strive to provide adequate orientation to the Service and the refuge, a structured, interesting opportunity, enough contact and oversight to give volunteers adequate direction and support, and will ensure the work is recognized and appreciated. We will provide volunteers with an:

- Orientation to the Service, Refuge System, and refuge.

- Explanation of expectations, policies, and procedures that impact the planned work.
- Training in safety, first aid, and best management practices for relevant tasks.
- Training on various management techniques and best management practices for the tasks at hand.
- Written evaluations of and by volunteers to help facilitate recruitment and retention.
- Volunteer appreciation, incentives, and awards.
- On-refuge housing opportunities, as appropriate and when funding and space allow.

An active volunteer program supports all refuge goals.

### **Refuge Operating Hours**

To protect refuge resources, we will continue to open most refuge units and divisions to the public 7 days a week from ½ hour before sunrise to ½ hour after sunset, with the following exceptions:

- To protect sensitive resources, Wissatinnewag Unit, Dead Man's Swamp Unit, and Saddle Island Unit are closed to all public use year-round.
- The Mount Tom Unit is currently closed to all public use year-round due to vandalism and safety concerns. Once it is safe to do so, we intend to open the property for wildlife observation, photography, interpretation, and environmental education.
- Historically, the Roger Tory Peterson and Hatfield Units have been closed to public use. We intend to evaluate opportunities for public recreation with the development and implementation of step-down plans.
- The Nulhegan Basin Division is open 24 hours a day.
- The Third Island Unit is seasonally closed to all public use to protect nesting bald eagles.
- Other areas may be seasonally or temporarily closed to protect refuge resources.
- Snowmobilers under a group permit on designated trails on the Pondicherry and Dead Branch divisions are allowed outside of these hours.
- Hunters, in accordance with respective State and refuge hunting regulations, may be allowed on the refuge outside of these hours.
- Visitors actively engaged in fishing, in accordance with respective State and refuge fishing regulations, may be allowed on the refuge outside of these hours.
- Other exceptions will be by special use permit, such as for research; night or overnight group wildlife observation, interpretive, and environmental educational programs; fishing, and, campers in designated camping sites.

Promoting access on refuge lands for appropriate and compatible uses supports all refuge goals, particularly goals 2 and 3.

## Refuge Step-down Plans

Service planning policy identifies 25 step-down plans that may be applicable on any given refuge. We have identified the plans below as the most relevant to this planning process, and we have prioritized them. They are listed in priority order for completion. We offer a more detailed explanation of some of them following our listing.

Step-down plans will be updated or revised as we gain new information or acquire new refuge lands so we can continue to keep them relevant. Existing plans will be updated consistent with the CCP. All of these plans contribute to the mission of the Refuge System, the refuge's purposes, and one or more of the refuge's goals. Other than step-down plans that are strictly for administrative purposes, all other plans related to public use and access or habitat management will involve NEPA compliance and a public process, including partner, community, and stakeholder participation during plan development, and review and comment prior to a final decision and implementation. Examples include HMPs, Hunting and Fishing Plans, and Visitor Services Plans.

*Within 3 years of CCP approval, we will initiate:*

- HMPs for the following refuge divisions; priority order for completion includes HMPs for Nulhegan Basin, followed by Pondicherry, and Fort River divisions. Other HMPs will be completed as refuge divisions reach a sufficient size for habitat management activities (see discussion below).
- Hunt plans and opening packages for refuge lands in each State. We will follow all required administrative procedures to develop and approve hunt plans on refuge lands.
- Fishing plans and opening packages for refuge lands in each State. We will follow all required administrative procedures to develop and approve fishing plans on refuge lands.
- Annual Habitat Work Plans (AHWPs) will be developed by refuge divisions to support HMP implementation (see discussion below).

*Within 5 years of CCP approval, we will initiate:*

- IMPs for the following refuge divisions (see discussion below); the order of completion follows development of HMPs.
- Fire management plans for refuge divisions; use of prescribed fire may also be included in HMPs, as warranted. If, upon development, it appears to be more efficient to consolidate fire plans by combining multiple divisions (e.g. by state), this will be pursued.

*Within 7 years of CCP approval, we will complete:*

- A Visitor Services Plan, combining all refuge divisions and units. This plan will incorporate hunt and fishing plans, which will be written for each State.
- A Law Enforcement Plan, combining all refuge divisions and units.
- Facilities and Sign Plan, combining all refuge divisions and units.
- Integrated Pest Management and Invasive Species Plan (see discussion below), combining all refuge divisions and units.

## Habitat Management Plans

A HMP for refuge divisions of manageable size is the requisite first step to achieving the objectives of goal 1. For example, the HMP will incorporate the

habitat guidelines and strategies developed herein, and identify “what, where, how, and when” actions will be implemented over the 15 year timeframe 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 guidelines and strategies under each objective identify how we intend to manage habitats on the refuge.

Both the CCP and HMP are based on public, stakeholder, and partner input; current resource information; published research; and our own field experiences. Our methods, timing, and techniques will be updated as new, applicable information becomes available. To facilitate our management, we will regularly maintain our GIS database, documenting any major vegetation changes (e.g., changes due to climate change) on at least a 5-year basis. As appropriate, actions listed below will be incorporated into the HMP. When developing HMPs, refuge staff will follow all appropriate NEPA compliance requirements.

#### **Annual Habitat Work Plans**

The AHWPs for the refuge are priorities for completion upon CCP approval. This plan is important and helpful when implementing habitat management actions and measuring our success in meeting the habitat objectives under goal 1. The AHWP is generated each year from the HMP, and will outline specific management activities to occur in that year. This document can also be used as an outreach tool to communicate our management plans and report our accomplishments for a given year.

#### **Inventory and Monitoring Plans**

IMPs will outline and prioritize the methodology to assess whether our original assumptions and management actions are supporting our habitat and species objectives. For example, the IMP will help determine what types of inventories and surveys to conduct on refuge lands. Currently, we have some baseline information on our larger, more established refuge divisions (e.g., Nulhegan Basin and Pondicherry Divisions), but lack thorough baseline inventories on many of our smaller units and newer divisions. Also, as we acquire new refuge lands, our priority will be to conduct baseline vegetation and wildlife surveys and habitat mapping. All of these surveys will help us develop or refine an HMP.

The IMP will also detail the types of long-term monitoring we plan to conduct on the refuge. During the development of our IMPs, we will coordinate our projects with the work and priorities of the NALCC and with studies being conducted on other national wildlife refuges in the region. In particular, we will focus on monitoring NALCC representative species on the refuge. We will work with the NALCC and other partners (e.g., States, universities, and non-governmental organizations) to develop, prioritize, and implement inventories and monitoring that will help inform our management decisions on the refuge.

The IMP will also include efforts to assess the effects of climate change on refuge resources. 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. See more discussion on our inventory and monitoring program above.

#### **Visitor Services Plans**

The Service’s policy on wildlife-dependent recreation (605 FW 1) directs refuges to develop visitor services plans to provide overarching guidance for the refuge’s visitor services programs and facilities. The visitor services plan builds off the visitor services goals and objectives from the refuge’s CCP and describes

specific strategies for achieving these goals and objectives. The plan includes detailed information on the refuge's recreational program, including compatibility determinations and findings of appropriateness for refuge uses, and incorporates any hunting or fishing plans. When developing these plans, refuge staff will follow all appropriate NEPA requirements.

### **Environmental Education, Interpretation, and Outreach**

We will continue working with our partners to enhance opportunities for quality environmental education, interpretation, and outreach. The refuge's mobile exhibit, the WoW Express, travels throughout the watershed to public events such as fairs and conservation-themed festivals. This exhibit also serves as a teaching tool for schools by contributing to specific state curriculum standards. In the near future, the refuge will unveil a Biological Assessment Trailer (BAT), a traveling environmental classroom that will bring tools and knowledge of conservation inventory, monitoring, and restoration to schools, providing them experiential learning focused on nearby habitats. The ultimate goal is to use this tool to have schools, civic groups, local conservation organizations, and individuals form long-term connections to local natural areas and the refuge through an Adopt-a-Habitat program.

We will continue to develop curriculum, and adapt and implement programs in partnership with other educators using these teaching tools. We will also continue to offer onsite programs at schools and other environmental educational facilities as resources allow. Our hope is that we can inspire a new generation of conservationists to embody a conservation ethic and form long-term relationships with the natural world through these connections. These programs will help achieve goals 2 and 4.

### **Hunting and Fishing**

We will continue to work with the respective States and our other conservation partners to provide quality opportunities for hunting and fishing throughout the watershed, and particularly on refuge lands where it is found to be compatible. Under the 1997 Refuge Improvement Act and Service policies (605 FW 2, 605 FW 3), hunting and fishing are two of the six priority public uses of the Refuge System (<http://www.fws.gov/refuges/hunting/>; accessed August 2016). The other four priority uses are wildlife observation, photography, environmental education, and interpretation. Additionally, with regards to hunting, Executive Order 13443—Facilitation of Hunting Heritage and Wildlife Conservation, directs the Service “to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat.”

All refuge lands currently open to hunting and fishing will remain open. With few exceptions, refuge lands are open consistent with State regulations. These regulations and limits are set annually using data about wildlife populations to ensure that species are not overharvested. Habitat that normally supports healthy wildlife populations produces harvestable surpluses that are a renewable resource. State agencies also set safety regulations to reduce any safety concerns (e.g., requiring hunters and recreationalists to wear hunter orange during the hunting season, and requiring safety zones around buildings).

In general, as new lands are acquired for the refuge, our intent is to officially open them to hunting and fishing under state regulations wherever they are determined to be compatible. We will complete our administrative requirements to formally open lands to these uses, which includes a NEPA compliant process. On newly acquired lands that were previously open to public hunting and fishing, we will allow these uses to continue on an interim basis, wherever possible and compatible, until the administrative process, associated with hunting and fishing step-down plans, is complete. Those step-down plans will provide details on how the programs will be managed.



Hunting and fishing programs will help achieve goal 3.

### **Encouraging the use of nontoxic ammunition and tackle**

We will continue to work with the States and our partners to educate and inform hunters and anglers on the impacts associated with the use of lead ammunition and tackle. For example, we will continue to distribute materials providing hunters and anglers with information on those impacts on fish and wildlife; encourage visitors to use cost-effective, lead-free ammunition and tackle; and, describe actions that can be taken to protect wildlife from contamination when lead ammunition and tackle are used. In addition, we will work with the States to identify the impacts associated with requiring the use of non-toxic ammunition and some fishing tackle for hunting and fishing on refuge lands. This will include identifying, quantifying, and evaluating the impacts of lead exposure to wildlife on refuge lands, as well as considering the impacts of lead restrictions on hunters and anglers. Prior to any actions or changes to the status quo there will be opportunities for public input and comment, consistent with NEPA and specific to the refuge opening package and the other Service administrative and legislated requirements.

Our interest is in minimizing the impacts to fish, wildlife, habitats, and human health. Lead from tackle (e.g., lead fishing sinkers, weights, jigs, and other tackle) and lead shot (e.g., spend lead shot, bullets) can be poisonous to fish and wildlife if ingested (Michael 2006). Lead poisoning can cause severe negative effects on the nervous and reproductive systems of fish and wildlife and is often fatal (USGS 2013c). Symptoms of lead poisoning often include weakness and lethargy, weight loss, and the inability to fly in birds (USGS 2013c).

The main way in which wildlife is exposed to lead is by ingesting lead-contaminated soil and prey (Kendall et al. 1996, Pattee and Pain 2003, MA EOEEA 2014). Due to their feeding habits, waterfowl and other waterbirds are particularly susceptible to lead poisoning (Michael 2006). Some species of wildlife, such as waterfowl, can accidentally swallow lead shot and tackle while feeding (MA EOEEA 2014, USGS 2013c). Up to 50 percent of adult loons are killed by ingesting lost fishing sinkers and jigs (VDFW 2014). Also, laboratory studies show that an amount of lead as small as 82.5 milligrams can be lethal for a bald eagle (Pattee et al. 1981, Hoffman et al. 1981); this lethal amount represents less than one percent of a single 12-gauge slug, a single 20-gauge slug, or a single muzzleloader bullet. There are also concerns about impacts to human health from lead ammunition. Several studies have shown that fragments from lead bullets were present in wild game meat processed for human consumption, even though measures were taken to try to remove lead during processing (NPS 2014).

Lead-free ammunition is already required by Federal regulations and the four States in the watershed for hunting ducks, geese, swans, other waterfowl, and certain other migratory birds, such as coots (50 CFR 20.21; 50 CRF 20.108). However, lead-free ammunition is not currently required for deer, turkey, or small-game hunting by any of the States or by refuge-specific regulations. Three of the four watershed States currently restrict the use of lead fishing tackle. Massachusetts does not allow the use of any lead sinkers, jigs, or weights that weighs less than 1 ounce. New Hampshire prohibits the use of lead sinkers weighing 1 ounce or less and lead jigs less than 1 inch long along their longest axis. In Vermont, it is illegal to sell or use lead sinkers weighing one-half ounce or less. Connecticut does not prohibit lead tackle.

Hunting and fishing programs support goal 3.

### **Appropriateness and Compatibility Determinations**

Chapter 2 describes the requirements for appropriateness and compatibility determinations. Appendix D contains the approved findings of appropriateness and compatibility determinations to support the activities under the final management direction. We will continue to only allow activities determined to be appropriate and compatible uses, and which meet or facilitate refuge legislated purposes, goals, and objectives, and contribute to the fulfillment of the Refuge System mission.

The refuge manager has determined that all six priority public uses can be accommodated in a manner compatible with refuge purposes on most portions of the refuge, although some uses allowed require stipulations to ensure compatibility. Stipulations are included in appendix D for each use determined to be compatible. Appendix D also identifies some areas that are also closed to protect sensitive resources, while identifying others open only by special use permit. Non-priority public uses that the refuge manager deems compatible on some or all of the refuge lands, and including stipulations, are also detailed in appendix D.

Managing compatible public uses supports refuge goals 2 and 3 related to education, interpretation, and recreation.

### **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 the 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.

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, off road vehicle, and dirtbike use, target shooting, manned and unmanned aircraft for recreational use, and off-road bicycling. Appendix D documents the refuge manager’s decision on their appropriateness. Most of these activities are sufficiently provided elsewhere nearby on other ownerships; therefore, the lack of access on the refuge does not eliminate the opportunity in proximity to refuge lands. Furthermore, many of these activities are not consistent with public safety when combined with existing appropriate and compatible uses, or they harm wildlife and habitats, further supporting the finding of not appropriate. According to Service policy 603 FW 1, if the refuge manager determines a use is not appropriate, it can be denied without determining compatibility.

Not allowing inappropriate or noncompatible uses supports all refuge goals.

### **Permitting Special Uses**

The refuge manager will evaluate refuge uses that require a special use permit for their appropriateness and compatibility on a case-by-case basis. Activities that require special use permits include, but are not limited to, research, commercial or economic uses (e.g., commercial guiding, haying, commercial forest management), and furbearer management, hunting dog training, and camp leases at the Nulhegan Basin Division (see discussion below on “Cabin Leases at Nulhegan Basin Division”). Access outside of normal refuge hours also requires a special use permit (except at the Nulhegan Basin Division and for hunters and anglers at other divisions and units who are engaging in these activities in accordance with respective State and refuge hunting and fishing regulations). Implementing this program supports refuge goals 1, 3, and 4.

## Commercial and Economic Uses

All commercial and economic uses will continue to adhere to 50 CFR, Subpart A, §29.1 and Service policy which stipulates that we may only authorize these types of public or private uses where we determine that the use contributes to the achievement of refuge purposes or the Refuge System mission. Examples of these types of uses include commercial haying and forest management to improve wildlife habitat. Allowing these activities also requires the Service to determine appropriateness and prepare a compatibility determination and an annual special use permit that outlines terms, conditions, fees, and any other stipulations to ensure compatibility. These uses, if implemented according to Service policy, can potentially support refuge goals 1, 2, and 3.

## Removing Unnecessary Structures and Site Restoration

In order to reclaim habitat values, we will restore to desired habitat conditions, as soon as practicable, developed sites that are no longer needed for refuge administration, public access, or visitor programs. Strategies for doing so include:

- Continue to remove dwellings, such as cabins, houses, out-buildings, or other developed sites or structures, following Service acquisition, as soon as practicable, if determined to be surplus to refuge needs. Re-grade sites to natural topography and hydrology and re-vegetate to establish desirable conditions, if necessary.
- Within 5 years of CCP approval, inventory and assess existing roads, buildings, and other infrastructure within the refuge. Continue inventory and assessments on new lands as they are acquired. Implement procedures to remove unnecessary infrastructure and rehabilitate sites to desired conditions.

These actions will help achieve goal 1.

## Cabin Leases at Nulhegan Basin Division

We will not modify the existing cabin leases under special use permit at the Nulhegan Basin Division. The Service acquired much of the division in 1999. At that time there were over 60 cabins on the property. Over the past 15 years, the Service has acquired 38 cabins of which 27 have been removed and 8 are still occupied by the original leaseholders as part of a term use agreement. This approach allowed the owner to extract much of their equity and still retain use of the cabin for a set period of time. These permits are renewed every 5 years, assuming the terms of the permit are met, for the life of the current lessees up to a 50-year maximum (i.e., 2049). Among others terms, permit conditions will continue to specify: (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 permits will be issued for construction of new camps. Many of these structures were built as hunting cabins and may be used year-round, although not occupied as primary residences. We did not make any changes to the special use permit within the context of this CCP. Appendix D includes a compatibility determination for cabin leases.



*Nulhegan Basin Division camp*

Mark Maghini/USFWS

### **Boating Access**

We will maintain existing boat launches at Nulhegan Basin and Pondicherry Divisions. Appendix D details how those uses will be managed consistent with our fishing program. Managing boat access on refuge lands supports goal 3 related to recreation.

### **Furbearer Management**

We will continue to manage furbearer populations in a way that ensures we meet our refuge goals and objectives. There are times when individual furbearing animals, or local concentrations of those animals, affect 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 reasons furbearers might need to be managed. The species most likely to cause concerns are beaver and muskrat. Both non-lethal and/or lethal techniques can be employed in any given situation. We will analyze each situation where these techniques will be employed, and choose the most appropriate method to achieve our objectives.

The Service considers regulated trapping as an effective furbearer population management tool on national wildlife refuges (<http://www.fws.gov/refuges/hunting/whyAllowed.html>; accessed August 2016). Trapping by refuge staff, a Federal or State agency partner, or a State-licensed trapper working as an agent for the refuge, can occur at any time at the discretion of the refuge manager and is not subject to compatibility.

We will continue to have a public trapping program at Nulhegan Basin Division, based on refuge and State regulations, and as described in appendix D. On lands we acquire in the future, we will allow trapping to continue as a tool to manage wildlife populations where it is presently occurring, and where the management need is supported by the respective State fish and wildlife agency. Prior to opening refuge lands to trapping, we will complete a NEPA compliant document, a compatibility determination, and a furbearer management plan.

Administering a furbearer management program supports refuge goal 1.

### **Fire Management**

Prescribed fire can be used as a habitat management tool under specific criteria within the 15-year life of this CCP. While the chance of natural ignition is low, should a wildland fire occur, management direction outlined in this plan promotes rapid and aggressive suppression in areas where property is likely to be threatened according to the guidance in appendix L, "Fire Management Guidance." Our suppression objective is to minimize human health or safety concerns, avoid property damage, and reduce the likelihood of resource damage. Fire is not a frequent natural ecosystem process in the Northern Forest. It has been suggested by researchers that stand-replacement fire occurs at 800-year or greater intervals in most regional forest types (Lorimer 1977). However, given Northeast Regional climate change predictions, the average temperatures may increase, especially in the summer. Coupled with little change in summer rainfall, this may result in more frequent, short-term droughts (NECIA 2007). This, in turn, could alter the fire regime. We will continue to 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. Administering a fire program supports refuge goals 1, 2, and 4.

### **Expanding the Pondicherry Wildlife Refuge National Natural Landmark**

The NNL program, administered by the National Park Service, recognizes and encourages the conservation of sites that contain outstanding biological and geological resources, regardless of landownership type (<http://www.nature.nps.gov/nml>; accessed August 2016). Sites are selected for their outstanding condition, illustrative value, rarity, diversity, and value to science and education. They are designated by the Secretary of the Interior, with landowner concurrence, and the program is entirely voluntary. To date, nearly

600 landmarks have received the NNL designation within the United States, American Samoa, Guam, Puerto Rico, and the U.S. Virgin Islands.

In Chapter 3, “Affected Environment,” we describe the establishment of the Pondicherry Wildlife Refuge NNL in 1972. That NNL designation includes 304 acres of what is now the refuge’s Pondicherry Division. Specifically, Cherry and Little Cherry Ponds and the land immediately surrounding them were included in the designation. This was the rationale for designating this area as a NNL: “Within Pondicherry Wildlife Refuge are two shallow, warm water ponds, surrounded by marsh, bog, and forest that support an abundance of submerged, floating, and emergent vegetation, and a great variety of birds. The wetland complex is the type locality for a species of pondweed and spike-rush.”

The Pondicherry Division was established in 2000 and, through time, has grown to over 6,405 acres. Now included in the division are several areas adjacent to or in close proximity to the original NNL that contain several examples of relatively undisturbed boreal forest communities including:

- Black spruce–larch swamp.
- Black spruce–tamarack forest.
- Lowland spruce–balsam fir forest.
- Northern hardwood seepage swamp.
- Dwarf shrub fen.
- Alder shrubland.
- Open basin cattail marsh.
- Winterberry/cinnamon fern/spruce tall shrub thicket.
- Yellow pond lily-pickerelweed-pondweed aquatic bed.
- Aerenchymatous deep emergent marsh.
- Leatherleaf-sheep laurel/black spruce dwarf heath shrub bog/very poor fen.
- Black spruce-larch/heath sphagnum swamp.

These exemplary boreal communities support a diverse array of species including spruce grouse, boreal chickadees, black-backed woodpeckers, white cedar, and numerous other plants and animals that depend on this complex of habitats.

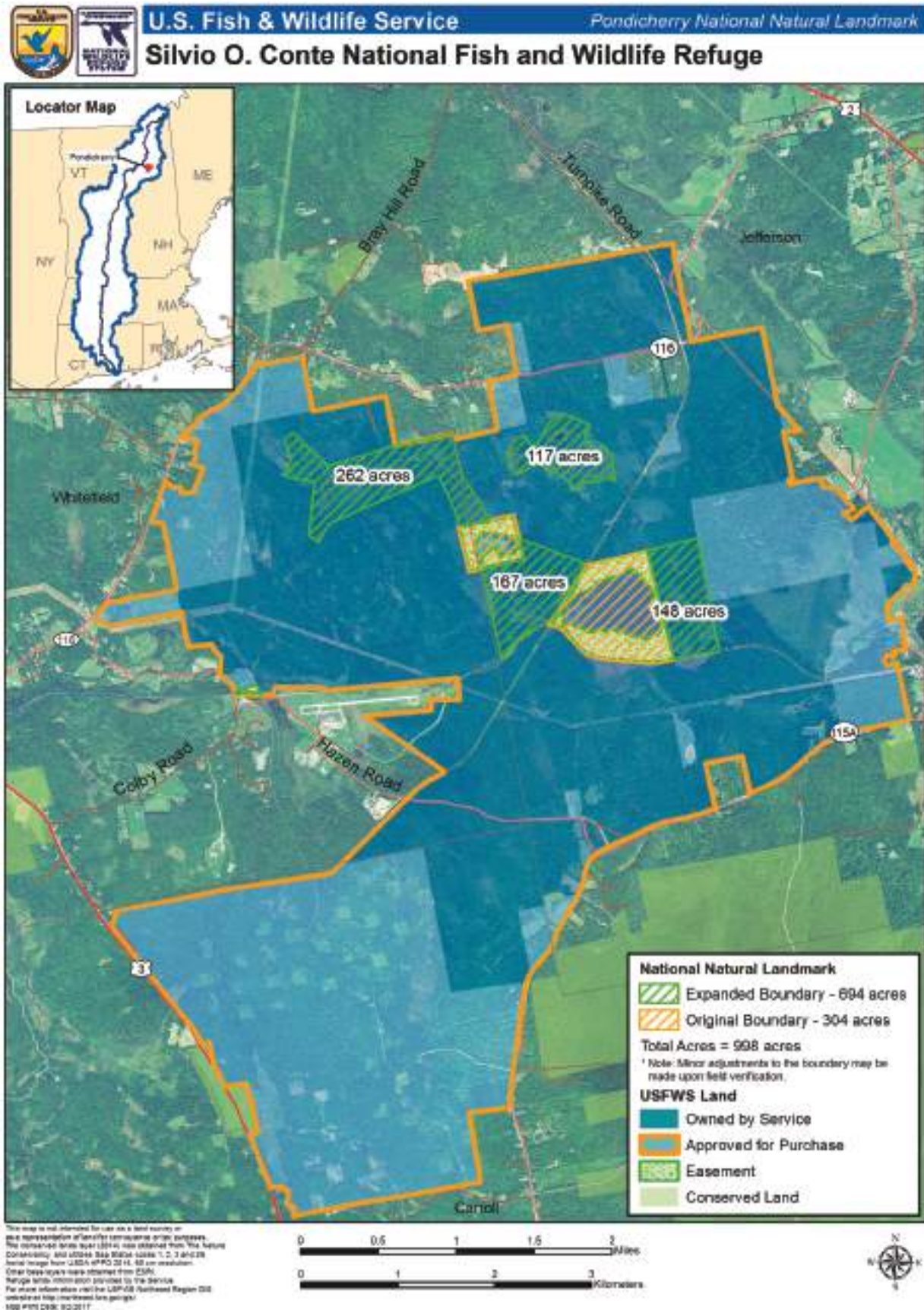
In cooperation with the NPS, we will expand the boundary of the Pondicherry NNL to one that includes the relatively undisturbed wetlands and boreal forests of the John’s River and Mud Pond (map 4.1). We had initiated the administrative process for this expansion, but never completed it. The new boundary will encompass a total of 998 acres, and include the original 304 acres.

Within 5 years of CCP approval, we will complete all administrative procedures necessary for NPS to consider expanding the existing NNL boundary and convene a workshop with ecologists to determine what additional information should be collected and what monitoring should occur to document any potential loss or degradation of the area. We will also establish a baseline from which to conduct monitoring and the collection of subsequent information. Implementing this program supports refuge goal 1 relating to the conservation of open water and wetlands habitats.

## **Cultural Resource Protection**

As a Federal land management agency, the Service is 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, archeological remains in the form of prehistoric camps 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. We will continue to conduct an evaluation on the potential to

Map 4.1. Pondicherry National Natural Landmark



impact archeological and historical resources as required, before taking any ground disturbing action, and will consult with respective Tribal and State Historic Preservation Officers (THPOs and SHPOs). We will be especially thorough in areas along lakes, the confluence of streams, river corridors, and other areas where there is a higher probability of locating a site. These activities will ensure we comply with section 106 of the NHPA. Compliance may require any or all of the following: a State Historic Preservation Records survey, literature survey, or field survey. Protecting cultural resources will support refuge goals 1, 2, and 4.

### **Endangered Species Act Section 7 Consultations**

All projects will continue to comply with the ESA. Approved consultation processes will continue to be followed for projects potentially affecting listed species or designated critical habitat on a site-specific basis as project implementation occurs. Protecting federally listed species supports goals 1 and 4.

### **Wilderness Review**

As we described in chapter 2, 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 ownership. Our inventory of this refuge determined that two areas at the Nulhegan Basin Division meet the eligibility criteria for a Wilderness Study Area (WSA) as defined by the Wilderness Act. Out of the wilderness study, four alternatives were developed for the two study areas. Under this CCP, neither of the WSAs will be proposed for new wilderness designation. Because the forest habitat has been heavily managed, it was concluded that a combination of active and passive management will be the best path to restore multi-aged forests, comprised of native species growing on appropriate natural community sites. In the absence of active management, restoration of desired natural community composition and structure would be unacceptably protracted. The results of the wilderness inventory and study are included in appendix E. The entire refuge will undergo another wilderness review as part of the next CCP 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.

### **Wild and Scenic Rivers Review**

Service planning policy also requires that we conduct a wild and scenic rivers review during the CCP process to determine their potential for Federal Wild and Scenic Rivers designation. We inventoried the river and river segments which occur within CPAs and determined that some 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 and other stakeholders. The results of our Wild and Scenic River inventory are included in appendix F.

In appendix F, we recognize our information may not be complete or current. Some of the river segments in the watershed are currently being evaluated by other entities for their potential to be designated. We learned of several studies underway or where there is interest in initiating a planning process; however, we do not provide status updates in this document because we simply did not have the resources to assess every potential project. However, for those planning efforts or studies underway in any of the CPAs, we request lead agencies or organizations to contact us so that we may partner in those efforts.

The management direction under this CCP will provide protection for free-flowing river values, and other river values, pending the completion of future comprehensive inter-jurisdictional eligibility studies.

**Distributing Refuge Revenue Sharing Payments**

As we describe in chapter 3, we pay the associated localities annual refuge revenue sharing payments based on the acreage and the appraised value of refuge lands within their jurisdiction. These annual payments are calculated by a formula determined by, and with funds appropriated by, Congress. We 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 will be added to the program with future acquisitions. Implementing the refuge revenue sharing payment program helps achieve goal 4.

**Silvio O. Conte Refuge Advisory Council**

We have officially disbanded the Silvio O. Conte NFWR Advisory Committee. The Conte Refuge Act (Section 108) called for the creation of this Advisory Committee to assist the Secretary on community outreach and education programs that further the purposes of the refuge. The Committee, which has never been fully constituted, was to be comprised of members from each of the four States, with members representing the refuge’s municipal, state agency, and private conservation organization partners. Efforts were made to establish and maintain this formal, multi-agency, 15-member committee but, ultimately, these Secretarial and Gubernatorial appointments proved unsuccessful due to the short-term limits and the length of time it took to designate an appointee. Since the creation of Conte Refuge in 1991, we have accomplished the intent of the Advisory Committee through other means. The refuge’s strong commitment to community outreach and environmental education has been, and will continue to be advanced through partnerships with the organizations that comprise the Friends of Conte Refuge, the Connecticut River Watershed Council, environmental educators in the four watershed states, and the operations of the refuge’s visitor facilities.

**Existing and Approved Refuge Ownership**

Table 4.1. Existing and Approved Refuge Ownership as of February 2016.

State(s)	Conservation Partnership Area (CPA)	Conservation Focus Area (CFA)	Refuge Unit <sup>1</sup>	Acres Currently Owned by Service <sup>2</sup>	Acres Approved for Service Ownership <sup>3</sup>
CT/MA/NH/VT	~	Quonatauck CFA	~	0	8,000
CT/MA	Farmington River CPA	Farmington River CFA	~	0	7,661
CT	Maromas CPA	Maromas CFA	~	0	3,935
CT	Muddy Brook CPA	Muddy Brook CFA	~	0	2,661
CT	~	Pyquag CFA	~	0	3,329
CT	Salmon River CPA	Salmon River CFA	~	468	4,455
CT	Scantic River CPA	Scantic River CFA	~	0	4,144
CT	Whalebone Cove CPA	Whalebone Cove CFA	~	116	3,930
CT	~	~	Deadman Swamp Unit	31	31
CT	~	~	Roger Tory Peterson Unit	56	56
MA	Fort River CPA	Fort River CFA	~	261	1,660
MA	Mill River CPA	Mill River CFA	~	249	2,300



State(s)	Conservation Partnership Area (CPA)	Conservation Focus Area (CFA)	Refuge Unit <sup>1</sup>	Acres Currently Owned by Service <sup>2</sup>	Acres Approved for Service Ownership <sup>3</sup>
MA	Westfield River CPA	Westfield River CFA	~	125	6,177
		Dead Branch CFA	~	98	5,186
MA	~	~	Fannie Stebbins Unit	98	98
MA	~	~	Hatfield Unit	19	19
MA	~	~	Honeypot Road Wetlands Unit	21	21
MA	~	~	Mount Toby Unit	30	30
MA	~	~	Mount Tom Unit	141	141
MA	~	~	Third Island Unit	4	4
MA	~	~	Wissatinnewag Unit	21	21
NH	Ashuelot River CPA	Ashuelot River CFA	~	0	17,860
NH	Blueberry Swamp CPA	Blueberry Swamp CFA	~	1,166	4,636
NH	Mascoma River CPA	Mascoma River CFA	~	761	20,593
NH	Pondicherry CPA	Pondicherry CFA	~	6,443	10,249
NH	Sprague Brook CPA	Sprague Brook CFA	~	0	3,016
NH	~	~	Saddle Island Unit	2	2
VT	Nulhegan Basin CPA	Nulhegan Basin CFA	~	26,605	32,779
VT	Ompompanoosuc River CPA	Ompompanoosuc River CFA	~	0	15,072
VT	Ottauquechee River CPA	Ottauquechee River CFA	~	0	5,985
VT	West River CPA	West River CFA	~	0	22,947
VT	White River CPA	White River CFA	~	0	10,054
VT	~	~	Putney Mountain Unit	285	285
			<b>Totals</b>	<b>37,000</b>	<b>197,337</b>

<sup>1</sup> Refuge Units may be assigned to a CFA/Refuge division in the future.

<sup>2</sup> Totals as of February 2016.

<sup>3</sup> Includes acres currently owned by Service. These totals represent the estimated maximum acreage the Service would conserve. As detailed in appendix C, we have the authority to acquire approximately 90% of total acreage, on average, within CFAs, and the remaining 10% in surrounding CPAs (see maps in chapter 4). We only purchase lands from willing sellers and do not expect to purchase any lands already permanently conserved by others, except under extenuating circumstances.

**Summary of Management Goals, Objectives, Actions and Strategies**

Table 4.2 below provides a summary of the goals, objectives, actions, and strategies in the CCP. It relates details that are planned under full implementation of the CCP, including the staffing, funding, and infrastructure needed to support the objectives, strategies, and actions. The presentation is organized by the four refuge goals, and then by resource or program features. Further narrative details on objectives, actions, and strategies, precede this table in chapter 4, and are also presented by each CFA geographic area in appendix A. Appendix C provides details on the land protection plan. We recommend readers consult each of these sections to understand the full range of actions approved in the CCP.

Table 4.2. Summary of Management Objectives, Actions, and Strategies in the Conte Refuge CCP

<b>Refuge Management Direction</b>	
<b>Goal 1: Wildlife and Habitat Conservation</b>	
Promote the biological diversity, integrity, and resiliency of terrestrial and aquatic ecosystems within the Connecticut River watershed in an amount and distribution that sustains ecological function and supports healthy populations of native fish, wildlife, and plants, especially Federal trust species of conservation concern, in anticipation of the effects of climate, land use, and demographic changes.	
<b>Objective 1.1: Forested Uplands and Wetlands (Including Riparian and Floodplain Forests)</b>	
In cooperation with willing landowners and other partners, protect, manage, and restore forested habitats within the Connecticut River watershed. These forested habitats will help sustain the biological diversity, integrity, and ecological and hydrologic function of the river ecosystem, provide habitat connections and wildlife travel corridors, accommodate anticipated shifts in species' ranges from climate and land use changes, and support forest-dependent species of conservation concern, including migratory birds and federally listed endangered and threatened species.	
<b>Forested Uplands and Wetlands:</b> <ul style="list-style-type: none"> <li>• Core Forest Blocks</li> <li>• Forest Corridors</li> <li>• Forest Age, Structure, and Composition</li> <li>• Forest Wetland Integrity</li> <li>• Climate Change Adaptation</li> </ul>	<p><i>Within CPAs</i></p> <p>Work with partners and willing landowners within the watershed, with a priority on CPA lands, to:</p> <ul style="list-style-type: none"> <li>• Protect, restore, and promote unfragmented, contiguous blocks of forest.</li> <li>• Promote a diversity of forest age, structure, and composition to benefit a diversity of native fish, wildlife, and plants.</li> <li>• Maintain hydrologic functions and wildlife values of forested wetlands by protecting and restoring natural hydrological regimes and vegetative edges (e.g., restore floodplain forests and replace culverts and bridges).</li> <li>• Assist with developing and implementing effective climate adaptation response strategies.</li> <li>• Support the development of climate change vulnerability assessment models for the Connecticut River watershed.</li> <li>• Support and provide guidance for forest restoration efforts off refuge lands through:             <ul style="list-style-type: none"> <li>* Grant support.</li> <li>* Technical and field assistance.</li> <li>* Cooperative and other shared resource agreements.</li> </ul> </li> </ul> <p><i>On Refuge Lands</i></p> <p>Expand and enhance forested uplands and wetlands management opportunities to protect, manage, and restore forested habitats to meet refuge and State WAPs. We will emphasize active forest management to provide contiguous forest habitat to benefit area-sensitive migratory birds and other native wildlife. Acreages below are a rough approximation. Details will be developed in step-down habitat management plans, which will be coordinated with States and stakeholders.</p> <ul style="list-style-type: none"> <li>• Actively manage approximately 11,550 acres of forested habitat over the 15-year CCP across refuge divisions to improve habitat for priority species, including the acres we are currently managing.</li> <li>• Conduct forest inventories and survey wildlife use.</li> <li>• Identify and implement active habitat management and restoration on refuge lands (e.g., tree plantings, timber harvesting, prescribed fire, etc.) improve forest age distributions, structural complexity, and species composition.</li> <li>• Work with partners to ensure habitat management on refuge complements adjacent land management activities.</li> <li>• Maintain at least 300-meter-wide forested corridors through non-forested matrix habitat to facilitate species movement.</li> <li>• Control invasive species.</li> <li>• Monitor species response to our management.</li> <li>• Map natural communities and vernal pools and protect rare and exemplary natural communities.</li> <li>• Assess hydrological conditions of forested wetlands.</li> </ul>

**Objective 1.2: Non-forested Uplands and Wetlands (Freshwater Wetlands, Pasture, Hay Fields, Grasslands, and Shrublands)**

In cooperation with willing landowners and other partners, protect, manage, and restore non-forested wetlands and uplands within the Connecticut River watershed. These non-forested habitats will help sustain the biological diversity, integrity, and ecological and hydrologic function of the river ecosystem, provide habitat connections and wildlife travel corridors, accommodate anticipated shifts in species' ranges from climate and land use changes, and support dependent species of conservation concern—including migratory birds and federally listed endangered and threatened species.

**Non-forested Uplands and Wetlands**  
 • **Wetland Integrity**  
 • **Pasture, Hay Fields, Grasslands and Shrublands**

*Within CPAs*

Work with partners and willing landowners within the watershed, with a priority on CPA lands, to:

- Protect, manage, and restore freshwater wetlands, with emphasis on restoring wetland edge habitat, headwater streams, and floodplains.
- Protect, manage, and restore shrublands to benefit shrubland-dependent species.
- Work with partners (e.g., USDA-NCRS) and willing landowners to conserve pasture, hay fields, and grassland habitat to benefit wildlife and/or restore former agricultural fields and promote enrollment in agricultural protection programs.
- Support state and local efforts to sustain farming on highly productive agricultural lands, but promote best management farming practices (especially in floodplain and riparian areas).
- Support priority restoration projects in active floodplains, areas that have high development pressures, or in areas that can provide critical habitat for State- and federally listed species.
- Support and guidance for restoration efforts on other ownerships will include:
  - \* Grant support.
  - \* Technical and field assistance.
  - \* Cooperative and other shared resource agreements and leases.

*On Refuge Lands*

Expand and enhance opportunities to protect, manage, and restore freshwater marsh, grassland, and shrubland habitats. Details will be developed in step-down habitat management plans, which will be coordinated with States and stakeholders.

Continue to:

- Restore degraded wetlands, where funding allows.
- Manage approximately 200 acres of grassland and shrubland on existing refuge lands, and seek opportunities to expand where appropriate. Existing lands include:
  - \* Managing (e.g., brushhog) up to 11 acres of shrubland every 3 to 5 years at Pondicherry Division for shrubland dependent species (e.g., woodcock).
  - \* Implementing woodcock habitat management at Nulhegan Basin Division (7 acres mowed every year for singing grounds, and 18 acres every 3 to 4 years for roosting fields).
  - \* Mowing up to 67 acres of cool season grassland each year at the Fort River Division for grassland nesting birds (e.g., northern harrier, upland sandpiper, barn owl, grasshopper sparrows, and bobolinks). Also, mow up to 22 acres of warm season grassland each 2 to 3 years.
  - \* Mowing approximately 60 acres of grasslands every 2 to 3 years at the Blueberry Swamp Division.
  - \* Mowing approximately 16 acres of grassland at the Salmon Division River every 2 to 3 years.
  - \* Mowing approximately 0.5 acres of grassland annually at the Dead Branch Division.
- Control invasive species.

**Objective 1.2: Non-forested Uplands and Wetlands (Freshwater Wetlands, Pasture, Hay Fields, Grasslands, and Shrublands) (cont.)**

In cooperation with willing landowners and other partners, protect, manage, and restore non-forested wetlands and uplands within the Connecticut River watershed. These non-forested habitats will help sustain the biological diversity, integrity, and ecological and hydrologic function of the river ecosystem, provide habitat connections and wildlife travel corridors, accommodate anticipated shifts in species' ranges from climate and land use changes, and support dependent species of conservation concern—including migratory birds and federally listed endangered and threatened species.

In addition, implement the following new strategies:

- Restore and actively manage these habitats based on management needs and priorities.
- Conduct plant and wildlife inventories.
- Evaluate wetland hydrology.
- Assess habitat conditions for priority resources of concern.
- Protect rare or exemplary communities.
- Minimize activities that disturb wetland communities.
- Work with the Vermont State Natural Heritage Program to annually monitor the presence/absence of current northeastern bulrush populations in emergent wetlands.
- Explore and support research opportunities with academic partners to address information gaps for resources of concern (e.g., northeastern bulrush, New England cottontail).
- Monitor plant and wildlife species responses to management.
- Map natural communities.
- Manage approximately 548 acres of grassland.
- Manage (e.g., brushhog, hydroax, etc.) approximately 775 acres of shrubland habitat to benefit migratory birds, the New England cottontail, and other shrubland-dependent species.
- Assess the condition of newly acquired acres of pasture, hay fields and grassland habitats to determine if they should continue to be maintained in these habitat types or if they should be restored to native forest. Use this assessment to inform more detailed management strategies in an HMP. Where appropriate, maintain contiguous grassland habitat for breeding and migrating grassland-dependent bird species. Also, where appropriate, restore pasture and grasslands to floodplain forest.
- Work with partners to ensure management on refuge lands complements adjacent land management.

**Objective 1.3: Inland Aquatic Habitats (Freshwater Rivers, Streams, Ponds, and Lakes)**

In cooperation with willing landowners and other partners, protect and restore in-stream and riparian habitat structure and function, and restore aquatic species passage and water quality within the Connecticut River watershed to improve the ecological integrity and environmental health of the river ecosystem and enhance habitat for migratory and inter-jurisdictional fish, mussels, and other native aquatic species of conservation concern.

**Inland Aquatic Habitats:**

- **Habitat Assessments**
- **Population Assessments**
- **Stream and Floodplain Functions**
- **Hydrological Modeling**

*Within CPAs*

Work with partners and willing landowners within the watershed, with a priority on CPA lands, to:

- Develop hydrologic models of Connecticut River watershed and other tools to evaluate aquatic habitat conditions; work on priorities identified by Connecticut River Coordinator's Office.
- Inventory wildlife and fish populations of conservation concern.
- Conduct and/or participate in short and long-term monitoring programs for puritan tiger beetle, migratory fish, mussels, and other native aquatic species of conservation concern.
- Maintain and restore in stream, riparian, and floodplain habitats.
- Eliminate barriers to fish and other aquatic species passage.
- Protect and increase spawning habitat for aquatic species.
- Reduce combined sewer overflow.
- Continue to support research opportunities on wildlife and fish populations of conservation concern.
- Continue support for aquatic species programs and initiatives.
- Work with USDA-Rural Development to address storm and waste water issues in rural areas of the watershed.
- Work with USDA-NRCS to promote riparian habitat and streambank stabilization.
- Support and guidance for restoration efforts on other ownerships within CPAs will include:
  - \* Grant support.
  - \* Technical and field assistance.
  - \* Cooperative and other shared resource agreements.

*On Refuge Lands*

- Expand and enhance opportunities to protect, manage, and restore inland aquatic habitats to meet refuge goals.
- Test the effectiveness of tools to evaluate aquatic habitat conditions.
- Map natural communities and protect rare and exemplary communities.
- Monitor species and habitat response to management.
- Maintain conservation buffers along riparian habitats (at least 300 meters).
- Control invasive species.
- Work with partners to:
  - \* Inventory aquatic resources including mussels, invertebrates, and fish.
  - \* Manage and protect puritan tiger beetles at Deadman's Swamp Unit.
  - \* Perform habitat surveys and quantify potential spawning and nursery habitat for fish such as brook trout.
  - \* Evaluate the productivity and health of fish communities.
  - \* Conduct stream assessments to identify man-made physical barriers (e.g., culverts, dams, impassible road crossings) to aquatic species passage.
  - \* Develop a plan for protection and restoration of native races of brook trout, and other aquatic species.
  - \* Develop and implement a plan to remove barriers to aquatic species passage.
  - \* Protect and increase hard bottom substrate for spawning aquatic species.
  - \* Reduce combined sewer overflow.
  - \* Restore degraded streams.

**Objective 1.4: Coastal Non-forested Uplands (Coastal Beaches and Rocky Shores)**

In cooperation with willing landowners and other partners, protect, manage, and restore coastal non-forested uplands within the Connecticut River watershed. These non-forested habitats will help sustain the biological diversity, integrity, and ecological and hydrologic function of the river estuary ecosystem, provide habitat connections and wildlife travel corridors, accommodate anticipated shifts in species' ranges from climate and land use changes, and support coastal upland-dependent species of conservation concern—including migratory birds and Federally-listed endangered and threatened species.

**Coastal Non-forested Uplands, including Coastal Beaches and Rocky Shores :**

- **Habitat Restoration**
- **Public use management**

*Within CPAs*

Work with partners and willing landowners within the watershed, with a priority on CPA lands, to:

- Support the LISS HRI goals and objectives.
- Provide information to partners and willing landowners to support informed decisions about balancing human use of shorelines with the needs of nesting birds of conservation concern and sensitive dune habitats.
- Provide support and guidance for restoration efforts on other ownerships within CPAs, which will include:
  - \* Grant support.
  - \* Technical and field assistance.
  - \* Cooperative and other shared resource agreements.

*On Refuge Lands*

Not much of this habitat type occurs in CFAs.

- Conduct habitat and wildlife inventories.
- Map natural communities; protect rare or exemplary examples.
- Work with partners to ensure management on Service lands complement adjacent land management objectives.
- Work with partners to restore these habitats on refuge lands.

**Objective 1.5: Coastal Wetlands and Aquatic Habitats (Tidal Salt Marsh and Estuary)**

In cooperation with willing landowners and other partners, protect, manage, and restore coastal wetlands and other coastal aquatic habitats within the Connecticut River watershed. These coastal aquatic habitats will help sustain the biological diversity, ecological integrity, and hydrologic function of the river ecosystem, provide habitat connections and wildlife travel corridors, accommodate anticipated shifts in species' ranges from climate and land use changes, and support coastal wetland-dependent species of conservation concern—including inter-jurisdictional fish, native aquatic species, waterfowl and wading birds and federally listed endangered and threatened species.

**Coastal Wetlands and Aquatic Habitat:**

- **Habitat Restoration**
- **Population Assessments**
- **Climate Change**

*Within CPAs*

Work with partners and willing landowners within the watershed, with a priority on CPA lands, to:

Support the LISS HRI goals and objectives: (1) restore the ecological functions of degraded and lost habitats, (2) restore at least 2,000 acres of coastal habitats and 100 miles of riverine migratory corridor habitat, and (3) use partnerships to accomplish restoration objectives so as to leverage financial resources from multiple public sources.

- Restore salt and brackish marshes by remediating drainage ditches; remove water control structures such as tide gates to restore natural tidal flows; and control invasive species populations like common reed (*Phragmites*) to improve species diversity and habitat function.
- Conduct short- and long-term monitoring of migratory fish, mussels, and other native aquatic species of conservation concern.
- Identify the best coastal wetlands and aquatic habitats to manage for conservation and natural diversity; and identify corridor and stopover locations that will help connect these areas.
- Develop coastal system models that would advance our understanding of existing impacts (e.g., stormwater and contaminants runoff) and projected future impacts (e.g., climate change, sea level rise, and marsh migration) and support local decisions on land use.
- Inventory wildlife and fish populations of conservation concern.
- Support research opportunities on wildlife and fish populations of conservation concern.
- Support and guidance for restoration efforts on other ownerships within CPAs will include:
  - \* Grant support.
  - \* Technical and field assistance.
  - \* Cooperative and other shared resource agreements.

*On Refuge Lands*

Expand and enhance opportunities to protect, manage, and restore these coastal habitats within the approved refuge boundary.

- Use active habitat management and restoration techniques to improve species diversity and habitat function (e.g. restore ditched marshes, remove unnecessary water control structures, control invasive plants).
- Minimize activities that disturb wetland communities.
- Monitor response of priority refuge resources of concern species to refuge management.
- Conduct habitat and wildlife inventories.
- Map natural communities and protect rare and exemplary communities.
- Work with partners to ensure management of Service lands complements adjacent land management objectives.

<p><b>Goal 2: Environmental Education, Interpretation, and Outreach</b></p> <p>Inspire residents and visitors to actively participate in the conservation and stewardship of the exceptional natural and cultural resources in the Connecticut River watershed, and promote a greater understanding and appreciation of the role of the Silvio O. Conte National Fish and Wildlife Refuge in conserving those resources.</p>	
<p><b>Objective 2.1: Environmental Education.</b></p> <p>In collaboration with public and private educators from all four States in the watershed, lead or facilitate the implementation of structured, high quality, natural and cultural resource curricula. The focus will be on guiding educators and students to: develop an awareness of, and concern about, natural and cultural resources and associated challenges; appreciate our conservation history; make informed decisions and work individually or collectively toward solutions; and, model responsible environmental stewardship in their everyday lives.</p>	
<p><b>Environmental Educational Planning and Training</b></p>	<p>Our first priority will be to provide environmental education in CPAs, on refuge lands, and in urban areas in the watershed. We will then, time and resources permitting, work throughout the rest of the watershed.</p> <p>Continue to offer these environmental educational opportunities in line with existing staff and resource capacities:</p> <ul style="list-style-type: none"> <li>• Design curricula for existing refuge environmental educational facilities and the WoW Express and BAT trailer that incorporate at least one state science learning standard for Massachusetts, Connecticut, New Hampshire, and Vermont.</li> <li>• Identify and strive to engage non-traditional audiences regarding environmental educational opportunities.</li> <li>• Support the Service’s initiatives such as Connecting People with Nature, Youth in the Great Outdoors, etc.</li> <li>• Provide refuge lands as outdoor classrooms.</li> </ul> <p>Contribute to professional educator development by periodically hosting and/or instructing teacher continuing education training.</p> <p>In addition, implement the following new strategies:</p> <ul style="list-style-type: none"> <li>• Host annual meeting with state agency environmental educators to look for opportunities to coordinate program priorities and share resources.</li> <li>• Develop school-focused curricula for all environmental educational efforts, that:             <ul style="list-style-type: none"> <li>* Incorporate multiple state and national learning standards.</li> <li>* Coordinate with existing state and national environmental education programs.</li> <li>* Contain consistent messages and themes.</li> <li>* Incorporate refuge purposes and management goals and objectives.</li> <li>* Where appropriate, incorporate national based curricula and national recognized initiatives.</li> </ul> </li> <li>• Develop specific goals, objectives, and strategies for each program/lesson.</li> <li>• Adapt and/or adopt an existing environmental educational evaluation system to assess all environmental educational curricula effectiveness.</li> <li>• Work with after school programs and summer camps to incorporate existing state curricula.</li> <li>• Provide support for curriculum-based programs such as Scouts, 4H, Boys and Girls Clubs, and Road Scholar.</li> <li>• Support state environmental educational programs (e.g., Hunter and Angler Education, Furbearer Education, Becoming a Great Outdoors Woman, etc.)</li> </ul>



**Objective 2.1: Environmental Education (cont.)**

In collaboration with public and private educators from all four States in the watershed, lead or facilitate the implementation of structured, high quality, natural and cultural resource curricula. The focus will be on guiding educators and students to: develop an awareness of, and concern about, natural and cultural resources and associated challenges; appreciate our conservation history; make informed decisions and work individually or collectively toward solutions; and, model responsible environmental stewardship in their everyday lives.

**Environmental Education Delivery**

Our first priority will be to provide environmental education in CPAs, on refuge lands, and in urban areas in the watershed. We will then, time and resources permitting, work throughout the rest of the watershed.

Continue to offer these environmental education opportunities in line with existing staff and resource capacities:

- Use staff, volunteers, and members of Friends groups to facilitate teachers and students at existing refuge and partner facilities.
- Use refuge facilities to provide opportunities for teacher-led classes as well as other environmental education entities.
- Have the WoW Express visit schools in each of the four states targeting students in grades 3 through 5. The goal is to capitalize on student contacts by increasing the amount of time spent with students to create a better quality experience for them.
- Have the WoW Express visit environmentally based summer camps in each of the four states.
- Use staff, volunteers, and members of friends groups to facilitate teachers and students at existing partner facilities.
- Support partnership with the State of Massachusetts at the Great Falls Discovery Center.

In addition, implement the following new strategies:

- Formally partner with local schools within the watershed and conduct environmental educational programs with these audiences multiple times per year.
- Promote refuge and partner lands as outdoor classrooms.
- Work with partners, educators, Friends group members, and other volunteers to offer environmental educational programs.
- Fully implement the “Adopt-a-Habitat” initiative with developed curriculum plans.
- Develop a traveling mobile environmental education classroom and BAT.
- Develop an evaluation system to measure the effectiveness of environmental education programs.
- Partner with other education centers, state programs, and other government agencies to meet environmental education objectives.

<p><b>Objective 22: Interpretation</b>                  Develop, lead, and facilitate interpretive programs that emotionally and intellectually connect the audience to natural and cultural resources in the watershed.</p>	
<p><b>Natural and Cultural Resource Interpretation Planning and Training</b></p>	<p>Our first priority will be to provide interpretive programs in CPAs and on refuge lands. We will then, time and resources permitting, work throughout the rest of the watershed.</p> <p>Continue to focus on these planning and training opportunities in line with existing staff and resource capacities:</p> <ul style="list-style-type: none"> <li>• Work with partners to develop a variety of different types of interpretive programs (e.g., talks, signs, brochures, audio/visual displays, etc.)</li> <li>• Develop self-guided interpretive services, such as interpretive trails and kiosks, exhibits, and printed media.</li> </ul> <p>In addition, implement the following new strategies:</p> <ul style="list-style-type: none"> <li>• Work with partners to create consistent interpretive themes.</li> <li>• Develop interpretive goals, objectives, and strategies; incorporate these into a Visitor Services Plan.</li> <li>• Develop an evaluation process to measure effectiveness of interpretation programs.</li> <li>• Develop a core set of interpretive programs.</li> <li>• Establish relationships with Tribes and local and watershed historians to incorporate cultural history into interpretive programs.</li> <li>• Make Certified Interpretive Guide (National Association for Interpretation) training available once every other year for refuge personnel, volunteers, and others.</li> <li>• Update existing and develop new interpretive materials that incorporate interpretive messages and themes and new media and technologies (e.g., QR codes/cell ranger), including general brochures, bird lists, self-guided interpretive trails, signs, kiosks, etc.</li> </ul>
<p><b>Natural and Cultural Resource Interpretive Program Delivery</b></p>	<p>Our first priority will be to provide quality interpretive programs in CPAs and on refuge lands. We will then, time and resources permitting, work throughout the rest of the watershed.</p> <p>Continue to offer these interpretive opportunities in line with existing staff and resource capacities:</p> <ul style="list-style-type: none"> <li>• Annually provide quality interpretive programs, exhibits, printed media at refuge facilities and properties.</li> <li>• Provide personal contacts at visitor centers, such as Great Falls Discovery Center and Nulhegan Basin Division, to initiate discussion and answer questions.</li> </ul> <p>Support partner facilities such as Great Northwoods Visitor Center, VINS, and Springfield Science Museum through cooperative agreements and the sharing of resources.</p> <p>In addition, implement the following new strategies:</p> <ul style="list-style-type: none"> <li>• Establish additional partnerships with interpretive facilities.</li> <li>• Create interpretive messages for region-wide media.</li> <li>• Incorporate thematic messages, measurable objectives, and evaluation measures into all interpretive programming.</li> <li>• Train staff, Friends, and other volunteers to deliver interpretive messages and programs.</li> <li>• Use both traditional and new media to deliver interpretive messages.</li> <li>• Contribute interpretive materials about the refuge for partner signs and publications (e.g., National Scenic Byway, State Parks, etc.)</li> <li>• Develop opportunities for commercial vendors who would like to offer on-refuge interpretation. Vendors will operate under a special use permit and may be charged a fee.</li> </ul>

**Objective 2.3: Public and Community Outreach**

Support, promote, and coordinate a wide range of outreach tools and activities to facilitate and improve communications and relationships with the American public and to articulate the importance of local conserved lands, including the refuge, to the watershed. Target audiences include: community members, adjacent landowners, and elected officials in the Connecticut River Watershed. Citizens will be empowered to recognize and resolve local natural resource issues and promote conservation and the responsible use of natural resources.

<p><b>Local Community Residents and Officials</b></p>	<p>Continue to offer these outreach opportunities in line with existing staff and resource capacities:</p> <ul style="list-style-type: none"> <li>• Maintain good lines of communication with refuge neighbors and community leaders.</li> <li>• Draft annual reports that introduce residents to the refuge, describe refuge accomplishments, detail visitor opportunities, and discuss refuge operations and current and future refuge projects.</li> <li>• Attend select board meetings, and visit town clerks, mayors, planners, and other elected officials as needed to keep them apprised of refuge issues and projects.</li> </ul> <p>In addition, implement the following new strategies:</p> <ul style="list-style-type: none"> <li>• Work directly with Chambers of Commerce, Rotary Clubs, and other civic and nonprofit organizations.</li> <li>• Keep neighboring and nearby landowners informed of refuge management activities.</li> <li>• Inform community members about refuge management practices, public use opportunities, and regulations, as well as the economic benefits of the refuge to the local economy.</li> <li>• Support and participate in community celebrations and events.</li> <li>• Develop and publicize special programming of interest to local residents and media on refuge lands.</li> <li>• Support outreach activities of refuge Friends groups and partners.</li> <li>• Evaluate and modify, as necessary, outreach efforts.</li> <li>• Conduct open houses on refuge divisions and partnership areas to introduce residents and local officials to the refuge.</li> <li>• Develop and implement an outreach plan for communicating with landowners to inform and educate them on their role within the watershed and how they can contribute. Plan will include tools and strategies. Possible tools will include landowner workshops, behind the scene tours, special open houses, and publications oriented toward them specifically.</li> <li>• Write issue driven outreach plans to keep elected officials informed of refuge and partner accomplishments and of issues within the watershed that have possible impacts to the refuge.</li> <li>• Pro-actively schedule consistent meetings with elected officials to share and update each other on constituent concerns and opportunities.</li> <li>• Develop messages and actions that frame refuge units as an asset to the local community. Example benefits that the refuge provides the community include: environmental education and interpretation programming, special events hosted for the community, employment for local youth through YCC, mutual aid agreements, etc.</li> <li>• Learn how to coordinate effectively with partner organizations to spread the Conte Refuge message to their membership (Audubon, TNC, Trust for Public Land (TPL), etc.).</li> <li>• Develop at least 10 Conte Corners with at least two in each state.</li> <li>• Create special programming that will draw local residents and media (i.e., participating in community events and festivals, etc.).</li> <li>• Fully implement the Adopt-a-Habitat program to be used as an outreach tool for schools and community residents to learn about and become stewards of their local environment.</li> </ul>
<p><b>State- and National-level Elected Officials</b></p>	<p>Continue to offer these outreach opportunities in line with existing staff and resource capacities:</p> <ul style="list-style-type: none"> <li>• Provide briefings to members of Congress or their staff as needed or as requested.</li> </ul> <p>In addition, implement the following new strategies:</p> <ul style="list-style-type: none"> <li>• Meet with political leaders and officials to inform and educate them on management practices occurring in their districts.</li> </ul>

<p><b>Objective 2.3: Public and Community Outreach (cont.)</b></p> <p>Support, promote, and coordinate a wide range of outreach tools and activities to facilitate and improve communications and relationships with the American public and to articulate the importance of local conserved lands, including the refuge, to the watershed. Target audiences include: community members, adjacent landowners, and elected officials in the Connecticut River Watershed. Citizens will be empowered to recognize and resolve local natural resource issues and promote conservation and the responsible use of natural resources.</p>	
<p><b>Media</b></p>	<p>Continue to offer these outreach opportunities in line with existing staff and resource capacities:</p> <ul style="list-style-type: none"> <li>• Write press releases detailing large refuge projects and accomplishments, and the joint efforts and accomplishments of the refuge and refuge partners.</li> <li>• Host media representatives on refuge lands regularly to disseminate refuge accomplishments and concerns.</li> <li>• In addition, implement the following new strategies:</li> <li>• Develop a media outreach plan with consistent refuge messages.</li> </ul>
<p><b>Greater Watershed Community</b></p>	<p>Continue to offer these outreach opportunities in line with existing staff and resource capacities:</p> <ul style="list-style-type: none"> <li>• Promote the refuge as a destination for recreation, interpretation, and environmental education opportunities.</li> <li>• Promote refuge lands for special events such as National Wildlife Refuge Week, International Migratory Bird Day, Earth Day, etc.</li> <li>• Support existing Friends groups and establish new groups as divisions are established.</li> <li>• Provide outreach materials at partners' facilities.</li> <li>• Promote cooperation with partners for the use of facilities, programs, and staff when conducting outreach.</li> </ul> <p>In addition, implement the following new strategies:</p> <ul style="list-style-type: none"> <li>• Attract visitors by linking the refuge and watershed to regional tourism, birding, and recreational programs.</li> <li>• Encourage citizen participation in activities throughout the watershed.</li> <li>• Maintain a well-written and informative Web site.</li> <li>• Create displays promoting the refuge for placement at major regional points of interest or entry (e.g., airports).</li> <li>• Use the WoW Express, the BAT, and other mobile exhibits to participate at regional environmental- and recreational-themed events, shows, and conferences.</li> <li>• Produce conservation messages that reach a wide range of audiences through a variety of media (e.g., print, broadcast, social).</li> <li>• With partners, explore communication strategies to reach targeted audiences with common messages.</li> <li>• Sponsor at least one Bio Blitz on refuge lands in each state, and ultimately in each division/or local community in conjunction with Adopt-a-Habitat program.</li> <li>• Offer the WoW exhibits and an interpreter to partners when feasible. Establish partnerships across the Watershed to jointly deliver WoW Express interpretive programs.</li> <li>• In cooperation with partners seek to interpret messages with the expansion of the Connecticut River Birding Trail to a Source to Sea birding trail.</li> <li>• Work with non-traditional venues (e.g., airports, shopping malls) to install interpretive media appropriate for general audiences.</li> </ul>

<p><b>Objective 2.4: Scientific and Technical Outreach</b></p> <p>Facilitate the collection and exchange of information that increases the knowledge and understanding of natural and cultural resources, addresses climate and land use changes and other conservation issues, and provides land managers with better information to make management decisions affecting resources.</p>	
<p><b>Institutions of Higher Learning and Other Partners Conducting Relevant Conservation Research</b></p>	<p>Continue to offer these outreach opportunities in line with existing staff and resource capacities:</p> <ul style="list-style-type: none"> <li>• Work with partners to conduct research relevant to refuge management issues.</li> </ul> <p>In addition, implement the following new strategies:</p> <ul style="list-style-type: none"> <li>• Formulate a list of important natural resource research questions that the refuge is interested in and share them with colleges and universities as possible graduate and undergraduate research projects.</li> <li>• Develop formal agreements with universities and other partners to conduct research on refuge lands.</li> <li>• In collaboration with the Friends of Conte seek funding for high priority research.</li> </ul>
<p><b>Technology and Information Exchange Related to Conservation Topics</b></p>	<p>Continue to offer these outreach opportunities in line with existing staff and resource capacities:</p> <ul style="list-style-type: none"> <li>• Play an active role in technology and information exchange.</li> <li>• Sponsor/host science based conferences as opportunities arise.</li> <li>• Encourage staff to participate in relevant, natural, and cultural resource conferences that will contribute to making good decisions.</li> </ul> <p>In addition, implement the following new strategies:</p> <ul style="list-style-type: none"> <li>• Host science forums to share research results with partners and the general public.</li> <li>• Distribute 'lessons learned' from refuge management to interested parties.</li> <li>• Provide inventory and monitoring summaries through the refuge website.</li> </ul>
<p><b>Mentoring Students</b></p>	<p>Continue to offer these outreach opportunities, in line with existing staff and resource capacities:</p> <ul style="list-style-type: none"> <li>• Reach out to local universities for student employment positions.</li> <li>• Offer student internships and host field trips.</li> <li>• Participate periodically in presenting information to classes at local universities and colleges.</li> </ul> <p>In addition, implement the following new strategies:</p> <ul style="list-style-type: none"> <li>• Seek opportunities to participate in student workshops, trainings, and events.</li> <li>• Develop a mentoring program to work with students to help them identify their career goals and introduce career paths within the Service.</li> <li>• Participate in undergraduate and graduate level classes at local universities and colleges, presenting information on various topics and issues of relevance to the refuge.</li> </ul>

<p><b>Goal 3: Recreation.</b>                  Promote high quality, public recreational opportunities in the Connecticut River watershed that are complementary between ownerships and provide regional linkages, with emphasis on promoting wildlife-dependent activities that connect people with nature in the outdoors.</p>	
<p><b>Objective 3.1: Hunting</b>                  Support quality public hunting opportunities in the Connecticut River watershed in cooperation with willing landowners to promote a unique understanding and appreciation of natural resources and their management, including the role of the Service and other public lands in resource conservation, while also protecting a traditional outdoor pastime deeply rooted in America's natural and cultural heritage and conservation history.</p>	
<p><b>Hunting Opportunities, Access, and Infrastructure</b></p>	<p><i>Within CPAs</i>                  Work with partners and willing landowners within the watershed, with a priority on CPA lands, to:</p> <ul style="list-style-type: none"> <li>• Continue to support hunting opportunities on lands within CPAs.</li> <li>• Collaborate with state fish and wildlife agencies to prepare and distribute a map of hunting opportunities within CPAs.</li> </ul> <p><i>On Refuge Lands</i>                  Expand hunting opportunities (i.e., more acres open to hunting).</p> <p>Continue to:</p> <ul style="list-style-type: none"> <li>• Allow hunting on the following refuge divisions and units:                         <ul style="list-style-type: none"> <li>* Nulhegan Basin Division</li> <li>* Putney Mountain Unit</li> <li>* Blueberry Swamp Division</li> <li>* Pondicherry Division</li> <li>* Fort River Division</li> <li>* Mill River Division</li> <li>* Dead Branch Division</li> <li>* Salmon River Division</li> </ul> </li> <li>• Complete all administrative requirements to maintain these hunts (e.g., hunt packages).</li> <li>• Hunting methods and seasons are generally consistent with state regulations.</li> </ul> <p>In addition, implement the following new strategies:</p> <ul style="list-style-type: none"> <li>• When compatible, allow hunting on current and future refuge lands, consistent with State regulations (some refuge-specific regulations may also apply and some units are not open due to sensitive resources).</li> <li>• Actively develop and maintain access enhancements on refuge facilities, including consideration for disabled hunters.</li> </ul>
<p><b>Hunter Education and Outreach</b></p>	<ul style="list-style-type: none"> <li>• Offer refuge facilities as host sites for State-directed hunter education courses.</li> <li>• Engage staff and volunteers in the delivery of established programs such as "Becoming a Bowhunter."</li> <li>• Partner with state fish and wildlife agencies, hunt clubs, and others to host a National Hunting and Fishing Day event in each of the states annually.</li> <li>• Use the WoV Express to share important hunting messages regarding the traditional values, ethics, safety, etc. at festivals, fairs, and other public events.</li> <li>• Provide hunt brochures, including regulations and maps, on the refuge Web site and at visitor contact points.</li> <li>• Work with the state fish and wildlife agencies to identify and evaluate the impacts associated with requiring the use of non-toxic ammunition for hunting on refuge lands.</li> <li>• At the Nulhegan Basin Division, the refuge and/or Vermont Fish and Wildlife Department will maintain a contact list of those individuals training and/or hunting with pursuit hounds (bobcat, bear, coyote), as well as those training beagles in order to share information regarding the identification of Canada lynx and their sign and appropriate actions when lynx are present.</li> </ul>

<p><b>Objective 3.2: Fishing</b></p> <p>Support quality public fishing opportunities in the Connecticut River watershed in cooperation with willing landowners to promote an understanding and appreciation of natural resources and their management, including the role of the Service and other public lands in resource conservation, while also protecting a traditional outdoor pastime deeply rooted in America's natural heritage and conservation history.</p>	
<p><b>Fishing Opportunities, Access, and Infrastructure</b></p>	<p><i>Within CPAs</i></p> <p>Work with partners and willing landowners within the watershed, with a priority on CPA lands, to:</p> <ul style="list-style-type: none"> <li>• With partners, promote fishing opportunities in the watershed by securing access to waters and developing infrastructure.</li> <li>• Actively develop and maintain access enhancements on and off refuge lands, including consideration for disabled anglers.</li> <li>• Collaborate with state fish and wildlife agencies to publish a fishing guide to publicly accessible waters within the watershed.</li> </ul> <p><i>On Refuge Lands</i></p> <p>Expand fishing opportunities.</p> <p>Continue to:</p> <ul style="list-style-type: none"> <li>• Offer fishing at: <ul style="list-style-type: none"> <li>* Nulhegan Basin Division</li> <li>* Blueberry Swamp Division</li> <li>* Pondicherry Division</li> <li>* Fort River Division</li> <li>* Mill River Division</li> <li>* Dead Branch Division</li> <li>* Salmon River Division</li> </ul> </li> <li>• Complete all administrative requirements to maintain these fishing opportunities (e.g., fishing plans).</li> </ul> <p>In addition, implement the following new strategies:</p> <ul style="list-style-type: none"> <li>• When compatible, allow fishing on current and future refuge lands with fishable waters, consistent with state regulations (some refuge-specific regulations may also apply and some units are not open due to sensitive resources).</li> </ul>
<p><b>Angler Education and Outreach</b></p>	<ul style="list-style-type: none"> <li>• Host fly-tying and other fishing “seminars” at refuge facilities to encourage increased participation, especially by women and children.</li> <li>• Partner with others to host a National Hunting and Fishing Day event in the form of training and/or demonstrations at least once in each of the four states each year.</li> <li>• Partner with state fish and wildlife agencies, hunt clubs, and others to host a “Take Me Fishing” event in support of National Fishing Day.</li> <li>• Produce fishing flyers/brochures and make available at kiosks and on the refuge Web site.</li> <li>• Work with the state fish and wildlife agencies to identify and evaluate the impacts associated with requiring the use of non-toxic tackle for fishing on refuge lands.</li> </ul>

<p><b>Objective 3.3: Wildlife Observation and Photography</b></p> <p>Support quality, public opportunities to observe and photograph wildlife in a variety of natural habitats in the Connecticut River watershed in order to connect a broad spectrum of people with nature.</p>	
<p><b>Wildlife Observation and Photography Opportunities, Access, and Infrastructure</b></p>	<p><i>Within CPAs</i> Work with partners and willing landowners to encourage and facilitate wildlife observation and photography opportunities in the watershed.</p> <p><i>On Refuge Lands</i> Expand wildlife observation and photography opportunities.</p> <p>Continue to offer the following opportunities:</p> <ul style="list-style-type: none"> <li>• All divisions and most units open to wildlife observation and photography through pre-acquisition compatibility determinations (Wissatinnewag, Saddle Island, and Dead Man’s Swamp Units are closed to all public use to protect sensitive resources; Mount Tom currently closed due to public safety and vandalism concerns).</li> <li>• Maintain existing refuge access and public use infrastructure, including roads and overlooks at Nulhegan Basin Division; and parking areas, and trails at Nulhegan Basin, Pondicherry, and Fort River Divisions and Putney Mountain Unit.</li> </ul> <p>In addition, implement the following new strategies:</p> <ul style="list-style-type: none"> <li>• When compatible, open current and future refuge lands to wildlife observation and photography.</li> <li>• When compatible, construct additional miles of hiking trails, blinds, and viewing platforms that highlight varied habitats, terrain, and vistas. Construct at least one Americans with Disabilities Act universally-accessible trail, parking area, and kiosk at every refuge division, once sufficient land is purchased.             <ul style="list-style-type: none"> <li>* Projects include: 7.2 miles of trails at the Nulhegan Basin Division, 0.6 miles at the Putney Mountain Unit, and 1.9 miles at the Pondicherry Division.</li> </ul> </li> <li>• When compatible, allow for professionally guided wildlife observation tours and photography seminars, subject to special use permits.</li> <li>• Evaluate all existing and proposed refuge infrastructure to provide access to those with disabilities.</li> <li>• At the more northerly Divisions, create pull-offs along plowed public roads to allow greater winter access for pedestrians.</li> <li>• Host a Big Sit at refuge divisions and other opportunities for visitors to get involved in refuge research and monitoring projects (e.g., bird banding, woodcock surveys).</li> </ul>
<p><b>Aids to Support Wildlife Observation and Photography on Refuge Lands</b></p>	<p><i>Within CPAs</i> Work with partners to develop materials to promote wildlife observation and photography opportunities, such as brochures, maps, Web-based information, and information and applications for mobile phones and devices.</p> <p><i>On Refuge Lands</i></p> <ul style="list-style-type: none"> <li>• Develop species lists and a map of key wildlife viewing areas on refuge lands and distribute them at refuge kiosks and website.</li> <li>• Work with partners to identify “Birding Hotspot” locations throughout the watershed with publications and signage.</li> <li>• Host wildlife identification and photography workshops at refuge facilities.</li> <li>• Where appropriate, develop tools such as phone apps, QR codes, E-bird sites, etc. at kiosks, visitor contact points, and partner facilities that inform visitors about CPA-based wildlife observation opportunities.</li> <li>• Loan “birding backpacks,” containing binoculars, field guides, checklists, etc. to the public at refuge visitor facilities.</li> </ul>
<p><b>Watershed-based Initiatives to Support Wildlife Observation and Photography</b></p>	<ul style="list-style-type: none"> <li>• Promote the Connecticut River Birding Trail by offering the existing guides at refuge and partner facilities.</li> <li>• Support extension of the Birding Trail to include Massachusetts and Connecticut.</li> <li>• Provide a link to the Birding Trail via the refuge’s website and work with the publisher to create a fully digital guide and aid in the transition to a paperless format.</li> <li>• Work with partners to develop and publish a list/map of key wildlife viewing areas on surrounding lands.</li> <li>• Promote the Connecticut River Byway by providing its informational materials at refuge facilities and providing a link via the refuge’s website.</li> </ul>



**Objective 3.4: Other Recreational Activities**

Support non-priority, outdoor recreational opportunities and public access that provide quality, nature-based experiences throughout the Connecticut River watershed to facilitate and improve community relationships, raise awareness and an appreciation for conserving natural resources, and garner support for the National Wildlife Refuge System.

<p><b>Regional Water-based Trail Initiatives and Opportunities</b></p>	<p><i>Within CPAs</i> Work with partners and willing landowners within the watershed, with a priority on CPA lands, to:</p> <ul style="list-style-type: none"> <li>• Assist Connecticut River Paddlers’ Trail to complete a continuous network of launches and campsites so that the trail is fully functional for its 410-mile length, including the siting of trail infrastructure on refuge lands when appropriate and compatible.</li> <li>• Publicize the Connecticut River Paddlers’ Trail on the refuge’s web page, and write letters in support of grant funding.</li> <li>• Work with state, local, and other conservation partners to identify at least six appropriate sites in each watershed state in order to improve direct public access to the Connecticut River and its major tributaries for the purpose of site-appropriate boating, fishing, and wildlife observation.</li> <li>• Expand partnership with Northern Forest Canoe Trail to enhance the visitor experience.</li> </ul> <p><i>On Refuge Lands</i> Expand opportunities for regional water-based trail initiatives.</p> <ul style="list-style-type: none"> <li>• On refuge lands, maintain a relevance to the larger recreational community and provide opportunities for non-traditional users to experience refuge resources by promoting regional water-based trails, such as the Connecticut River Paddlers’ Trail and Northern Forest Canoe Trail.</li> <li>• Work with the Northern Forest Canoe Trail to provide a campsite and access point for paddlers at the Nulhegan Basin Division.</li> </ul>
<p><b>Regional Land-based Trail Initiatives and Opportunities</b></p>	<p><i>Within CPAs</i> Work with partners and willing landowners to support land-based trail initiatives within the Connecticut River watershed that promote conservation and land ethic.</p> <p><i>On Refuge Lands</i> Expand opportunities to form linkages between refuge lands.</p> <p>Current connections to larger trail systems include:</p> <ul style="list-style-type: none"> <li>• Nulhegan Basin Division—snowmobile trails</li> <li>• Pondicherry Division—snowmobile trails</li> <li>• Presidential Recreational Trail through the division (hiking, bicycling, horseback riding, snowmobiling)</li> <li>• Cohos Trail</li> <li>• Mt. Tom Unit–Metacomet–Monadnock Trail</li> <li>• Putney Mt. Unit–Windmill Ridge Trail</li> <li>• Dead Branch Division—snowmobile trail</li> </ul> <p>In addition, implement the following new strategies:</p> <ul style="list-style-type: none"> <li>• When appropriate and compatible, use refuge lands to provide linkages for existing, established regional trails.</li> <li>• Future trails will be evaluated for appropriateness and compatibility on refuge lands on a case-by-case basis and maintained by user organizations under a special use permit. For the most part, such trails will conform to existing, identifiable corridors.             <ul style="list-style-type: none"> <li>* <i>Winter trails:</i> (snowmobiling, cross-country skiing, and snowshoeing)</li> <li>* <i>Spring, Summer, Fall trails:</i> (biking and hiking)</li> </ul> </li> <li>• Where refuge ownership interests coincide with regional hiking trails, such as the Appalachian National Scenic Trail and New England National Scenic Trail; assist in the long-term protection of their continuity and quality by using our land acquisition authority to acquire interest (fee and easements) in land to maintain the linear and lateral trail and habitat connectivity.</li> <li>• Work with Vermont Association of Snowmobile Travelers (VAST) to establish a snowmobile trail link to the Nulhegan Visitor Contact Station. Reduce redundant trail segments (approximately 1 acre) on the refuge (see appendix D compatibility determination for snowmobiling at Nulhegan Basin Division).</li> <li>• Open snowmobile trails at the Nulhegan Basin Division to snowshoers and cross-country skiers, similar to other public lands.</li> <li>• Partner with the Green Mountain Club to construct a 1.4-mile hiking trail segment to incorporate the Nulhegan Basin Division into their Gore Mountain Trail.</li> </ul>

**Objective 3.4: Other Recreational Activities (cont.)**

Support non-priority, outdoor recreational opportunities and public access that provide quality, nature-based experiences throughout the Connecticut River watershed to facilitate and improve community relationships, raise awareness and an appreciation for conserving natural resources, and garner support for the National Wildlife Refuge System.

**Other Recreational Opportunities that Enhance Visitor Use and Enjoyment of Refuge Lands**

*On Refuge Lands*

- Continue to allow other, compatible recreational opportunities in designated locations on existing refuge divisions and units, such as:
  - \* Pet walking.
  - \* Boating in designated waterbodies.
  - \* Bicycles and automobiles on designated roads.
- As new refuge lands are acquired, determine if these uses are compatible.
- Continue to allow snowmobiling on designated routes on the Nulhegan Basin, Pondicherry, and Dead Branch Divisions.

In addition, implement the following new strategies:

- Offer virtual geocaching opportunities to help interpret refuge resources.
- When compatible, allow commercial guiding in support of the six priority public uses by special use permit.
- When compatible, allow recreational gathering of blueberries, blackberries, strawberries, raspberries, mushrooms, fiddleheads, and antler sheds.
- Require pets to be on leash at all times.
- Open to bicycling Nulhegan Basin Division roads that are also open to motor vehicles.

<p><b>Goal 4: Partnerships.</b>                  Enhance the conservation, protection, and stewardship of natural and cultural resources, and promote wildlife-dependent recreation, throughout the Connecticut River Watershed by initiating, supporting, and promoting partnerships with other Federal, State, and local agencies, Tribal governments, and private organizations.</p>	
<p><b>Objective 4.1: Strategic Habitat Conservation Partnerships</b>                  Create, enhance, and facilitate partnerships to plan, design, deliver, and evaluate Strategic Habitat Conservation in the Connecticut River watershed, with an emphasis on promoting action in CPAs. Special effort will be made to coordinate with the North Atlantic LCC partnership, the four State fish and wildlife agencies, and other partners advancing conservation in the watershed.</p>	
<p><b>Habitat Restoration and Management</b></p>	<p><i>Within CPAs</i>                  Continue to work with habitat conservation partners throughout the Connecticut River Watershed, with priority attention to CPAs.</p> <ul style="list-style-type: none"> <li>• Work with partners and willing landowners to restore, manage, and enhance habitats for Federal trust resources and other species of conservation concern. Priorities include:                         <ul style="list-style-type: none"> <li>* Restoring riparian and floodplain habitat along the Connecticut River main stem and tributaries.</li> <li>* Removing barriers to aquatic passage, especially for migratory fish.</li> <li>* Restoring wetland functions and values.</li> <li>* Protecting federally listed species.</li> <li>* Treating invasive species that threaten important habitats.</li> </ul> </li> </ul>
<p><b>Private Lands Coordination</b></p>	<p><i>Within CPAs</i>                  Enhance the refuge's private land coordination program to help complement private landowner assistance among the four States, NRCS, the Forest Service, and other conservation agencies. Priorities include:</p> <ul style="list-style-type: none"> <li>• Working with landowners to find grant opportunities and submit grant applications.</li> <li>• Share scientific information and best management practices.</li> </ul>
<p><b>Land Protection</b></p>	<p><i>Within CPAs</i>                  Support partners' efforts to acquire land of high importance to species and habitats, and/or that support the Connect the Connecticut Landscape Conservation Design.</p> <p><i>Within CFAs</i>                  Pursue from willing sellers only, acquisition of those lands identified in approved land protection plan (Final CCP appendix C). Actions taken will complement other partners' land conservation efforts and support the Connect the Connecticut Landscape Conservation Design.</p>

<p><b>Objective 4.2: Terrestrial Species Protection, Restoration, and Management Partnerships</b></p> <p>Create, enhance, and facilitate partnerships to protect, restore, and manage populations of terrestrial species of conservation concern, including Federally listed species, species proposed for listing, and migratory birds, throughout the Connecticut River watershed, with an emphasis on promoting action in CPAs.</p>	
<p><b>Federally Listed Terrestrial Species Conservation</b></p>	<p><i>Within CPAs</i></p> <p>Enhance existing and build new partnerships to conserve federally threatened, endangered, and Federal candidate terrestrial species throughout the watershed, with priority attention to CPAs, including:</p> <ul style="list-style-type: none"> <li>• Collaborate with Federal and State agencies, local towns, nongovernmental organizations, and willing landowners.</li> <li>• Work with others to develop and implement species recovery plans, State WAPs, and other conservation measures with a goal to avoid new species listings. Measures may include land protection, public use and access management, and invasive species control.</li> </ul> <p><i>Within CFAs</i></p> <p>Complement partners' land conservation efforts by acquiring additional refuge lands within CFAs to protect important habitats for federally listed species.</p>
<p><b>Migratory Bird Conservation</b></p>	<p><i>Within CPAs</i></p> <p>Enhance existing and build new partnerships to conserve migratory birds throughout the watershed, with a special focus on CPAs, including:</p> <ul style="list-style-type: none"> <li>• Supporting migratory bird ecoregional plans and priorities developed through the NALCC including: <ul style="list-style-type: none"> <li>* Population monitoring, assessment, and management.</li> <li>* Habitat restoration, management, and protection.</li> <li>* Private lands coordination and grants writing and funding support.</li> <li>* Communications and outreach.</li> <li>* Recreational opportunities.</li> </ul> </li> </ul>
<p><b>Other Terrestrial Species of Conservation Concern Identified by the Service, NALCC Partnership, or States</b></p>	<p><i>Within CPAs</i></p> <p>Enhance existing and build new partnerships to conserve other terrestrial species of conservation concern throughout the watershed, with priority attention to CPAs, including working with partners to develop and implement conservation programs.</p>

<b>Objective 4.3: Aquatic Species Protection, Restoration, and Management Partnerships</b>	
Support the conservation of migratory fish and other aquatic species of conservation concern by collaborating with Federal and State agencies, local towns, and non-governmental organizations in the implementation of fish and other aquatic species conservation plans.	
<b>Federally Listed Aquatic Species Conservation</b>	<p><i>Within CPAs</i></p> <p>Enhance existing and build new partnerships to conserve federally threatened, endangered, and Federal candidate aquatic species throughout the watershed, with priority attention to CPAs, including:</p> <ul style="list-style-type: none"> <li>• Collaborate with Federal and State agencies, local towns, NGOs, and willing landowners.</li> <li>• Work with others to develop and implement species recovery plans, State WAPs, and other conservation measures with a goal to avoid new species listings. Measures may include land protection, public use and access management, and invasive species control.</li> </ul>
<b>Other Aquatic Species of Conservation Concern Identified by the Service, the NALCC Partnership, or States</b>	<p><i>Within CPAs</i></p> <p>Enhance existing and build new partnerships to conserve other aquatic species of conservation concern throughout the watershed, with priority attention to CPAs, including working with partners to develop and implement conservation programs. For example:</p> <ul style="list-style-type: none"> <li>• Work with others to remove barriers to aquatic species passage (e.g., dam removal and culvert replacement).</li> <li>• Work with others to restore native species; work together to identify, prioritize, seek funding, implement, and monitor success of projects.</li> </ul>
<b>Cooperative Invasive Species Management Areas and Other Invasive Species Partnerships</b>	<p><i>Within CPAs</i></p> <p>Work with partners to develop a framework for invasive species control at all levels within the watershed, including watershed-wide, in subwatersheds, and at local levels. The goal is to create an organization that will result in on-the-ground invasive species inventories, monitoring, education, and management activities in priority habitats. Specifically, we will:</p> <ul style="list-style-type: none"> <li>• Take a leadership role in forming and administering a watershed-wide, partnership-based invasive species management program using the CISMA model. Apply for Federal funds to run this “umbrella CISMA” and distribute funds to the smaller groups to complete projects.</li> <li>• Work with existing partners to develop invasive species management objectives and strategies.</li> <li>• Help develop invasive species partnerships in CPAs where none currently exist.</li> </ul>
<b>Invasive Species Outreach</b>	<p><i>Within CPAs</i></p> <p>Provide target audiences and concerned citizens with the information they need to take meaningful actions to control or prevent species spread on their own lands or through their recreational and/or professional activities. Specifically, we will:</p> <ul style="list-style-type: none"> <li>• Educate the public about the importance of each person doing their part and supply them with the information to take wise action.</li> <li>• Inform those who manage extensive amounts of vegetation and/or transport soils as part of their job duties about the potential transmission of invasive plants, and provide them with operational Best Management Practices (BMPs).</li> <li>• Prioritize actions by considering which species are of highest threat to biodiversity, are threatening rare species, or can most successfully be eradicated; as well as which areas are especially important to restore due to important natural resources; educate partners and public about these priorities.</li> <li>• Help groups successfully plan and implement volunteer control days in their communities for plants that are easy to control by hand such as garlic mustard.</li> </ul>

<p><b>Objective 4.4: Invasive Species Management and Other Invasive Species Partnerships</b></p> <p>Plan and implement coordinated and strategic actions among conservation partners and private landowners to reduce the ecological threat from invasive or exotic plants and wildlife species in the Connecticut River watershed. Work with those partners to design and implement strategies for controlling the spread of established invaders, preventing new invasions, and in the early detection and rapid response to control new invaders.</p>	
<p><b>Early Detection and Rapid Response Control</b></p>	<p><i>Within CPAs</i></p> <p>Work with partners to design and implement strategies for prevention, early detection, and rapid control response to new invaders, especially those deemed to pose a serious threat to native species populations or diversity. Specifically we will:</p> <ul style="list-style-type: none"> <li>• Become more actively involved with the Northeast Aquatic Nuisance Species Panel.</li> <li>• Work with the State invasive species groups to develop lists of potential invasive species that would pose serious threats to biodiversity if they became established in the watershed and develop a protocol for early detection and rapid response. Focus, first on priority species already known to be in New England such as zebra mussel, Asian longhorn beetle, hemlock wooly adelgid, emerald ash borer, mute swan, hydrilla, mile-a-minute vine, and Japanese stiltgrass.</li> <li>• Continue water chestnut spread control actions by assisting to find funds for large populations, leading groups to hand-pull smaller populations, and inspecting other water bodies for this species. Locate groups willing to “adopt a water body for water chestnut control” to further refuge efforts.</li> </ul>
<p><b>Invasive Species Inventories and Mapping</b></p>	<p><i>Within CPAs</i></p> <p>Work with partners to inventory and monitor populations of invasive species across the watershed, with priority attention to CPAs. Specifically, we will:</p> <ul style="list-style-type: none"> <li>• Ensure that inventory results are documented and shared in a timely manner, and to coordinate inventory efforts where possible.</li> <li>• Research how much of the watershed is covered in the inventory of the IPANE project (Invasive Plant Atlas of New England) and what gaps exist, especially on refuge-owned lands.</li> <li>• Work with IPANE staff to recruit IPANE volunteers to fill the gaps of the IPANE data within the watershed, (with a special focus on the CPAs and refuge-owned lands) and institute a procedure for the refuge to be notified if any invaders new to the area are discovered.</li> <li>• Work with IPANE program to include existing refuge data on invasive plants into the IPANE database.</li> </ul>
<p><b>Objective 4.5: Special Designation Area Partnerships</b></p> <p>Support existing Federal and State designated special areas, and work with partners and willing landowners to promote additional designations that enhance the protection and/or recognition of natural, cultural, and recreational resources of significance within CPAs.</p>	
<p><b>Eligibility and Monitoring</b></p>	<p><i>Within CPAs</i></p> <p>Work cooperatively with others throughout the watershed, with priority attention to CPAs, to promote special designations that benefit natural, cultural, and recreational resources, such as:</p> <ul style="list-style-type: none"> <li>• Work with partners throughout the watershed to share information with willing landowners on the benefits of and eligibility requirements for special designation areas.</li> <li>• Work with partners and willing landowners to establish a monitoring program, or implement ones already developed, and pool resources to accomplish that monitoring, in an effort to ensure that the special designation areas maintain their characteristics.</li> </ul>

<p><b>Objective 4.6: Research and Demonstration Partnerships, Particularly in Support of Climate Change Adaptation</b></p> <p>Create, enhance, or facilitate partnerships that advance conservation research in the Connecticut River watershed, leveraging resources among partners, with an emphasis on advancing our understanding of climate change and land use impacts and pursuing adaptation strategies in response, to ensure the long-term sustainability of native fish, wildlife, plants, and associated habitats found in the CPAs.</p>	
<p><b>Conservation Science Partnerships and Information Exchanges</b></p>	<p><i>Within CPAs</i></p> <p>Work with partners to conduct research and demonstration projects to address climate change throughout the watershed, with priority attention to CPAs. For example:</p> <ul style="list-style-type: none"> <li>• Promote research and development of applied management practices to sustain and enhance the natural and cultural resources.</li> <li>• Seek opportunities that engage research institutions and organizations such as universities and colleges and NGOs.</li> <li>• Primarily working through the NALCC partnership, develop, implement, and support cooperative research programs that address priority conservation and management needs or which provide basic information on species populations, their habitat needs, and response to climate change.</li> <li>• Encourage opportunities on the refuge for research, inventory and monitoring, and the demonstration of management practices.</li> </ul>
<p><b>Inventory and Monitoring Program</b></p>	<p><i>Within CPAs</i></p> <p>Work with other partners to inventory and monitor resources of conservation concern throughout the watershed, with priority attention to CPAs. For example:</p> <ul style="list-style-type: none"> <li>• Promote the efforts of the NALCC partnership to identify common inventory and monitoring needs and help the LCC with sharing resources to accomplish priority work.</li> <li>• Support the Service's LMRD and the inventory and monitoring priorities identified for the watershed.</li> </ul>
<p><b>Climate Science and Adaptation</b></p>	<p><i>Within CPAs</i></p> <p>Work with partners at the Federal, State, and local levels to identify and address climate change threats to fish, wildlife, and habitats throughout the watershed, including:</p> <ul style="list-style-type: none"> <li>• Encouraging communities in the watershed to plan to minimize the impacts of climate and land use changes and to conserve ecosystem services benefits.</li> <li>• Promoting the work of the NALCC to model land use and climate change and the projected impacts on fish, wildlife, and habitats.</li> <li>• Encouraging and supporting the restoration of floodplain forests and riparian buffers to protect public and private property from increased incidents of severe weather events, and any actions that will improve water quality in rivers and streams.</li> <li>• Supporting the work of the Northeast Climate Science Center to help provide scientific information, tools, and techniques to help anticipate, monitor, and adapt to climate change.</li> <li>• Working with other Service programs to develop, and share information with partners about, best practices for climate change adaptation.</li> </ul>

<p><b>Objective 4.7: Community-based Partnerships</b></p> <p>Create, enhance, or facilitate partnerships within watershed communities that enhance the Service’s ability to make positive contributions to civic life and local economies, and enrich community connections to a healthy, vibrant watershed (see objective 4.8 for those partnerships specifically dedicated to education, interpretation, and recreation).</p>	
<p><b>Economic Vitality within the Watershed</b></p>	<p><i>Within CPAs</i></p> <ul style="list-style-type: none"> <li>• Work to enhance the economic vitality of communities in the Connecticut River watershed through nature-based and ecotourism initiatives, agriculture and forest protection programs, and recreational activities that both advance strategic conservation and improve broad-based visitation to the refuge.</li> <li>• Meet with local community officials and leaders to establish how the Service can make a positive contribution to local economies consistent with the Service and Refuge System missions and refuge purposes where refuge lands are involved.</li> <li>• Communicate with local businesses when refuge staff are awarding contracts that have the potential for economic opportunity, including timber harvest, and construction and maintenance activities.</li> </ul>
<p><b>Historic and Cultural Resources</b></p>	<p><i>Within CPAs</i></p> <ul style="list-style-type: none"> <li>• As appropriate, support the protection, management, and restoration of cultural resources in the Connecticut River watershed and promote opportunities to connect people to the area’s rich history. Identify and develop working partnerships with academic institutions, museums, and tribal governments with the goal of identification, protection, and interpretation of historic and cultural resources, particularly land-based or archaeological features. The refuge will not lead on projects involving the acquisition, restoration, and interpretation of historic structures, but where practical and appropriate on such projects within CFAs that include a significant land protection component, we will work to be an effective partner in the overall protection effort.</li> </ul>
<p><b>Community Outreach, Shared Facilities, and Public Safety Resources</b></p>	<p><i>Within CPAs</i></p> <ul style="list-style-type: none"> <li>• Institute regular meetings (e.g., annual meetings, twice annual listening stations, etc.) with community leaders and citizens to make the refuge more relevant and connected to communities.</li> <li>• Make refuge buildings available for community meetings and events. Consider opportunities to provide office space to State natural resource and other conservation partners in order to better serve the public interest. Share maintenance equipment and other resources with a wide range of partners when possible.</li> <li>• Establish partnerships with local and State law enforcement agencies to benefit both communities and the refuge. Enter into mutual aid agreements to share personnel and equipment.</li> </ul>
<p><b>Easements, Leases, Cooperative Agreements, and Special Use Permits</b></p>	<p><i>Within CPAs</i></p> <ul style="list-style-type: none"> <li>• Employ a wide variety of agreement types to facilitate projects and other opportunities advancing conservation, environmental education, and recreation goals shared with partners in local communities.</li> <li>• Ensure the most appropriate agreement is created for each opportunity given expected outcomes and responsibilities. For example, encourage easements to provide additional public access or manage habitats, or to protect important habitat from land development.</li> <li>• We may pursue low or no-cost leases to facilitate the construction of capital improvements such as Conte Corner installations, boardwalks, trails, and interpretive kiosks.</li> </ul>
<p><b>Constituent Organizations</b></p>	<p><i>Within CPAs</i></p> <ul style="list-style-type: none"> <li>• Promote relationships with bird clubs, outdoor recreation and sportsperson’s clubs, and other constituent organizations to encourage their involvement in refuge management and to build support.</li> </ul>



**Objective 4.8: Educational and Interpretation Partnerships**

In conjunction with the strategies described under Goal 2—Environmental Education, Interpretation, and Outreach, above—coordinate our educational, outreach, and interpretive conservation programs with those of our partner agencies and organizations so that a consistent public message fosters respect for the natural world and gets more people motivated to promote conservation in their daily lives.

<p><b>Environmental Education and Interpretation Partnerships</b></p>	<p><i>Within CPAs</i></p> <p>Enhance existing and build new partnerships to develop and provide high-quality environmental education and interpretive programs, with priority attention in CPAs, including:</p> <ul style="list-style-type: none"> <li>• Working with each of the four State environmental education program coordinators to identify effective education programs, to integrate curriculums where appropriate, and to promote consistent standards of excellence for educational programs offered in the watershed.</li> <li>• Working with education partners to develop and deliver integrated interpretive messages about natural, cultural, and historic resources of the Connecticut River watershed.</li> <li>• Contribute interpretive information regarding the refuge to partner programs.</li> <li>• Continue and enhance shared environmental education and interpretation facilities that are effective in reaching a wide and diverse demographic with consistent and productive messages about the refuge and the Service’s contribution to conservation in the watershed.</li> <li>• Continue to seek new opportunities for partnerships.</li> </ul>
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**Objective 4.9: Recreation Partnerships to Connect People with the Outdoors**

Work with partners to promote and provide outdoor recreational opportunities in the watershed that facilitates connecting people with nature in a meaningful way, and encourages those connections over their lifetimes. Promote the development of a landscape-based recreation strategy within the watershed to connect, protect, and enhance a network of aquatic and terrestrial trails.

<p><b>Federal and State Agency Strategic Recreation Plans</b></p>	<p><i>Within CPAs</i></p> <p>Work cooperatively with other Federal and State partners throughout the watershed, with priority attention to CPAs, to plan and implement recreational opportunities.</p>
<p><b>Making Connections Outdoors</b></p>	<p><i>Within CPAs</i></p> <p>Coordinate with other Federal and State agencies, educational and recreational organization and user groups to promote activities that connect people with the outdoors, including:</p> <ul style="list-style-type: none"> <li>• Help sustain regional trails that connect people with nature, such as the Northern Forest Canoe Trail, Connecticut River Birding Trail, Connecticut River Paddlers’ Trail, and the “Source to the Sea” birding trail.</li> <li>• Engage with partners to develop concept plans, interpretive materials, and conduct inventories of infrastructure to support these trails and initiatives.</li> </ul>

<p><b>Objective 4.10: Friends Groups</b></p> <p>Develop and nurture active and vibrant Friends groups through formal, strategic support programs, and by strengthening communication, collaboration, and cooperation. Include them as full partners in the mission delivery of the refuge and the Refuge System. Implement national guidance on mentoring Friends groups designed to ensure each group's effectiveness in supporting the refuge, as well as to provide training and organizational resources, and encourage networking among Friends groups across the Refuge System. Provide guidance to partners who want to create Friends groups on other ownerships.</p>	
<p><b>Friends Groups</b></p>	<p><i>Within CPAs</i></p> <p>Continue to support existing Friends groups, including the Friends of Conte Refuge, Friends of Pondicherry, Friends of Nulhegan Basin Division, Friends of Salmon River, and Friends of the Great Falls Discovery Center.</p> <p>In addition, we will:</p> <ul style="list-style-type: none"> <li>• Enhance support for refuge Friends groups.</li> <li>• Develop, promote, and support development of Friends groups for other refuge divisions and units.</li> <li>• Formalize each refuge Friends group through a written agreement.</li> <li>• Encourage Friends groups to pursue non-profit status (501(c) 3 organization status).</li> <li>• Provide resources to conservation partners interested in establishing a Friends group on other ownerships.</li> </ul>
<p><b>Objective 4.11 Intergovernmental Partnerships</b></p> <p>Pursue strategic and synergistic intergovernmental partnerships at all levels of government to achieve specific, shared, and compatible landscape-level goals for conservation, education, and recreation within the watershed. Work within existing Federal and State programs to the full extent possible to help leverage funding and staff resources, information, and expertise among public and private partners. Formalize agreements through Memorandums of Understanding (MOUs), Memorandums of Agreement (MOAs), or other written, intergovernmental agreements, as warranted, when the identification of roles, responsibilities, and measures of success will enhance the likelihood of successful implementation.</p>	
<p><b>Multiagency or Public-Private Partnerships</b></p>	<p><i>Within CPAs</i></p> <p>Continue to support existing MOUs and other multiagency and public-private partnership agreements to meet refuge goals, the Refuge System mission, and other shared conservation priorities in the watershed.</p> <p>In addition, we will:</p> <ul style="list-style-type: none"> <li>• Enhance existing, and build new, multiagency and public-private partnerships to meet shared conservation goals throughout the watershed, with priority attention to CPAs, including:</li> <li>• Seek opportunities, to the extent possible, to share financial and staff resources, information, expertise, etc.</li> <li>• Work with partners to monitor and evaluate existing MOUs and MOAs prior to their renewal; continue, modify, or discontinue agreements as warranted.</li> </ul>
<p><b>Federal Agency Coordination</b></p>	<p><i>Within CPAs</i></p> <p>Continue to engage other Federal agencies in shared conservation goals for the watershed, and to enhance the implementation of Federal programs through partnerships.</p> <p>In addition, we will:</p> <ul style="list-style-type: none"> <li>• Enhance existing, and build new, Federal agency partnerships to expand and expedite programs to benefit local communities.</li> <li>• Seek opportunities, where possible, to share financial and staff resources, information, expertise, and otherwise leverage multi-agency investments in the watershed to accomplish shared goals and attract other investors.</li> <li>• Utilize the AGOs framework to catalyze and bolster local, community-driven conservation efforts and demonstrate how a strong Federal agency partnership can more effectively align, target, and leverage public resources across the watershed to accomplish shared goals and objectives.</li> </ul>

## Maps of CPAs

The following maps show the location of the 19 individual CPAs, and the location of the 22 CFAs within them, portraying graphically the information in table 4.1.

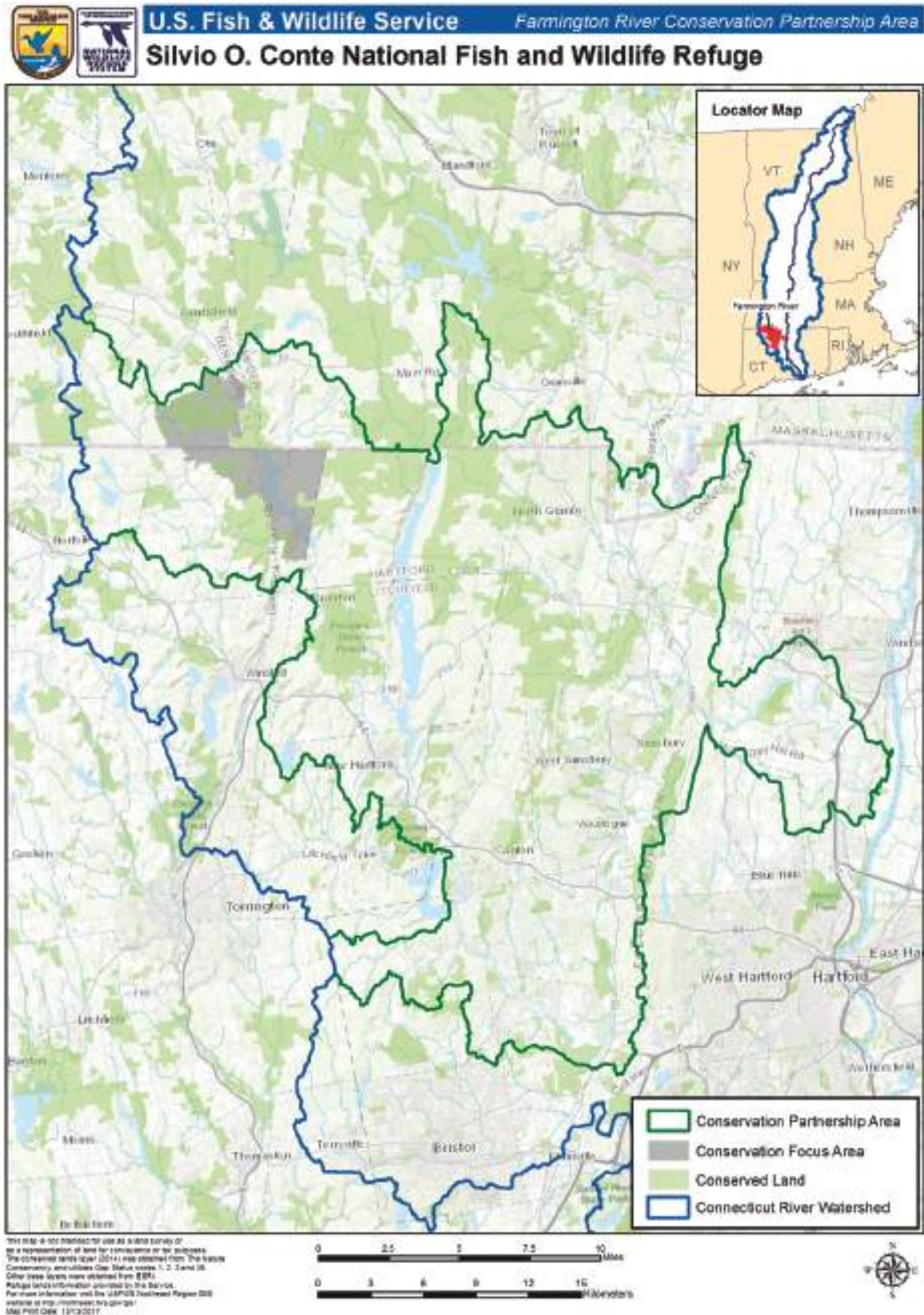
CPAs are areas where we will focus our support to our partners to best achieve shared conservation, education, and recreational goals. CFAs are areas where the Service will focus land acquisition efforts from willing sellers for Conte Refuge (fee title and easement) to make important contributions to the priority conservation targets.

The CPA maps below are organized alphabetically by State. On average, ninety percent (90%) of our approved acreage authority will be acquiring land from willing sellers within CFAs, with the remaining ten percent (10%) from willing sellers within the surrounding CPAs. Since that 10% is not depicted as discrete areas, we will coordinate with local municipalities, States, and abutting landowners prior to taking action.

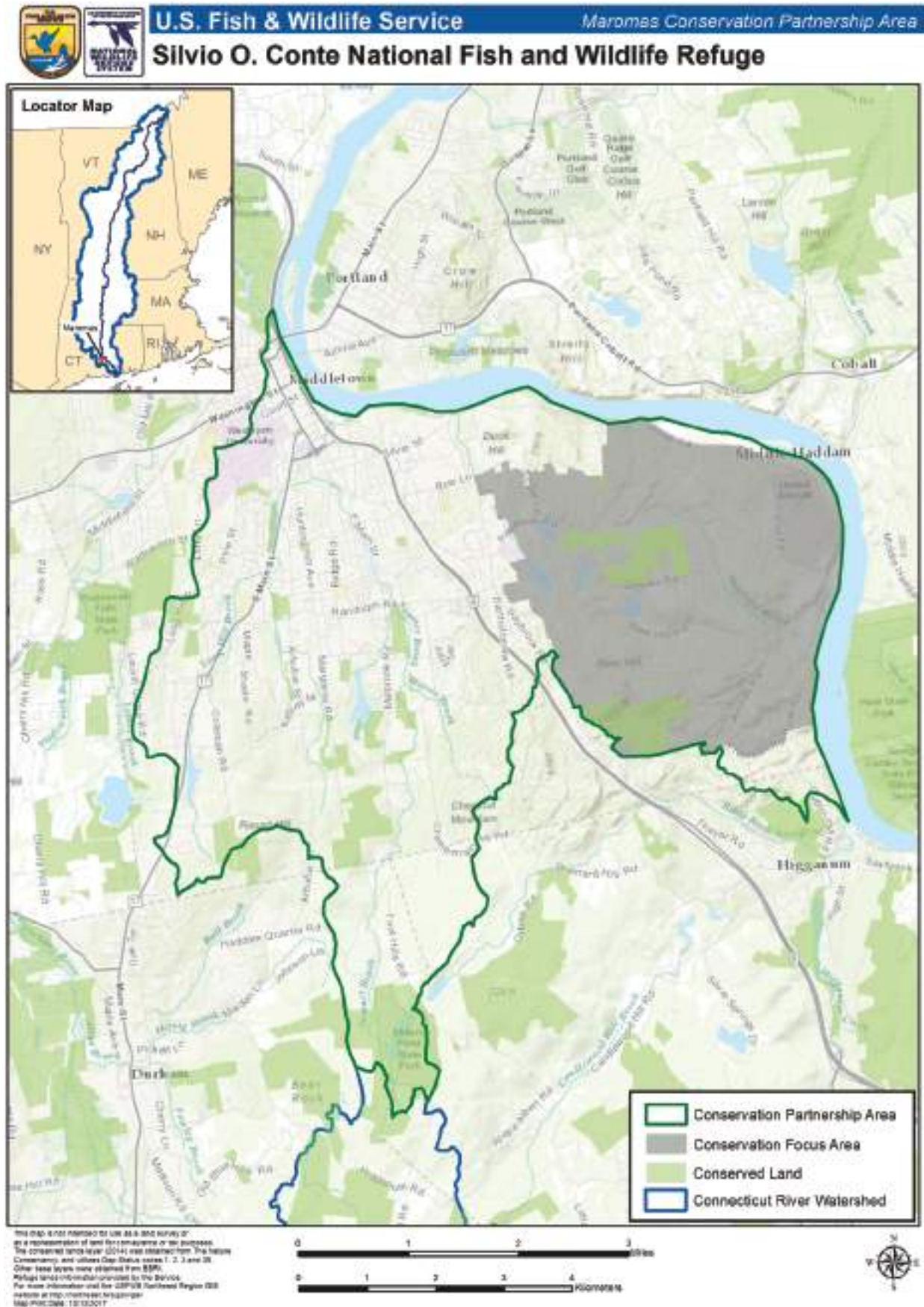
Each CPA map shows:

- The CPA boundary.
- The delineation of the CFA(s) (shown in gray).
- Conserved lands as defined by The Nature Conservancy's 2014 secured lands data using GAP status 1, 2, 3 and 39 definitions (<https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/edc/reportsdata/terrestrial/secured/Pages/default.aspx>). The Service does not intend to pursue acquisition of existing conserved lands (shown in green).

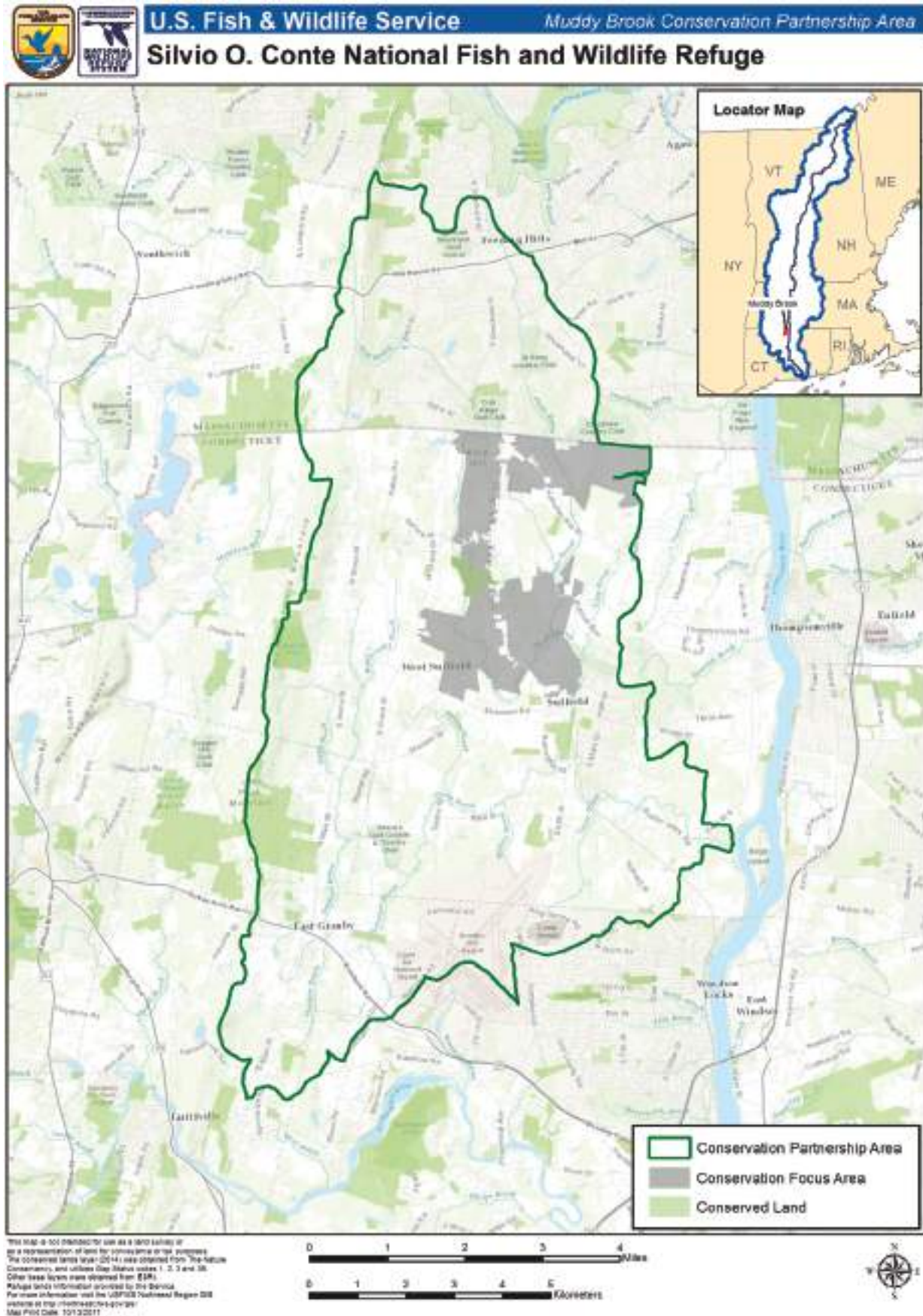
Map 4.2. Farmington River CPA, Connecticut and Massachusetts



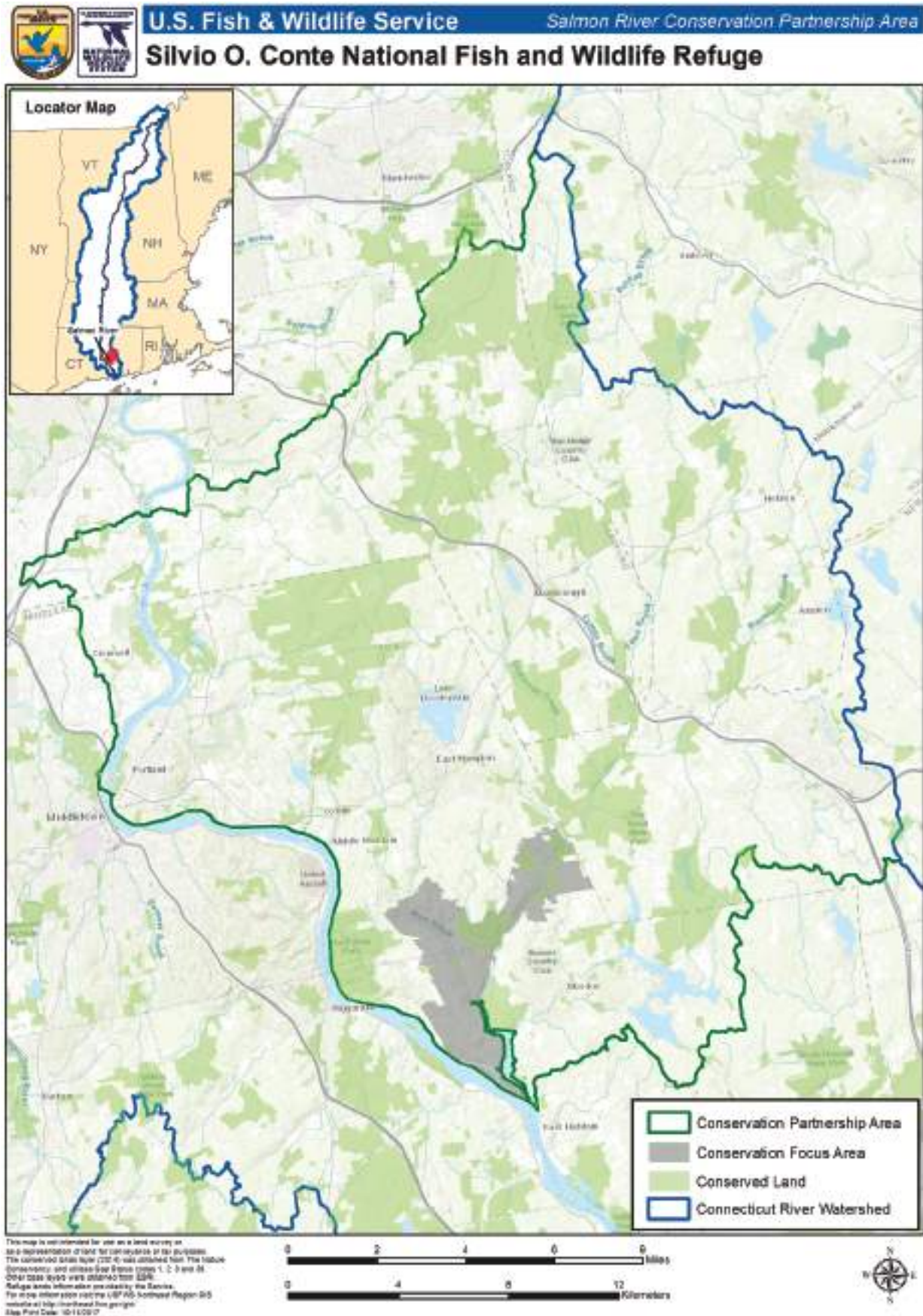
Map 4.3. Maromas CPA, Connecticut



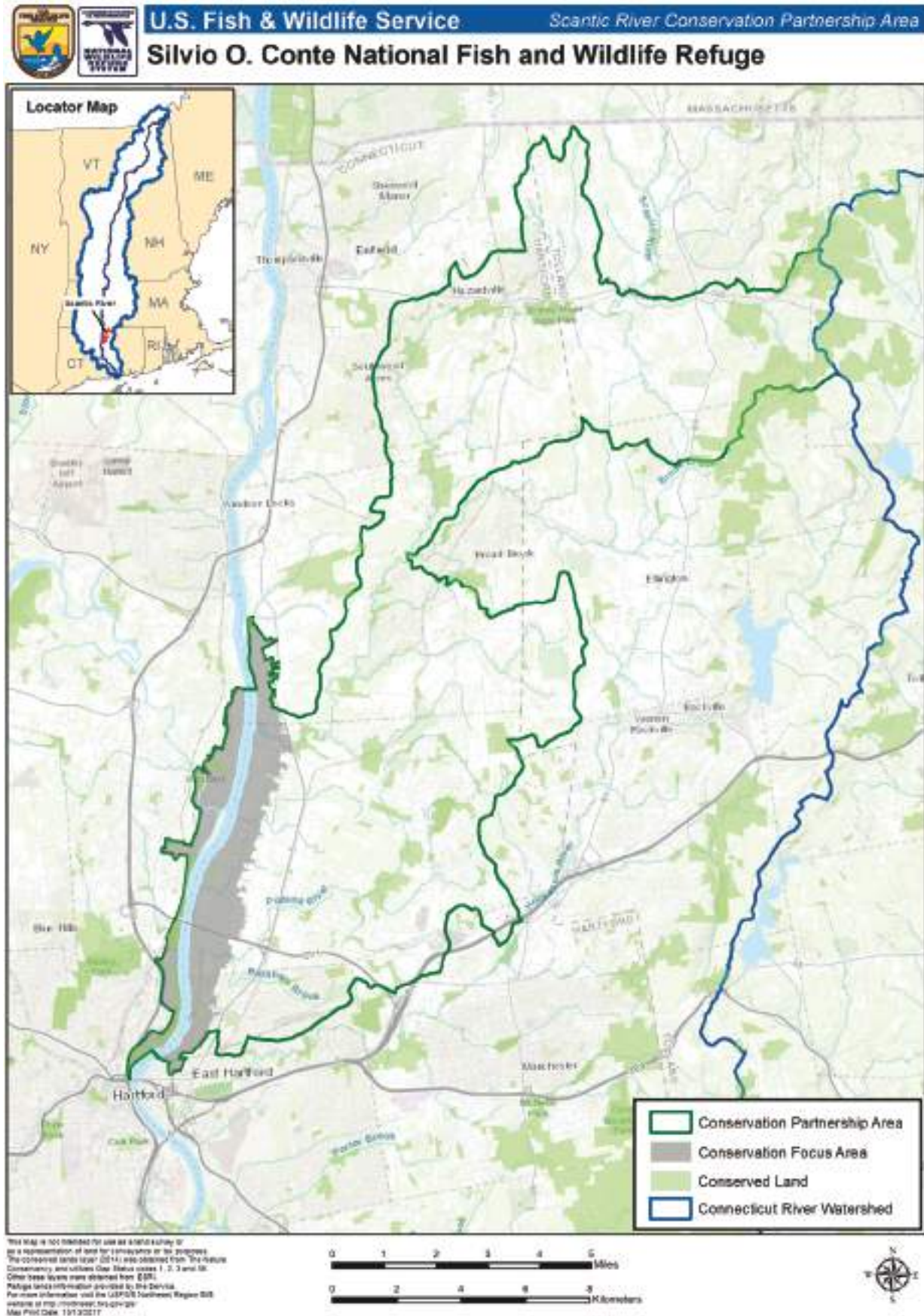
Map 4.4. Muddy Brook CPA, Connecticut



Map 4.5. Salmon River CPA, Connecticut



Map 4.6. Scantic River CPA, Connecticut



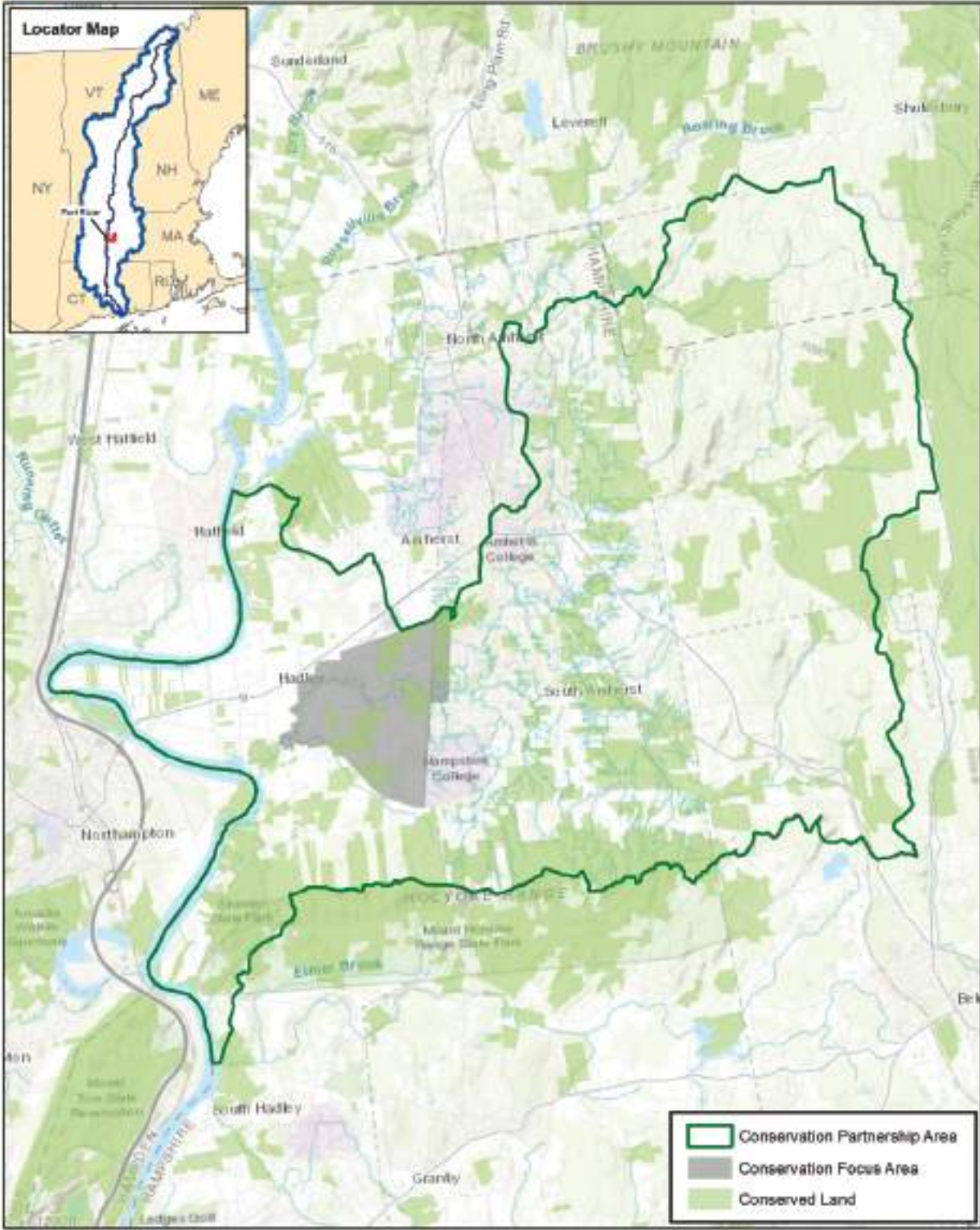




Map 4.8. Fort River CPA, Massachusetts

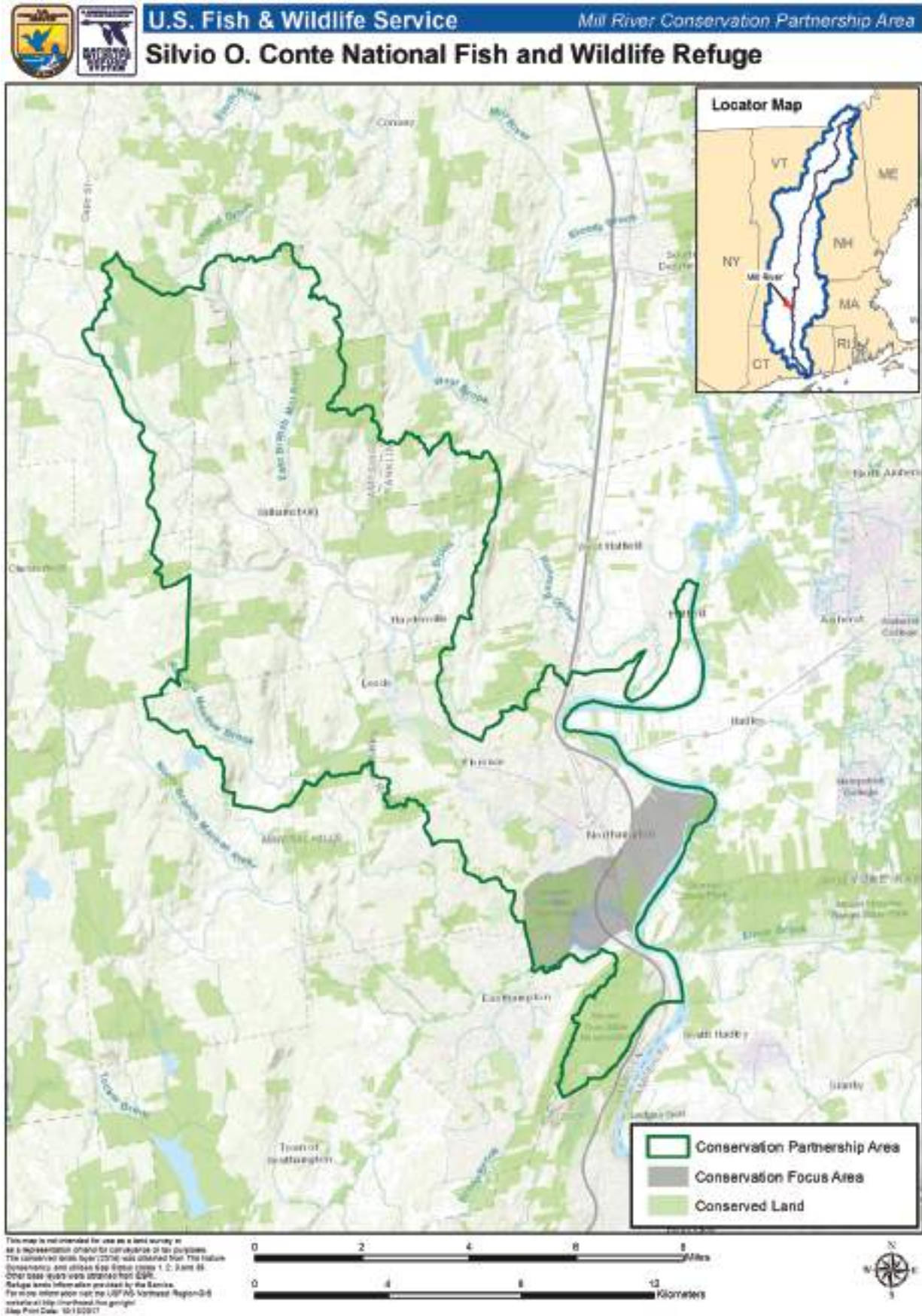


**U.S. Fish & Wildlife Service** *Fort River Conservation Partnership Area*  
**Silvio O. Conte National Fish and Wildlife Refuge**

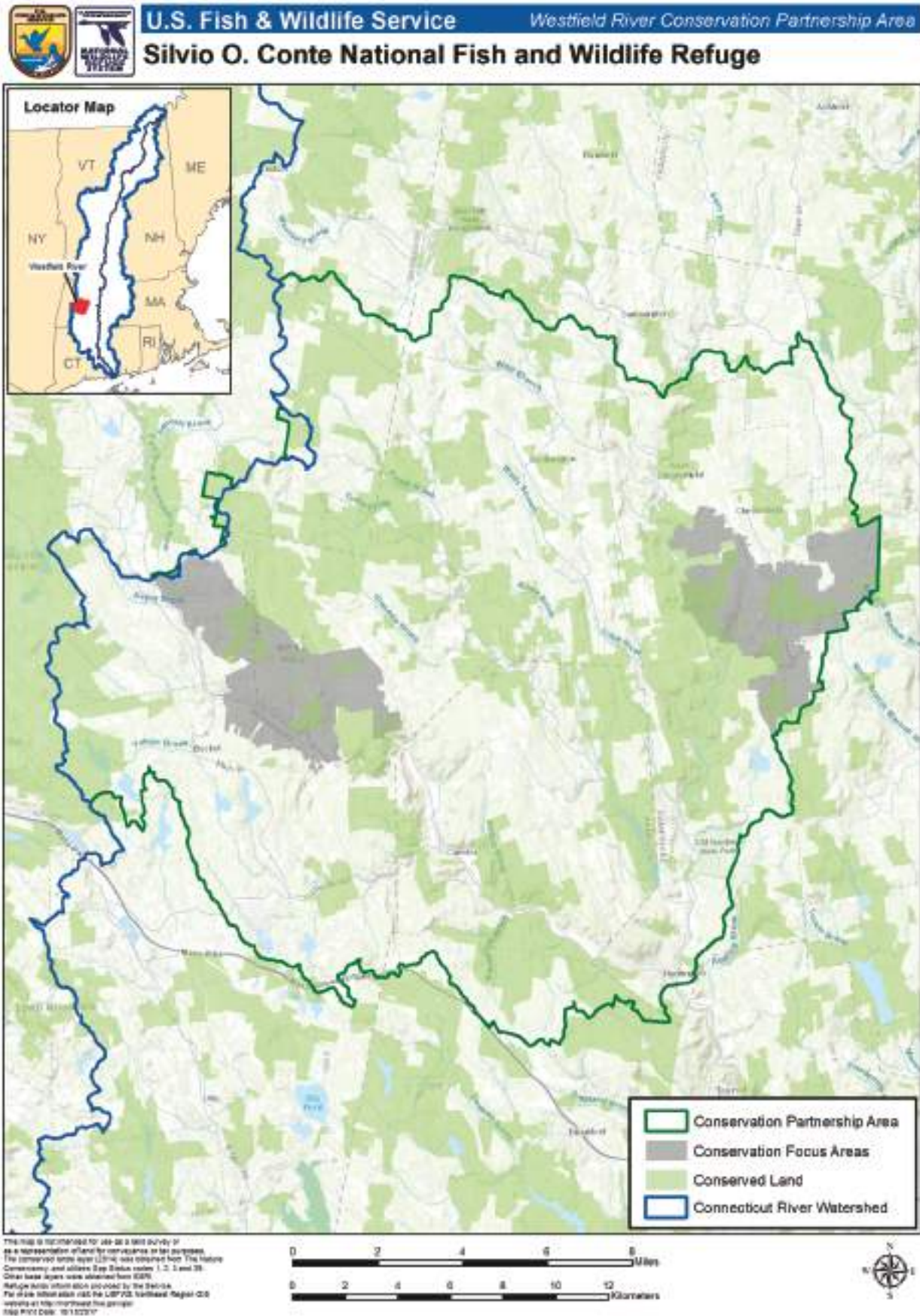


This map is not intended for use as a legal survey or as a representation of land for purposes of the purpose. The conservation status layer (2014) was obtained from the State Conservancy and various State Parks (1, 2, 3 and 3b). Other land status were obtained from GIS. Multiple data information are provided by the Service. For more information visit the USFWS Northeast Region GIS website at <http://www.fws.gov/northeast> Map Print Date: 10/13/2017

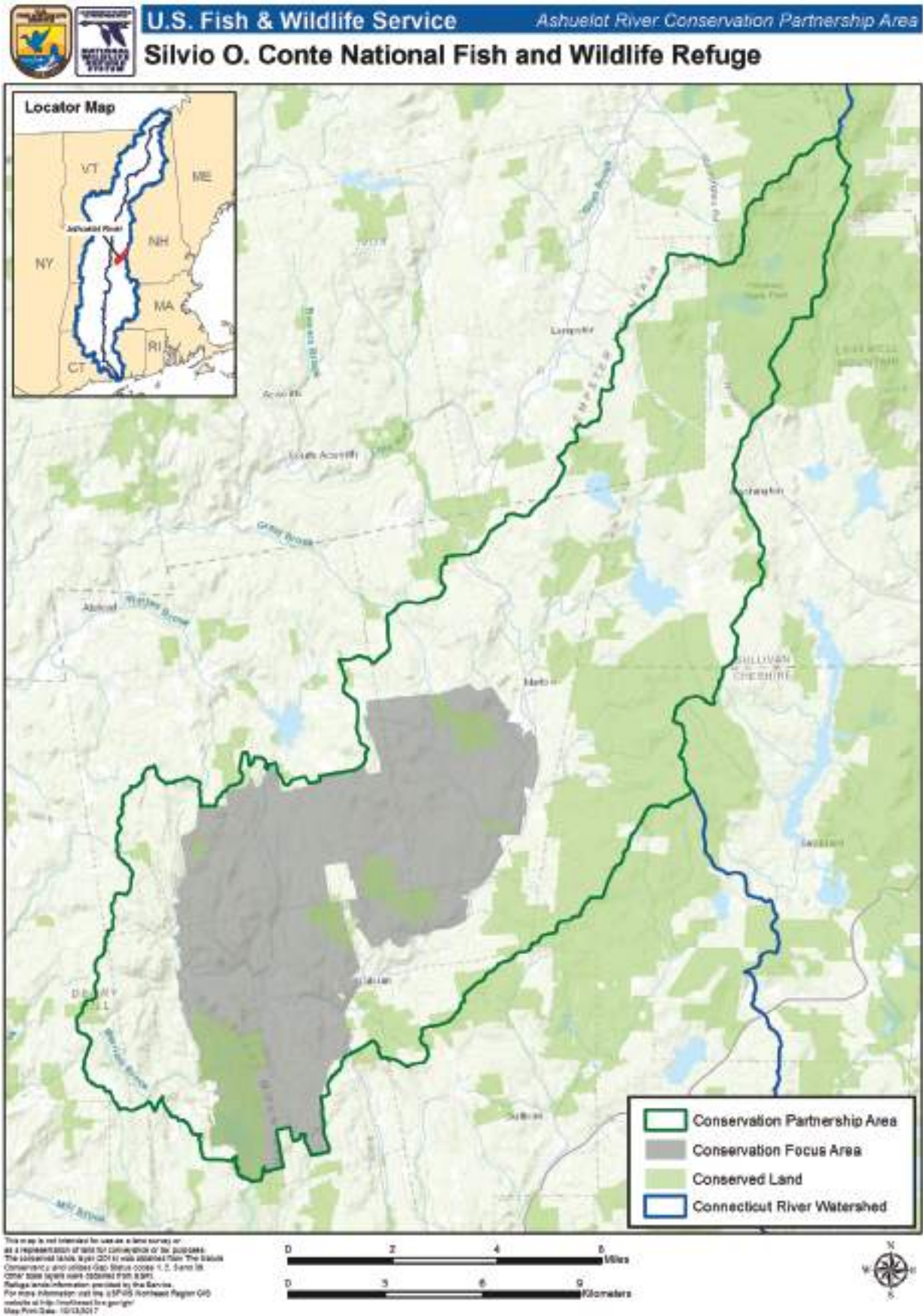
Map 4.9. Mill River CPA, Massachusetts



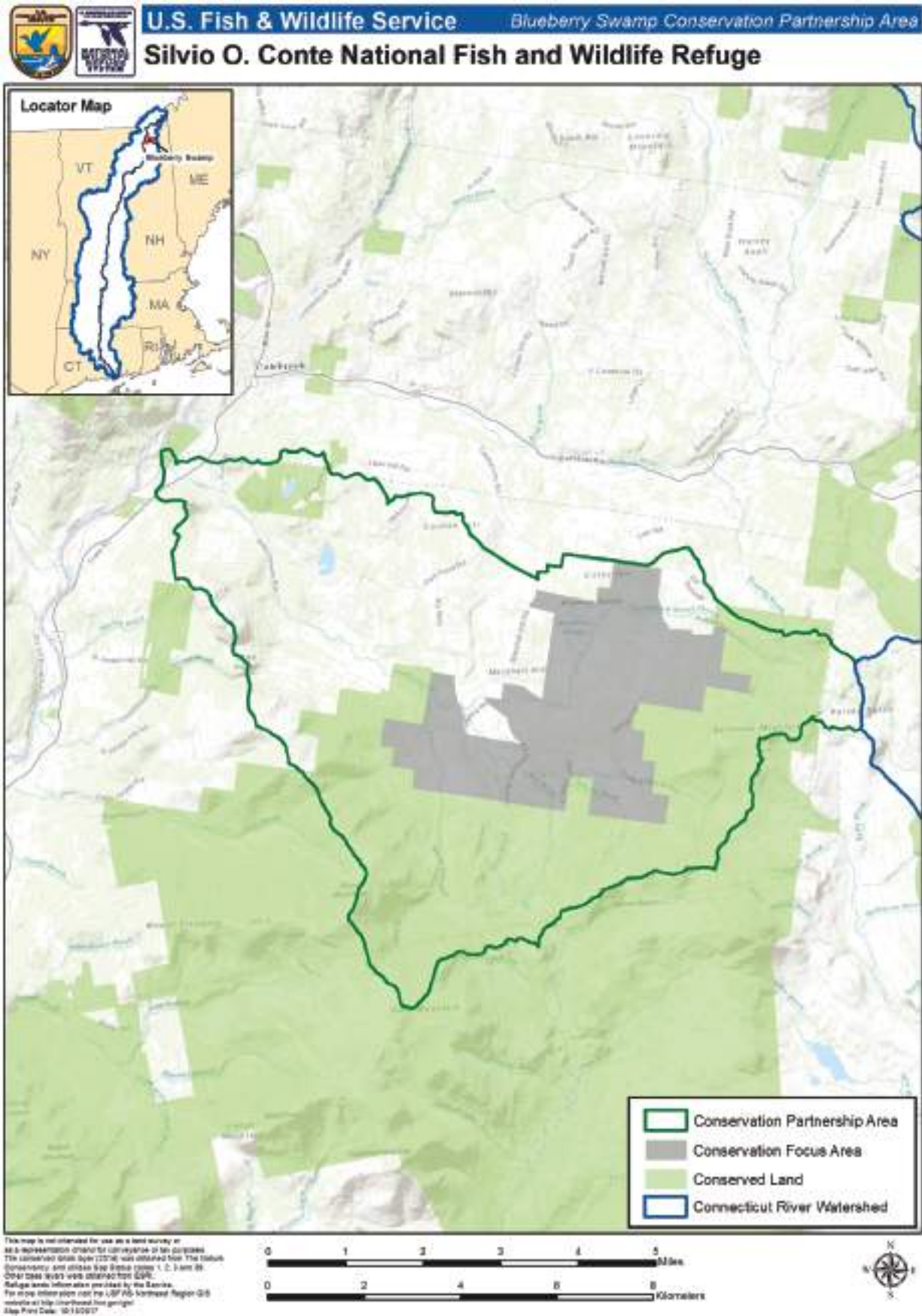
Map 4.10. Westfield River CPA, Massachusetts



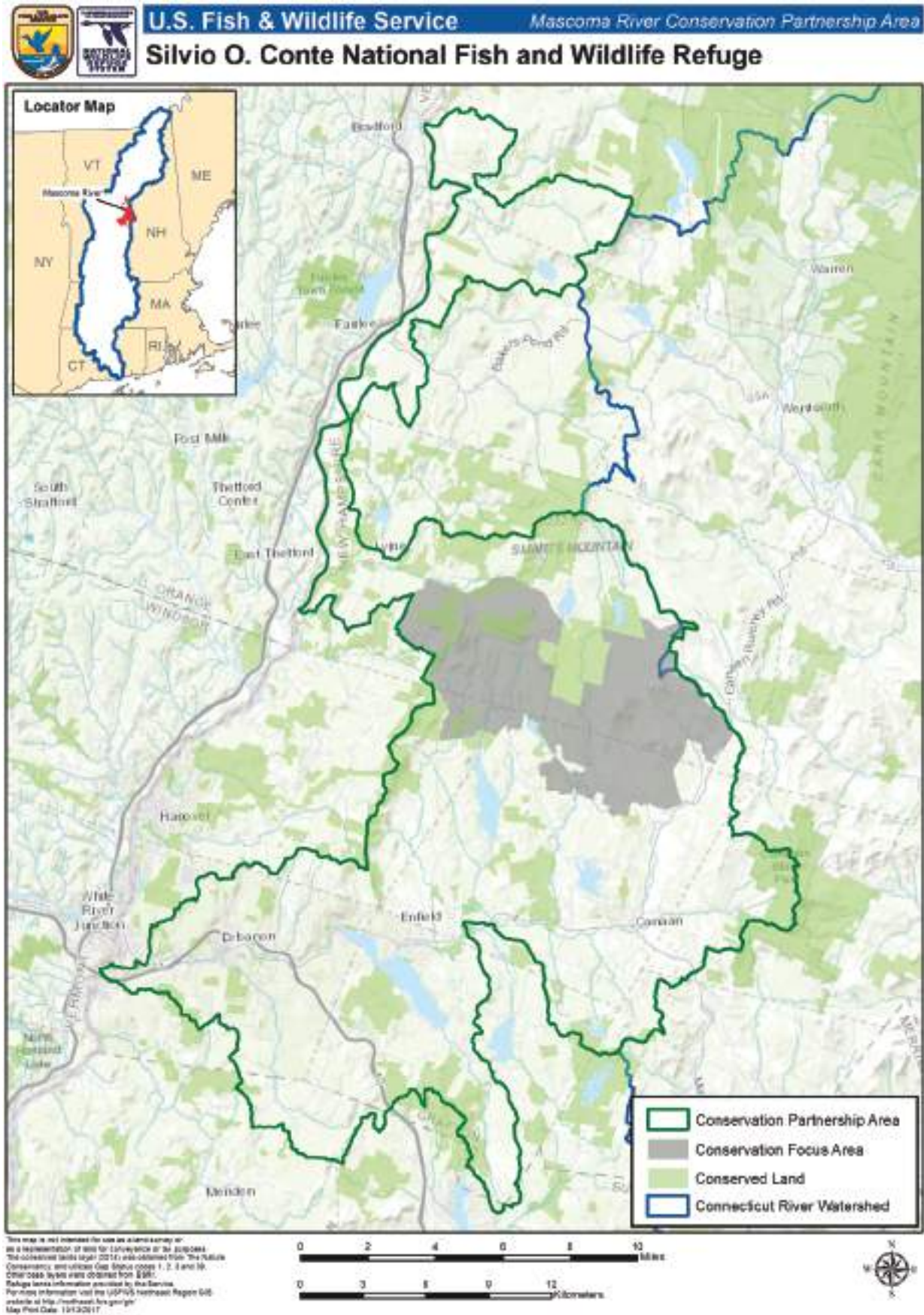
Map 4.11. Ashuelot River CPA, New Hampshire



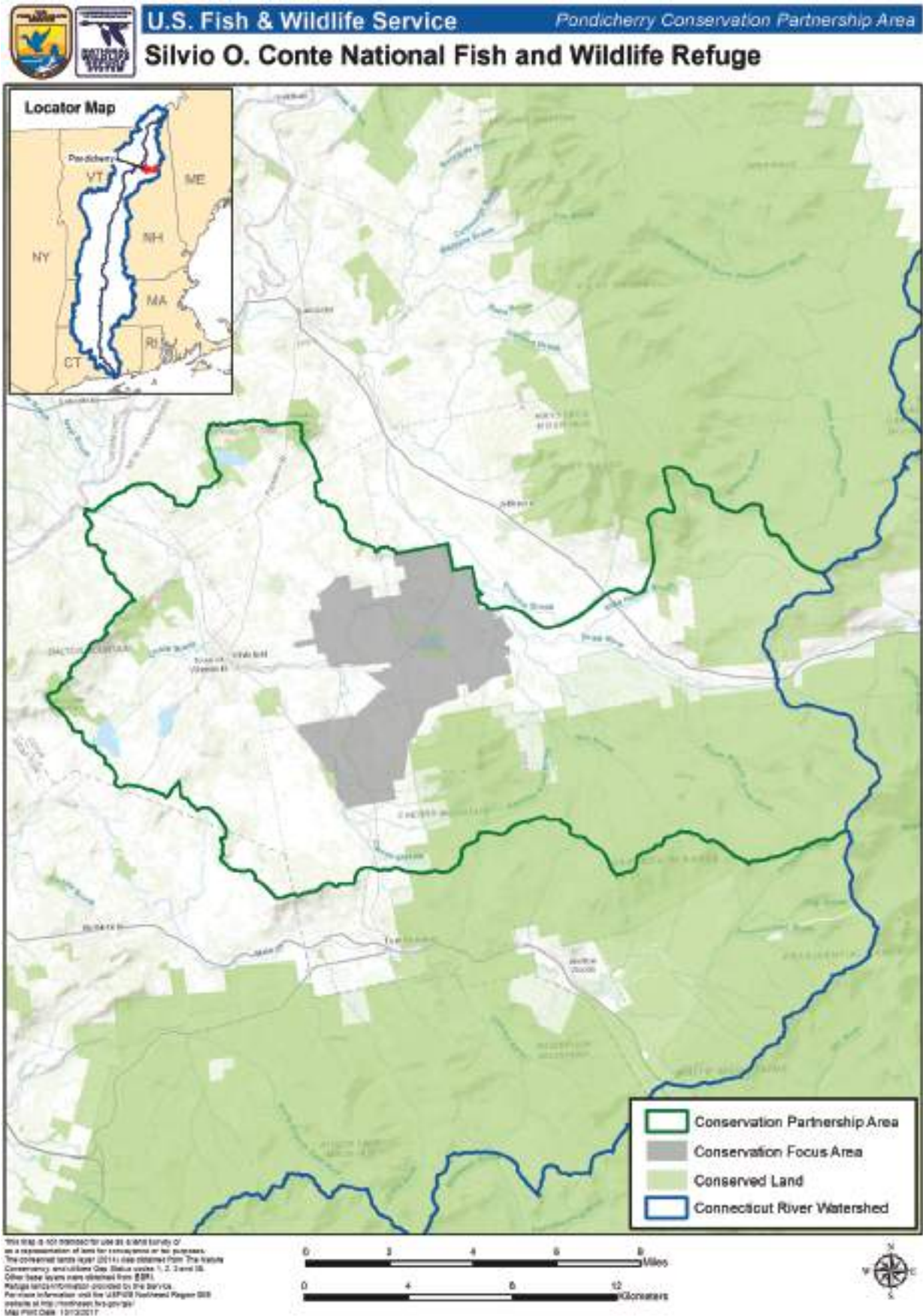
Map 4.12. Blueberry Swamp CPA, New Hampshire



Map 4.13. Mascoma River CPA, New Hampshire

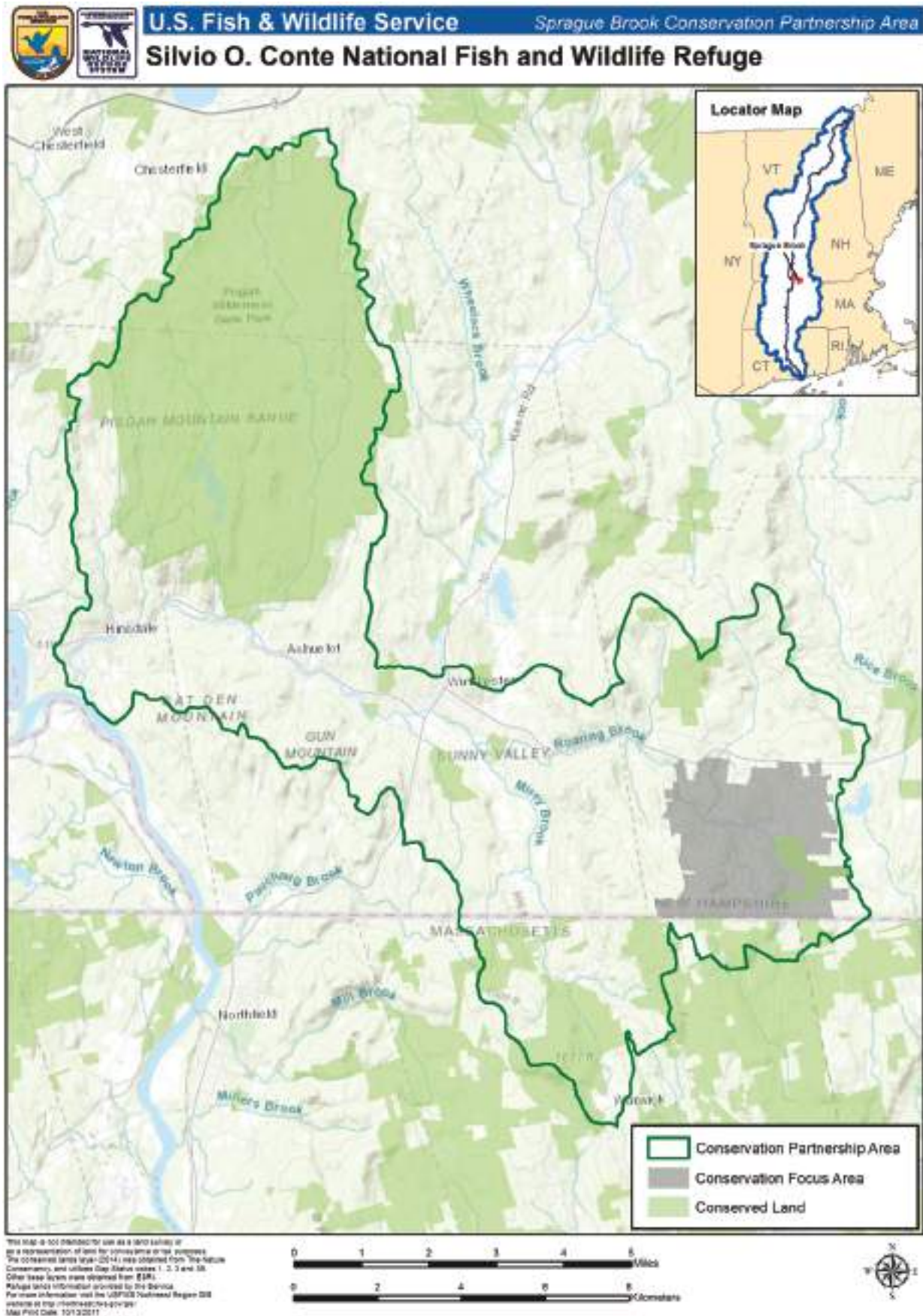


Map 4.14. Pondicherry CPA, New Hampshire

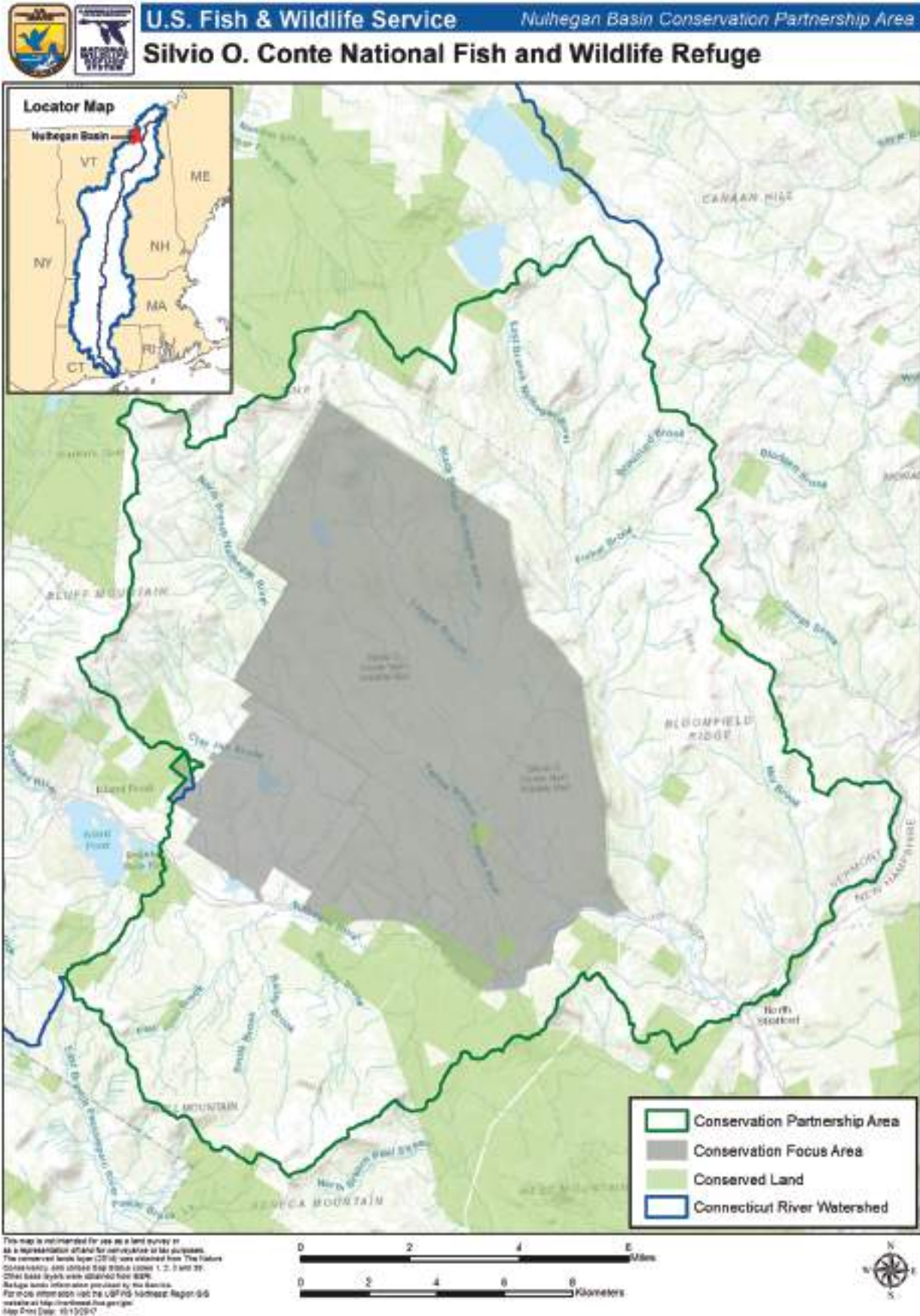




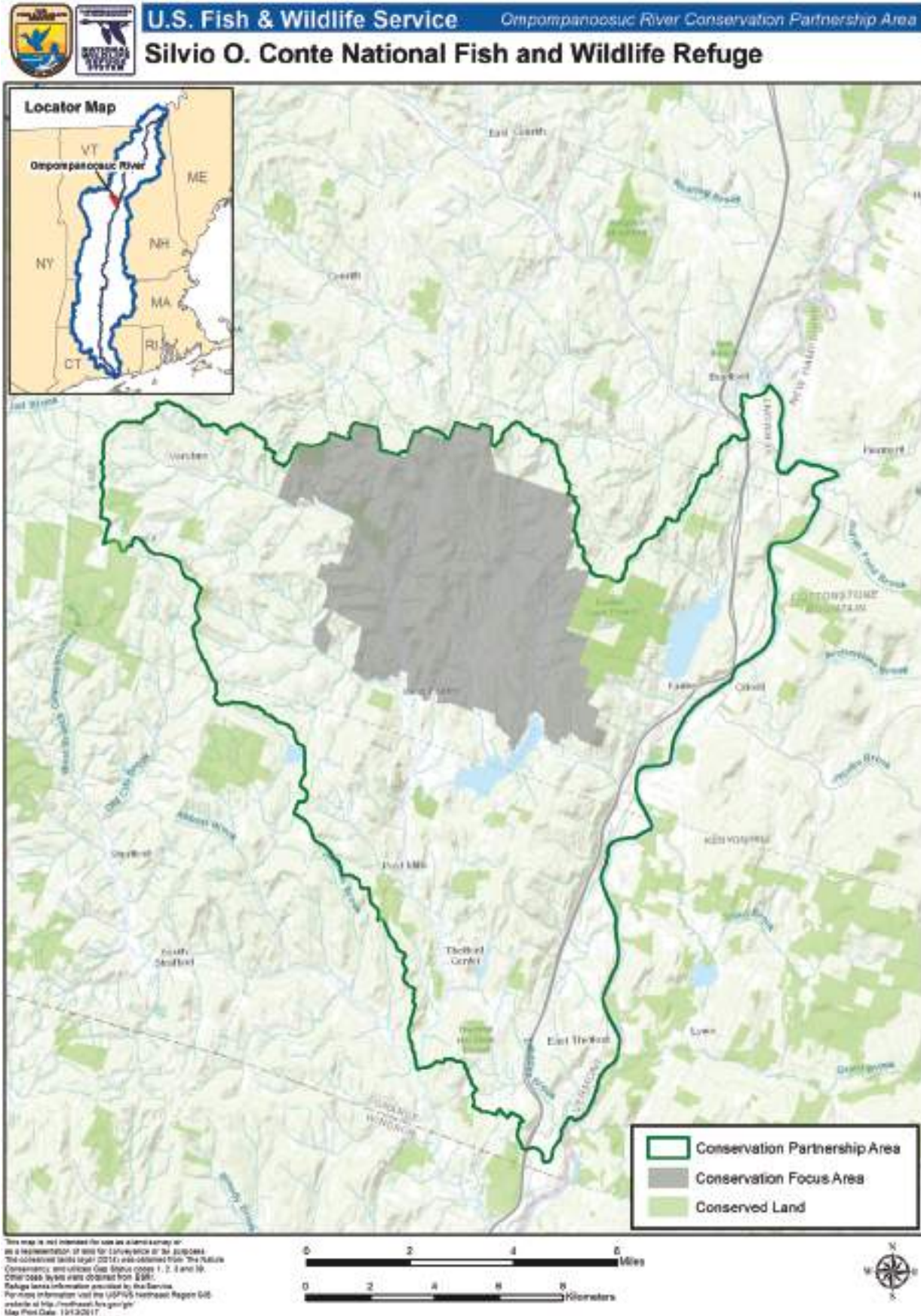
Map 4.15. Sprague Brook CPA, New Hampshire and Massachusetts



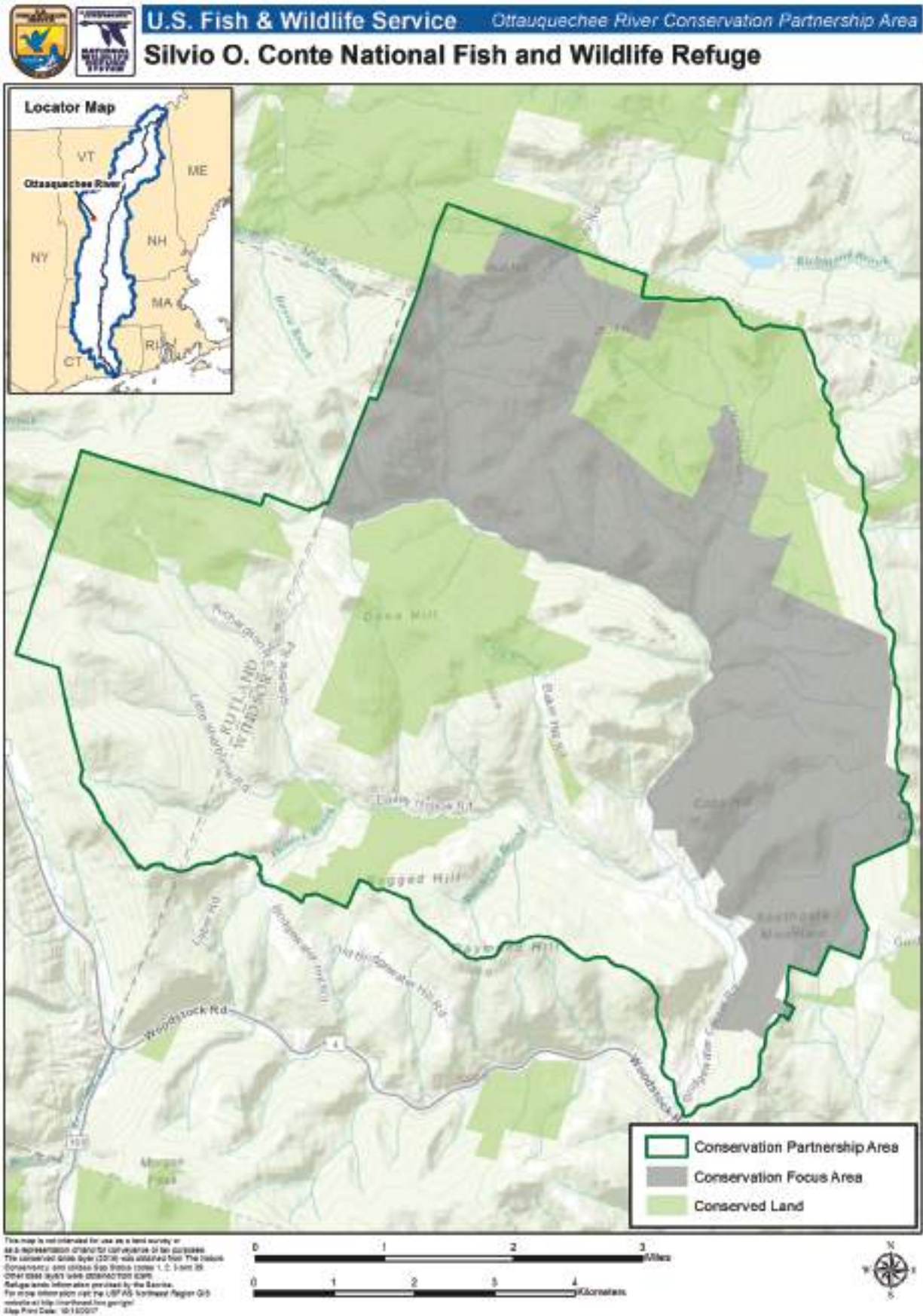
Map 4.16. Nulhegan Basin CPA, Vermont



Map 4.17. Ompompanoosuc River CPA, Vermont



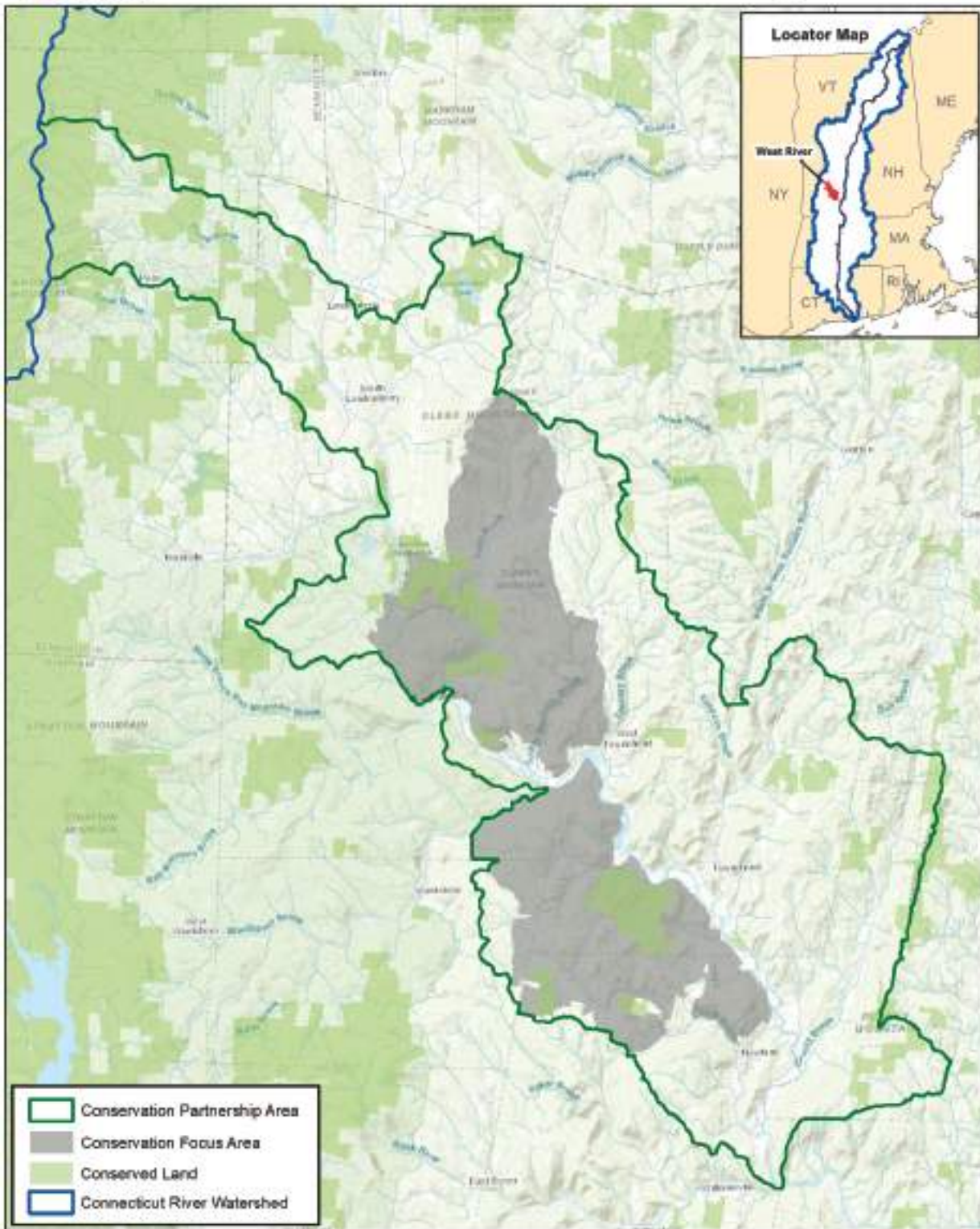
Map 4.18. Ottauquechee River CPA, Vermont



Map 4.19. West River CPA, Vermont



**U.S. Fish & Wildlife Service** *West River Conservation Partnership Area*  
**Silvio O. Conte National Fish and Wildlife Refuge**



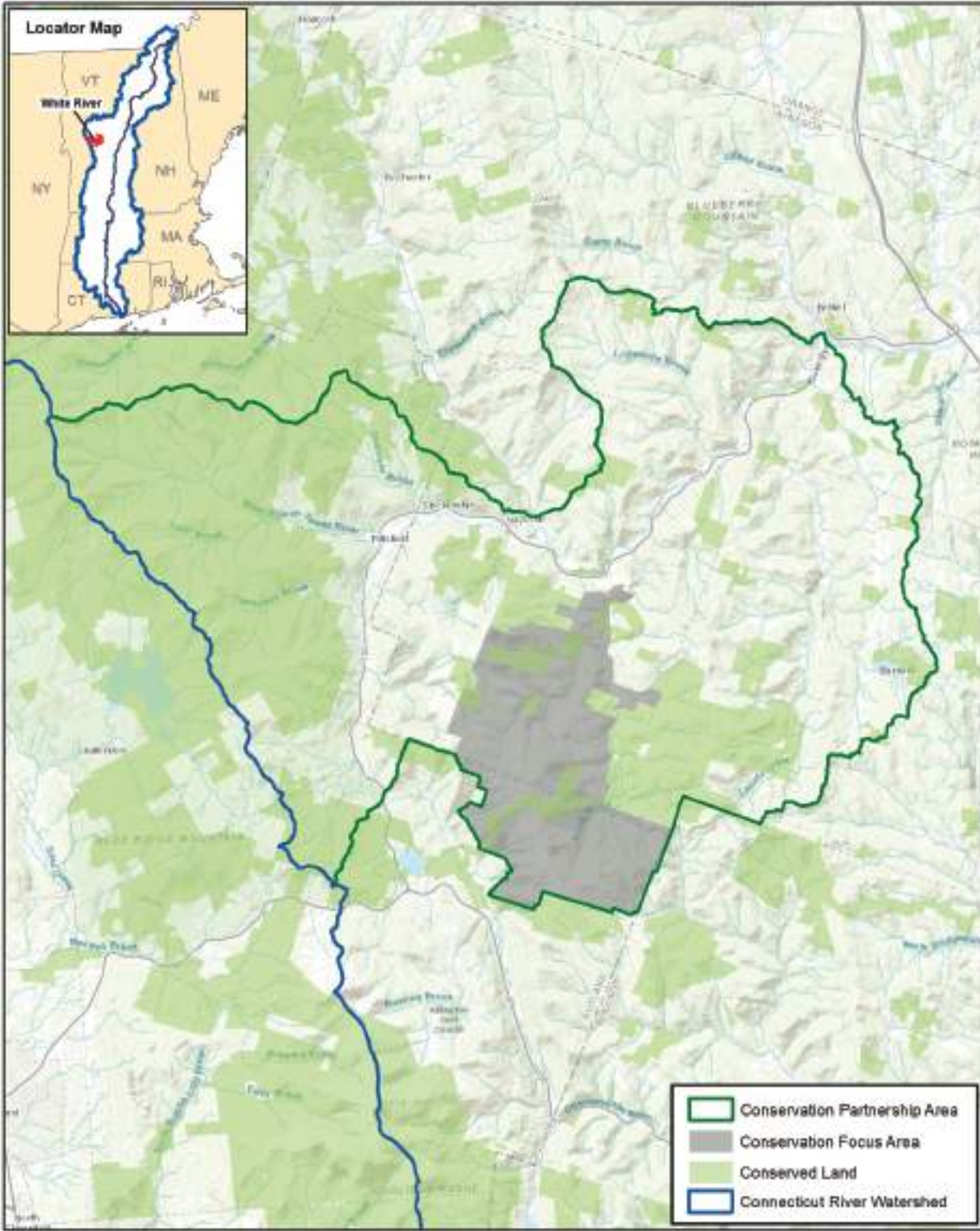
This map is not intended for use as a land survey or as a representation of land for conservation or other purposes. The Conservation Partnership Area (CPA) was obtained from the National Conservation and Lands Data System (NCLDS) 1:250,000 scale. CPA data were used to create this map. For more information visit the USFWS Vermont Region GIS website at <http://www.fws.gov/vt/gis/>. Map Print Date: 06/16/2017



Map 4.20. White River CPA, Vermont



U.S. Fish & Wildlife Service White River Conservation Partnership Area  
Silvio O. Conte National Fish and Wildlife Refuge



This map is not intended for use as a substitute for a professional survey or a representation of land for purposes of fee purchase. The conservation status (2014) was determined by the Silvio O. Conte National Fish and Wildlife Refuge under 1, 2, 3 and 4. Other land designations obtained from USFS. Map data and information provided by the Service. For more information visit the USFWS Northeast Region GIS website at <http://northeast.fws.gov/gis>. Date: April 2014. 10/13/2014

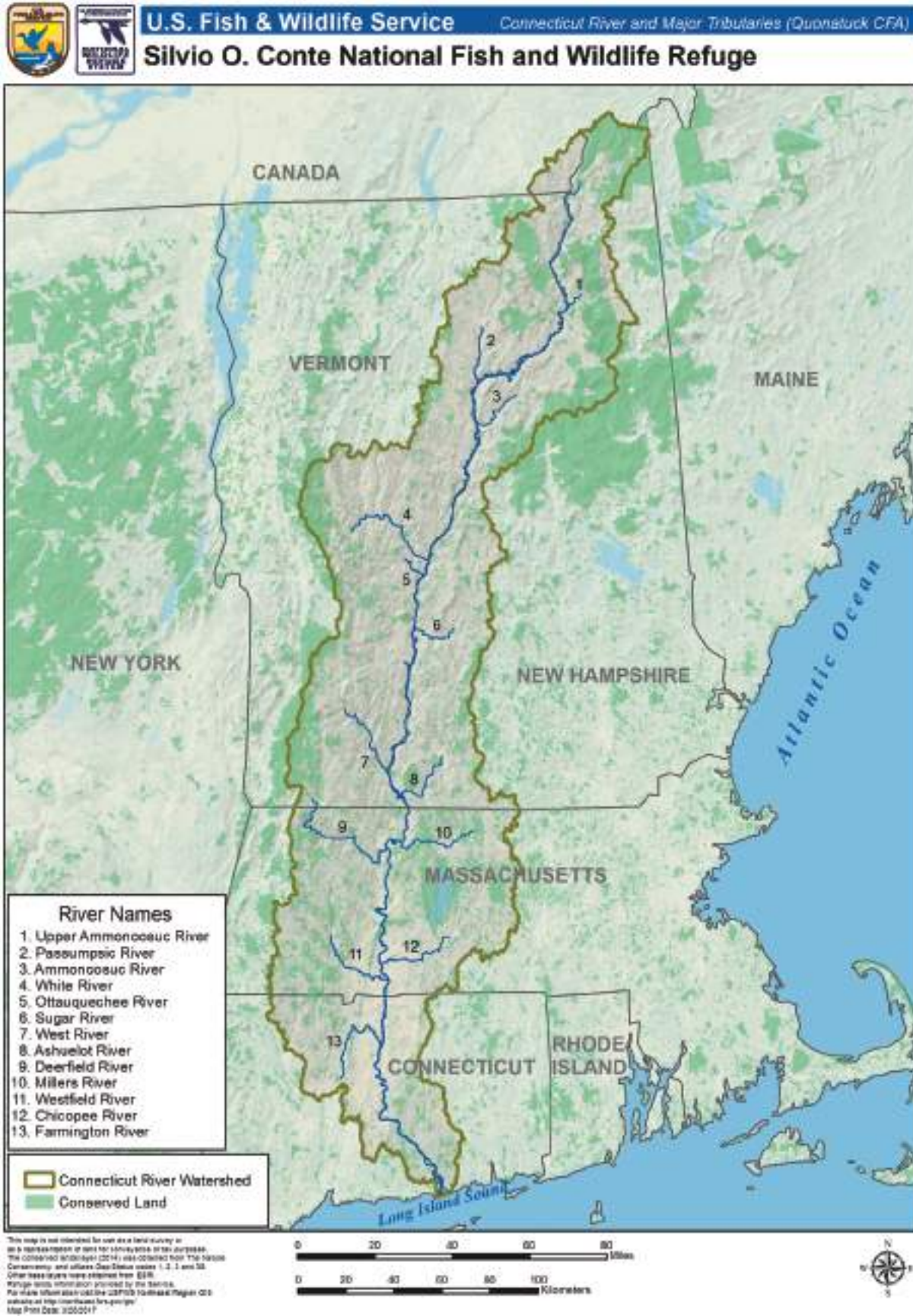
## Maps of CFAs

The following maps show the location of the 22 CFAs. CFAs are areas where the Service will acquire lands for the refuge, either through fee or easement. The CPA maps below are organized alphabetically by State. Each CPA map shows:

- The CFA boundary.
- The current refuge ownership in that CFA (shown in dark blue).
- Any additional lands that are currently approved for refuge acquisition in fee or easement (shown in light blue).
- Conserved lands as defined by The Nature Conservancy's 2014 secured lands data using GAP status 1, 2, 3 and 39 definitions (<https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/edc/reportsdata/terrestrial/secured/Pages/default.aspx>). The Service does not intend to pursue acquisition of existing conserved lands (shown in green).

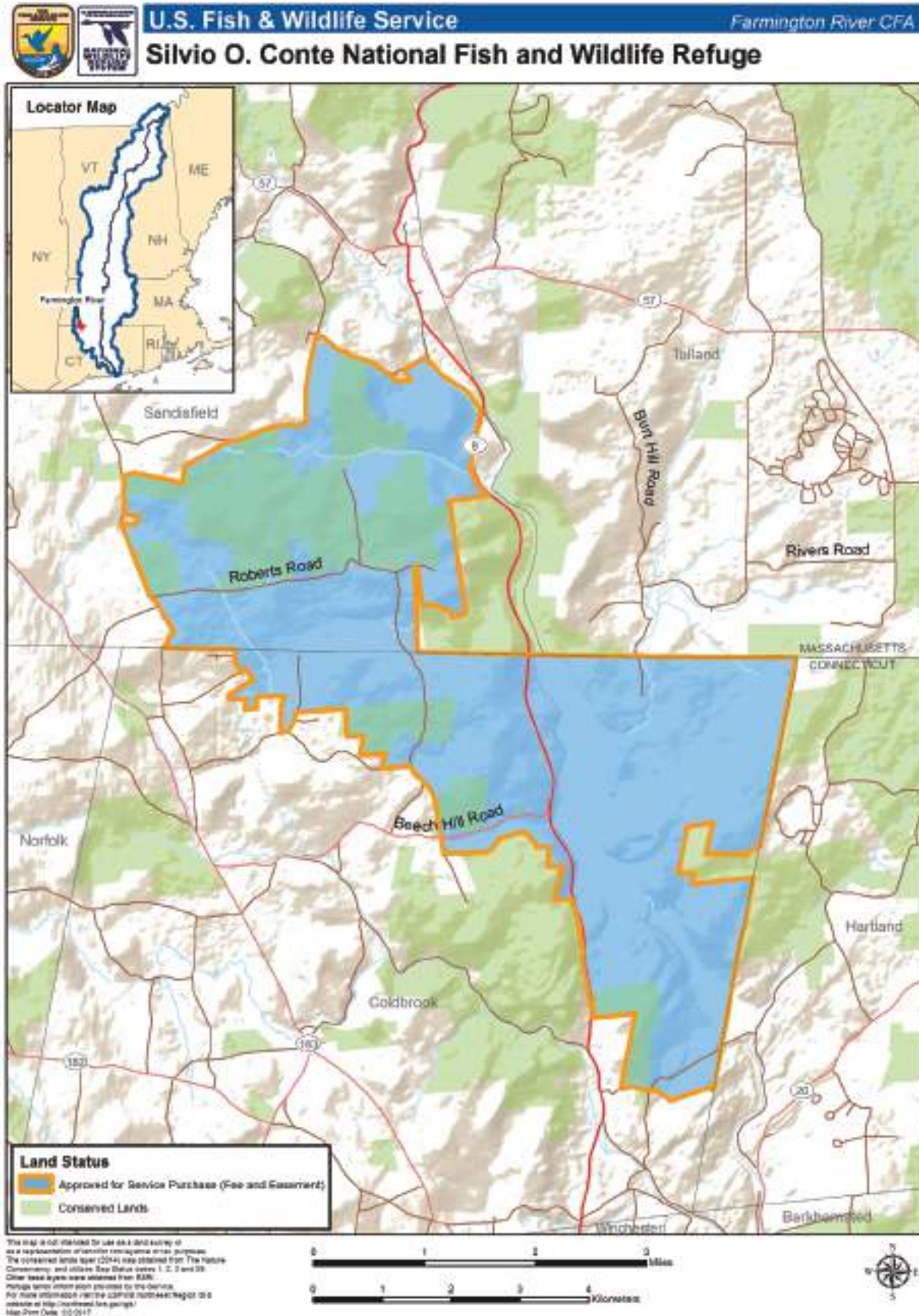
The Quonotuck CFA is unique among these maps as it is depicted as a linear feature. This depiction approximates our goal to acquire land from willing sellers within the 100-year floodplain of the Connecticut River mainstem and its major tributaries. The priorities within the Quonotuck CFA are to protect threatened and endangered species and their habitats, floodplain forest, and tidal wetlands.

Map 4.21. The Quonotuck CFA (100-year Floodplain)

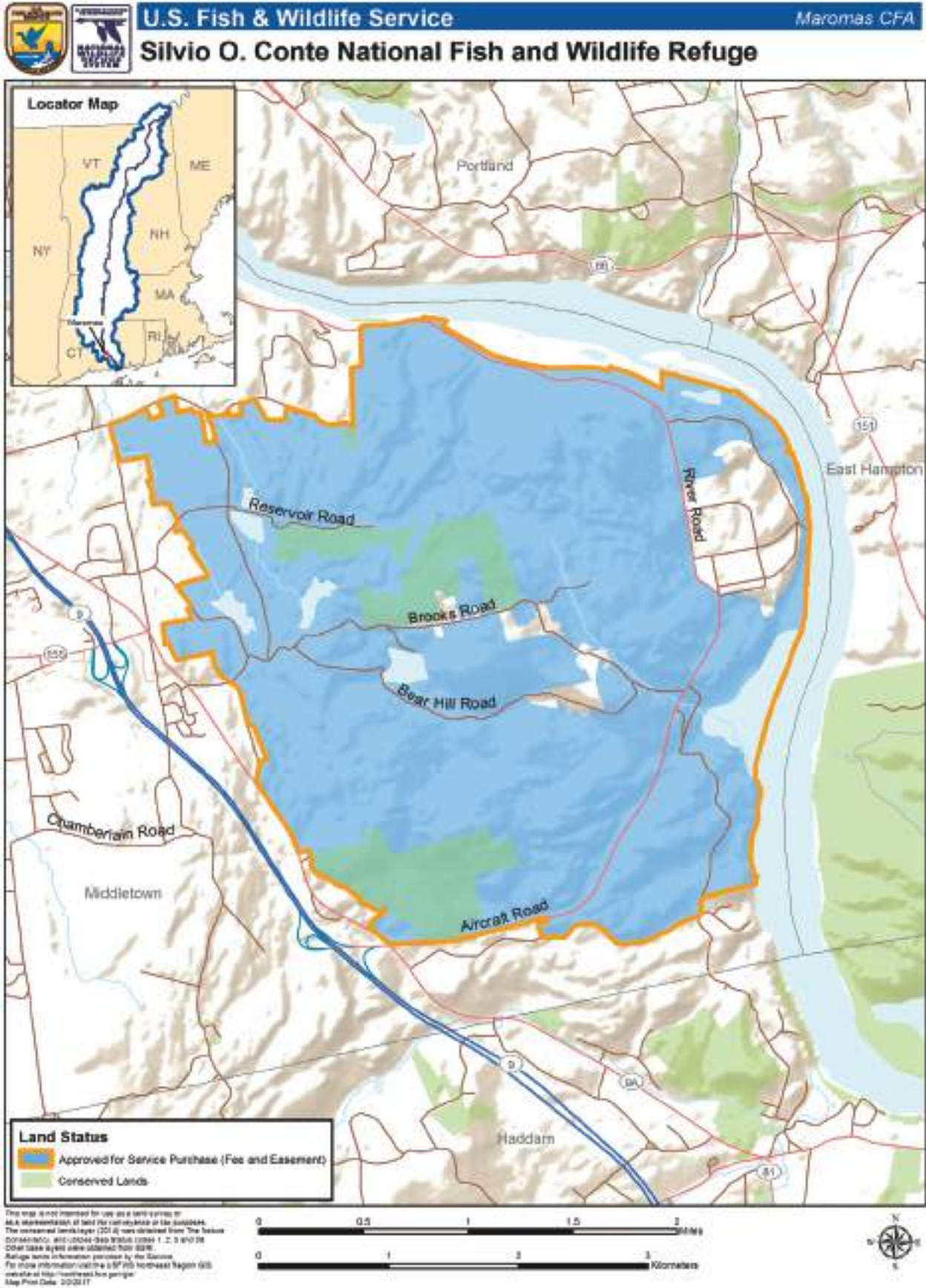




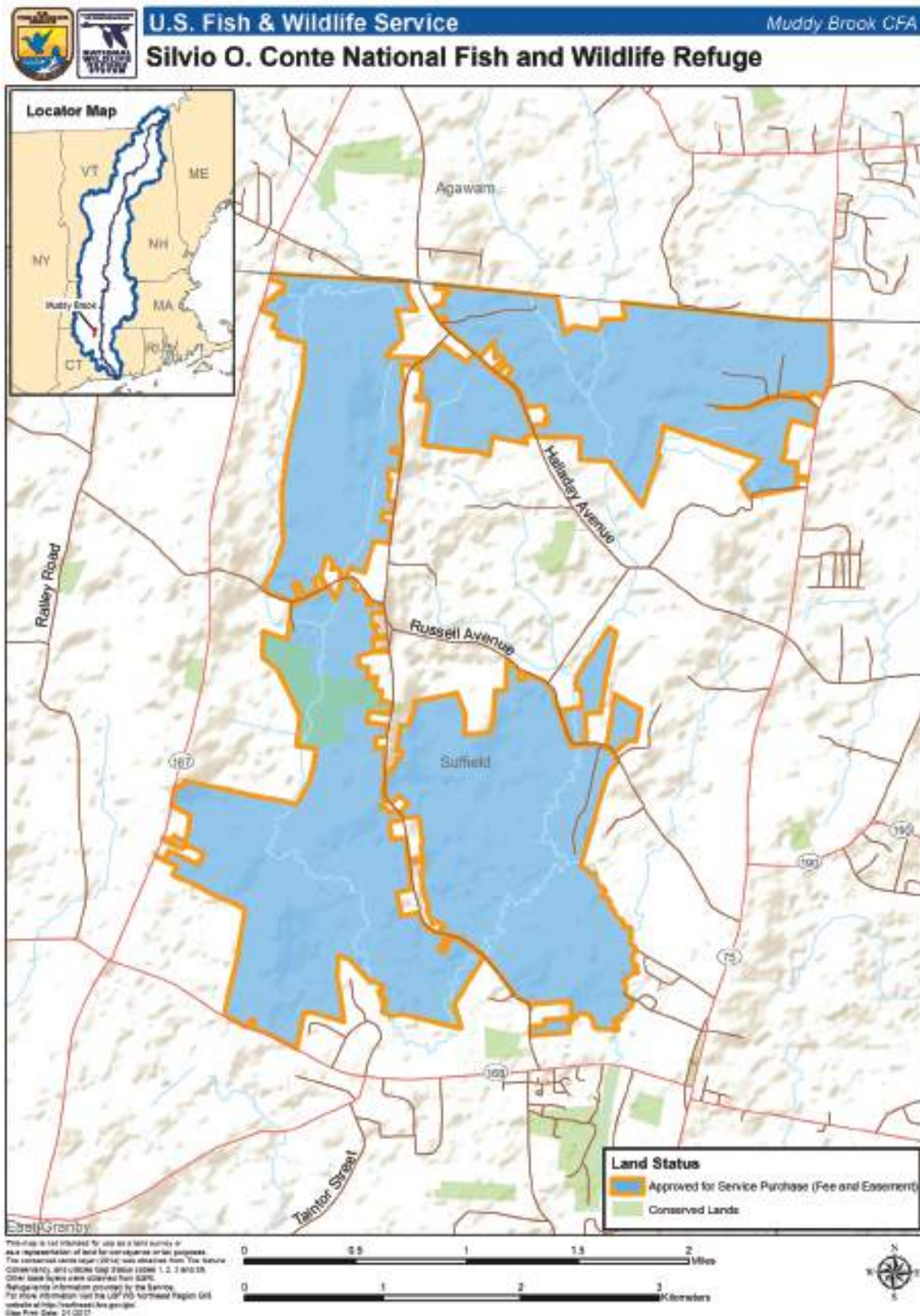
Map 4.22. Farmington River CFA, Connecticut and Massachusetts



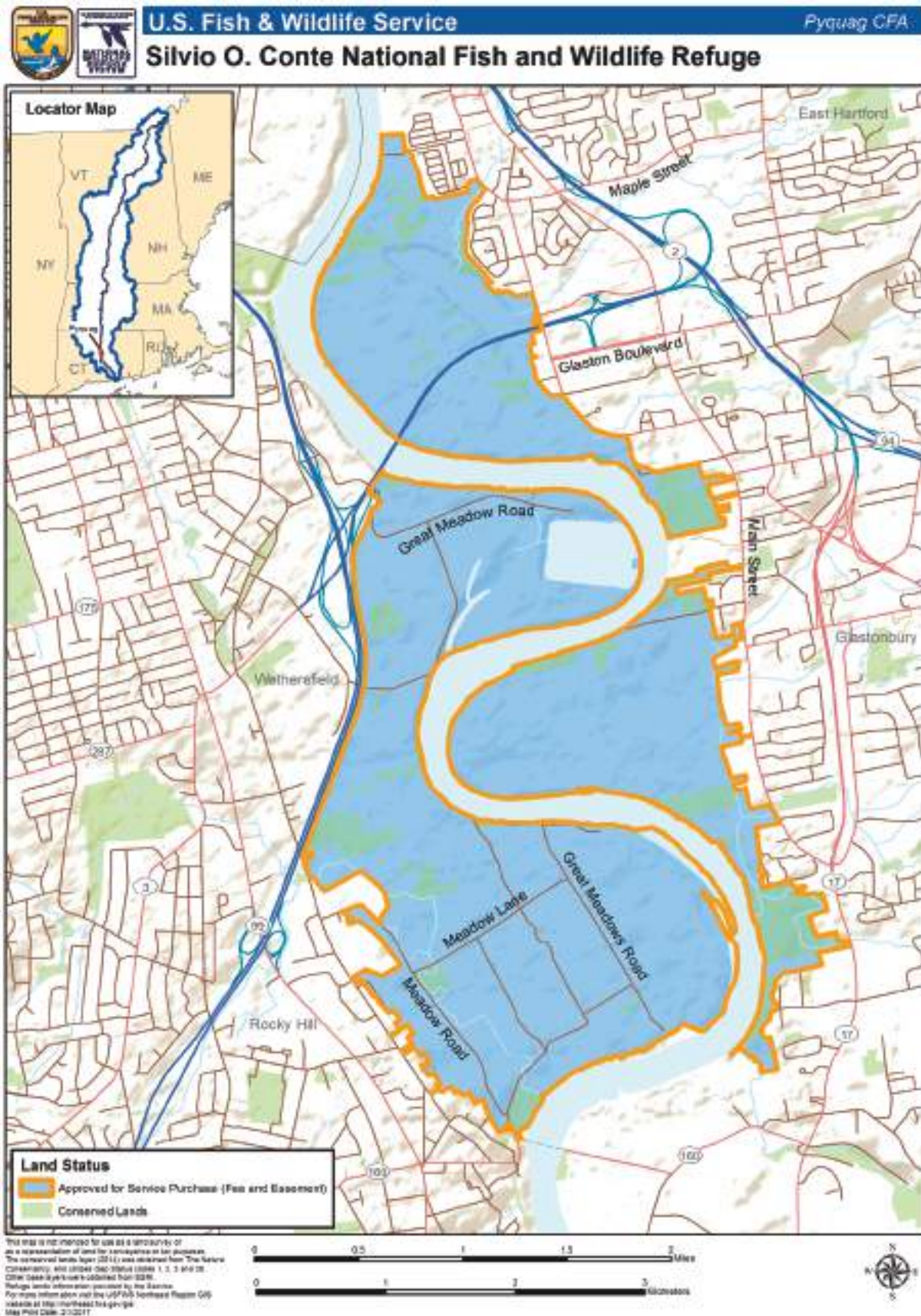
Map 4.23. Maromas CFA, Connecticut



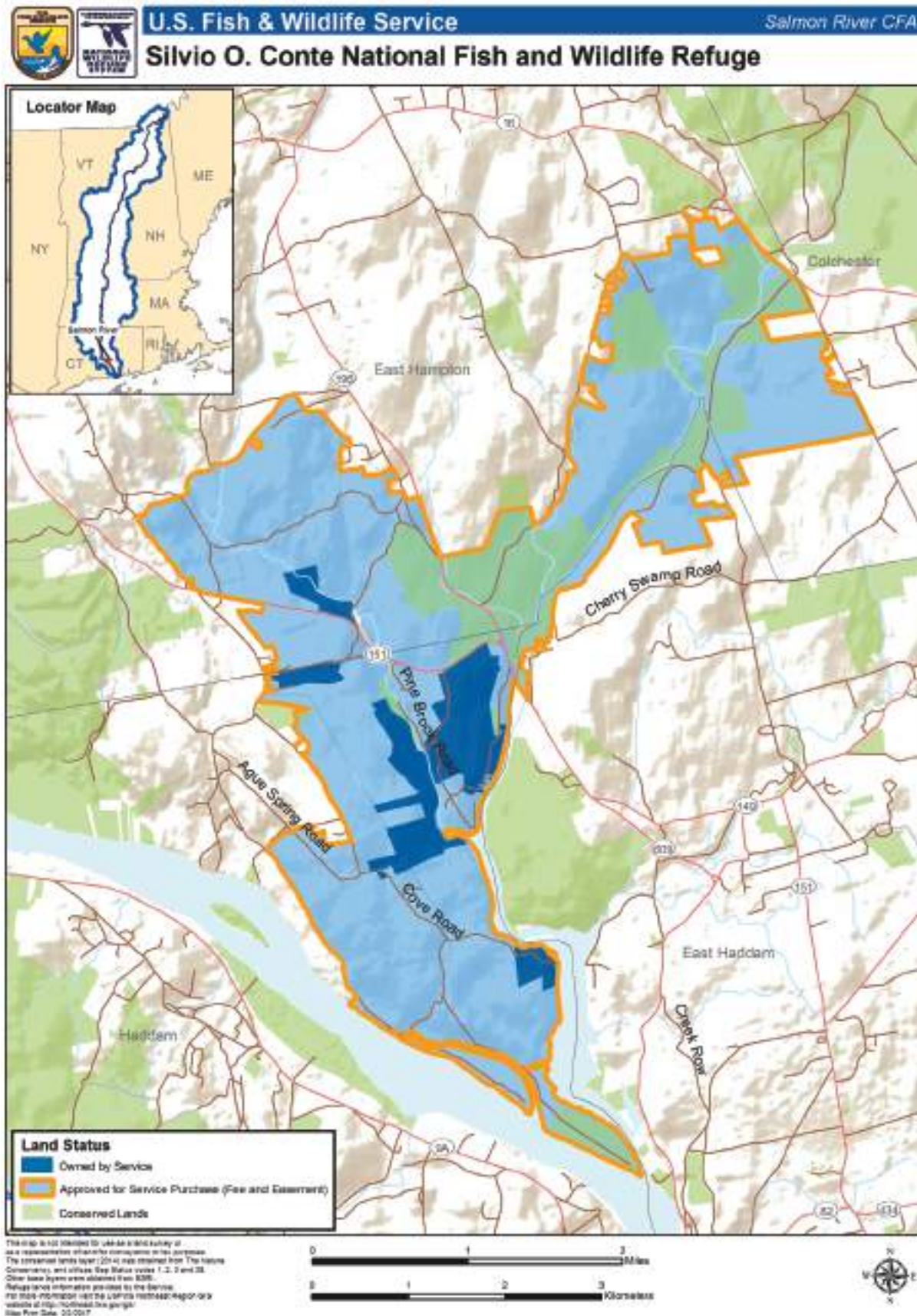
Map 4.24. Muddy Brook CFA, Connecticut



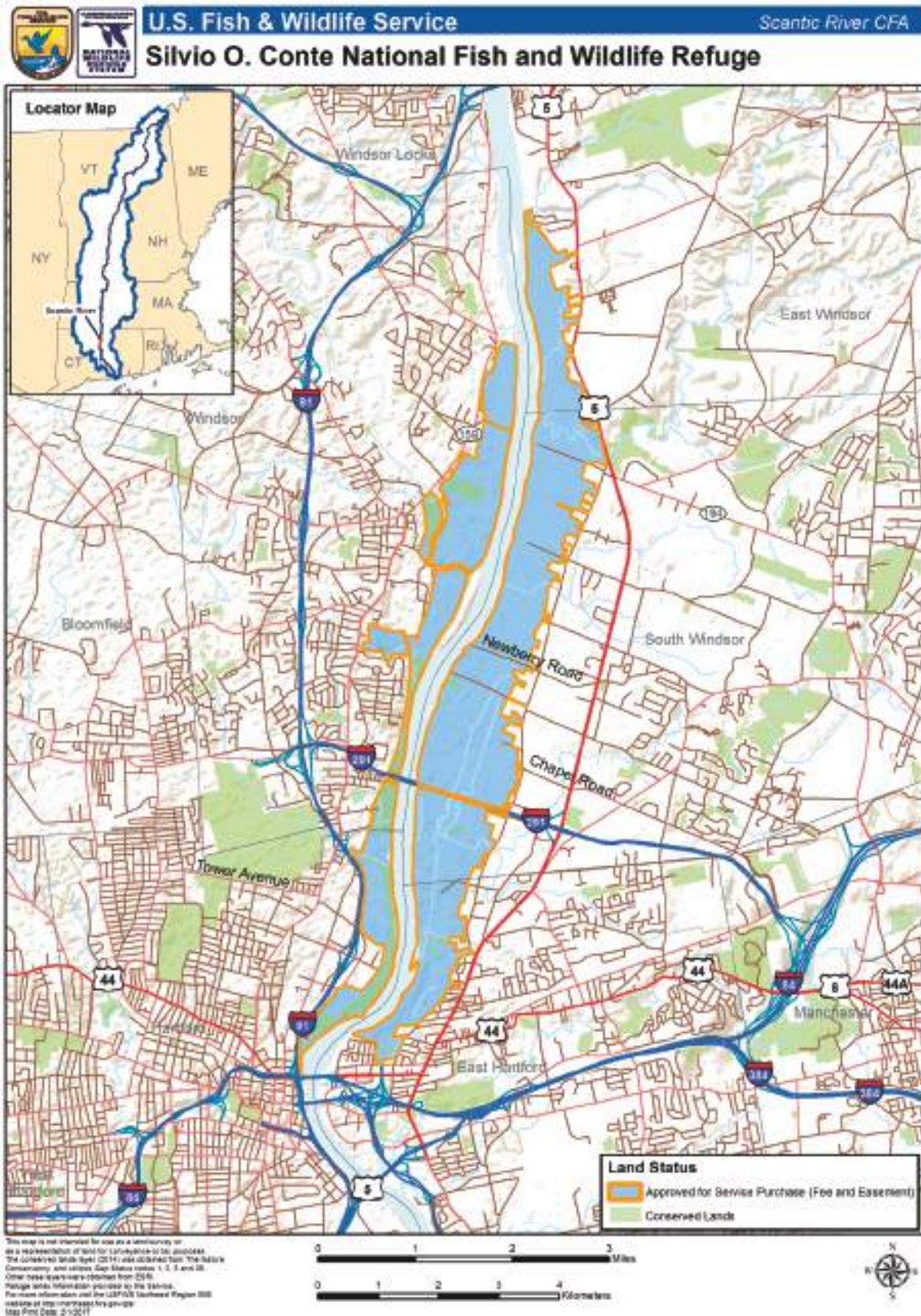
Map 4.25. Pyquag CFA, Connecticut



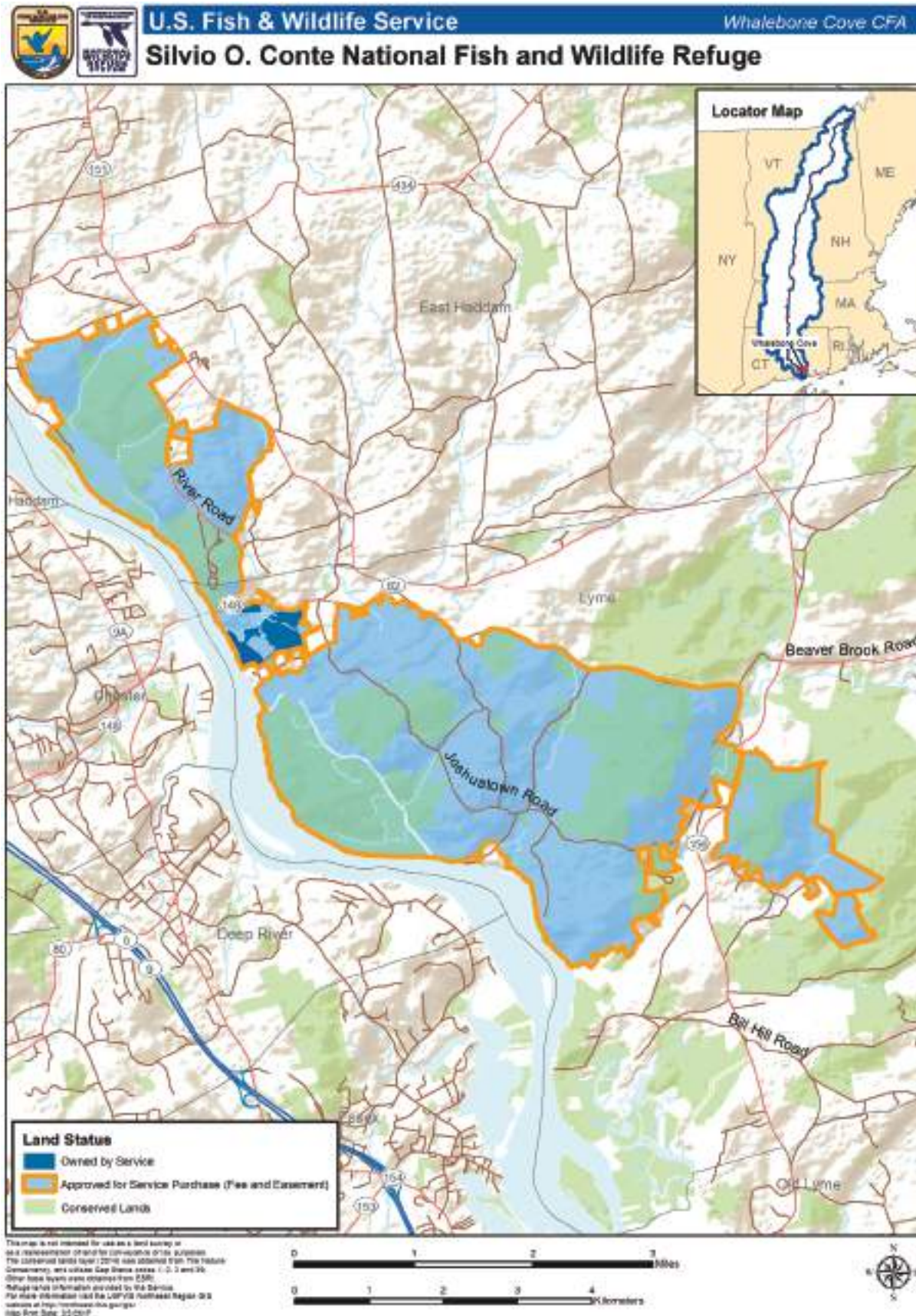
Map 4.26. Salmon River CFA, Connecticut



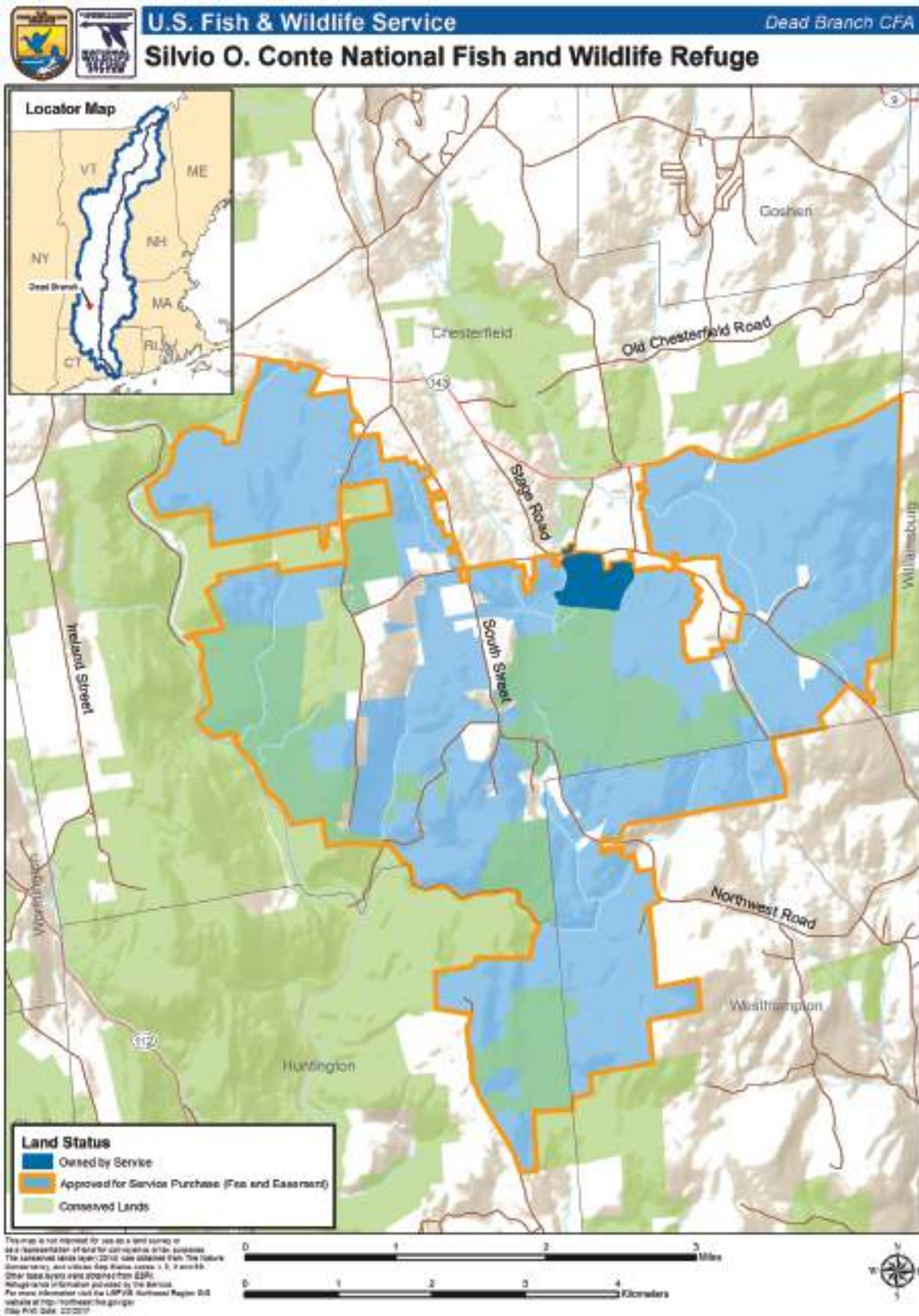
Map 4.27. Scantic CFA, Connecticut



Map 4.28. Whalebone Cove CFA, Connecticut

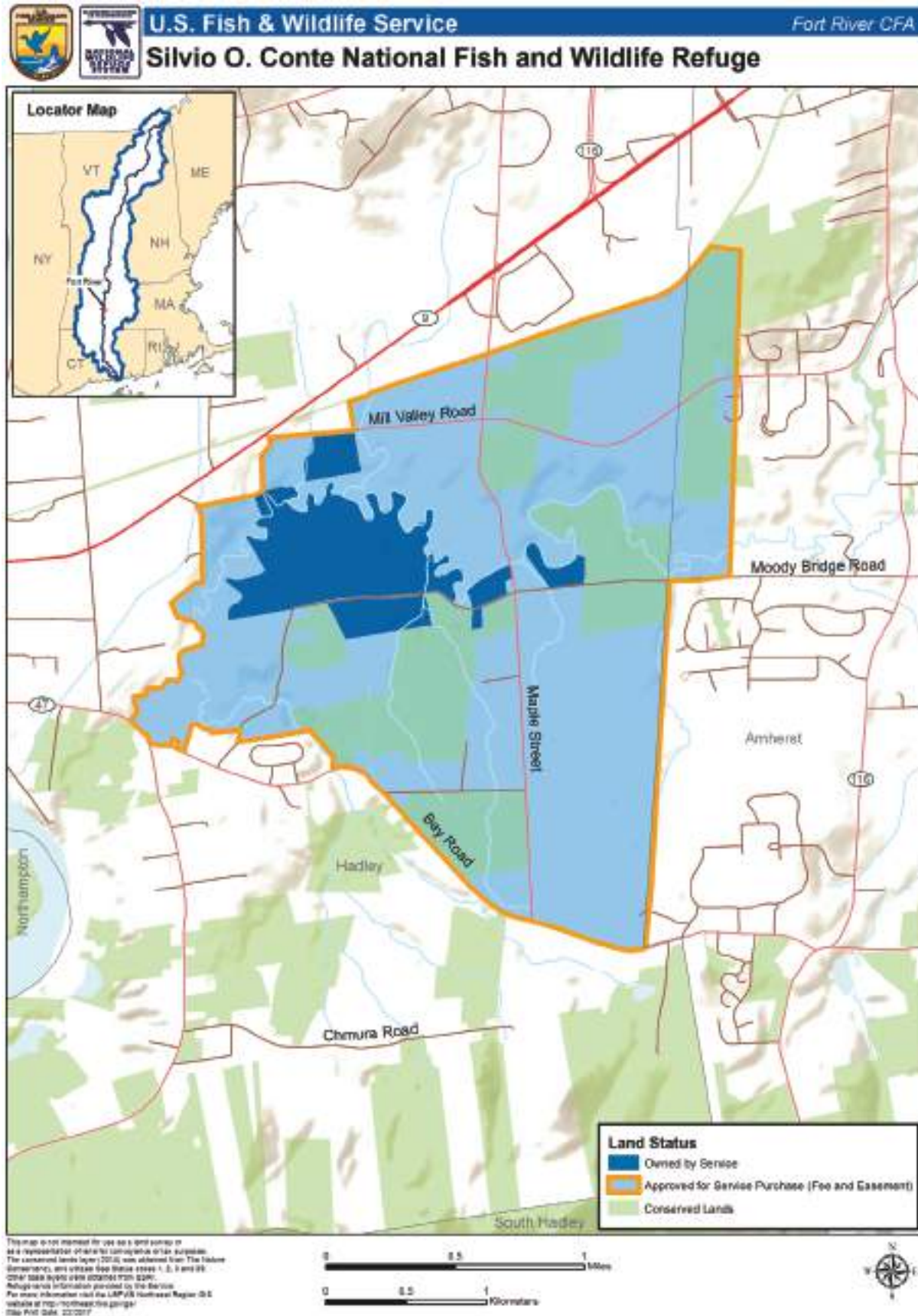


Map 4.29. Dead Branch CFA, Massachusetts



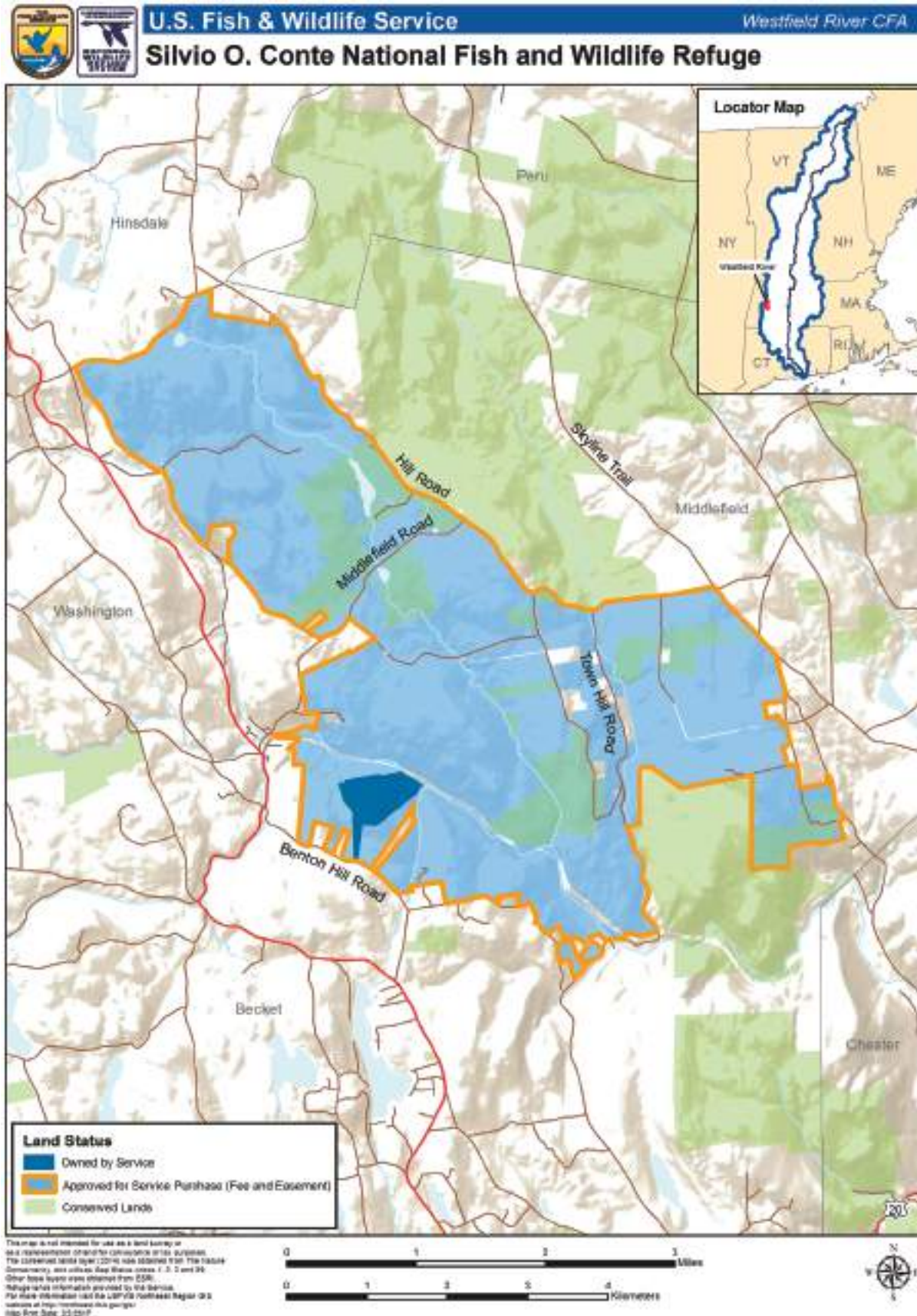


Map 4.30. Fort River CFA, Massachusetts

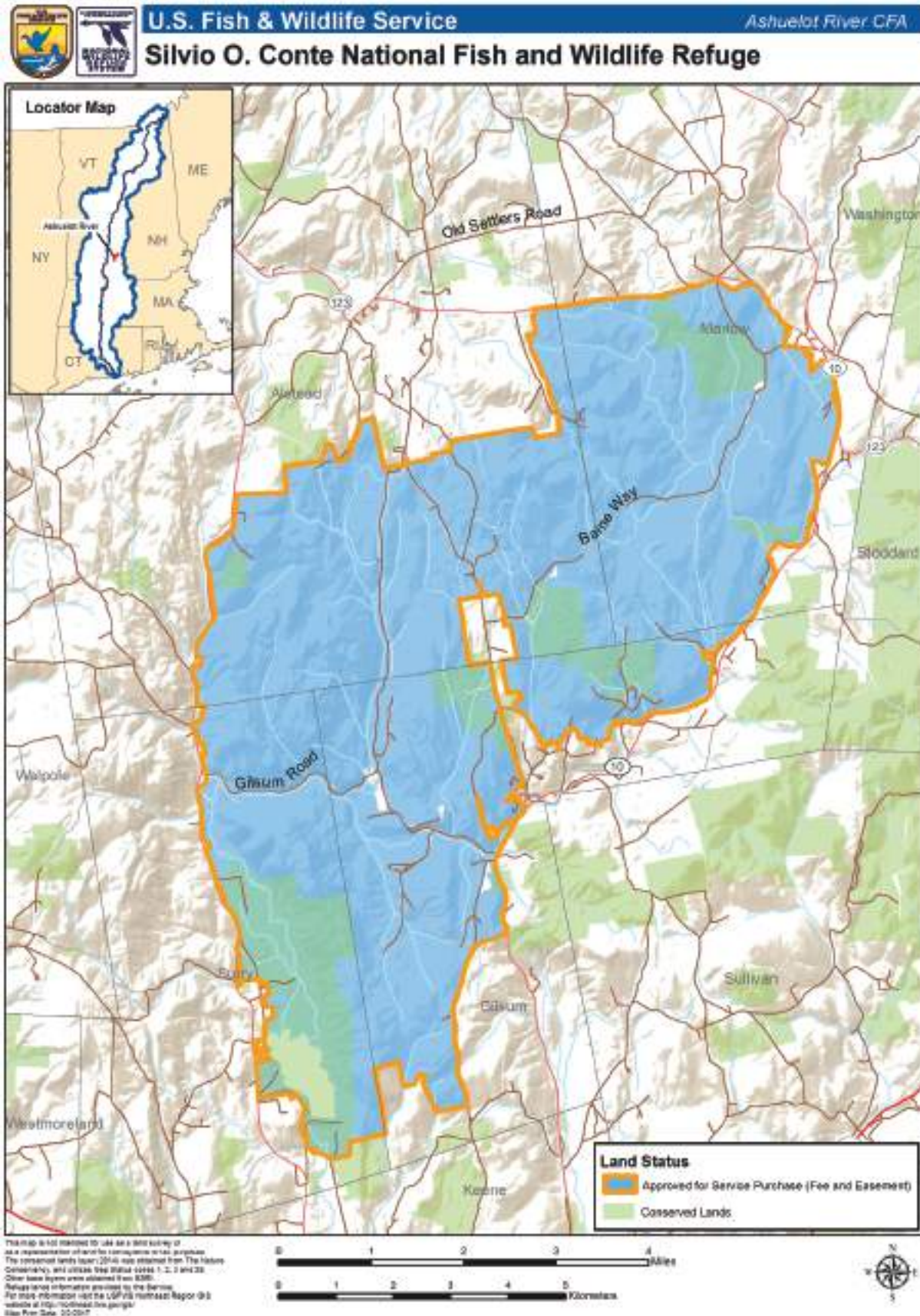




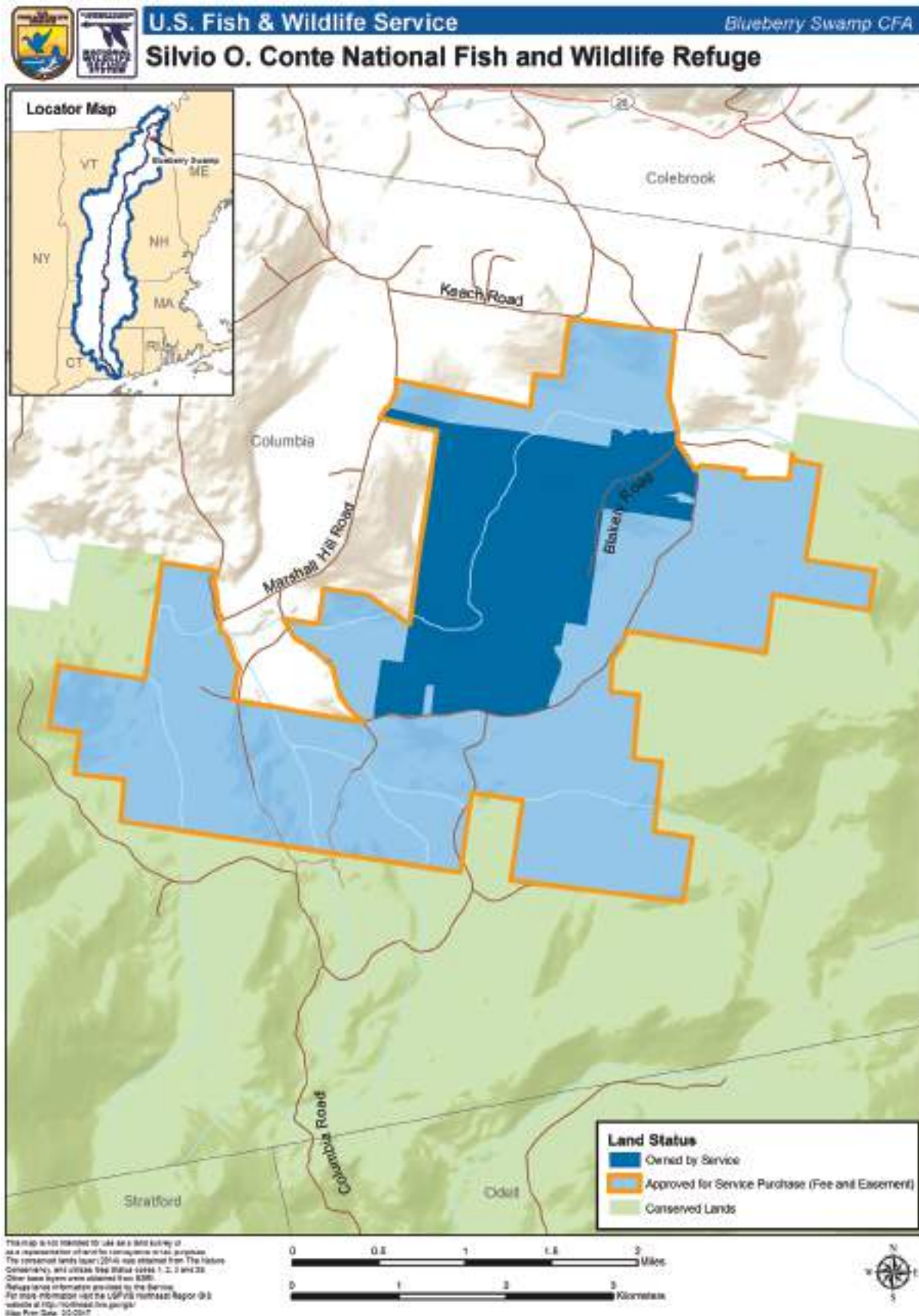
Map 4.32. Westfield River CFA, Massachusetts



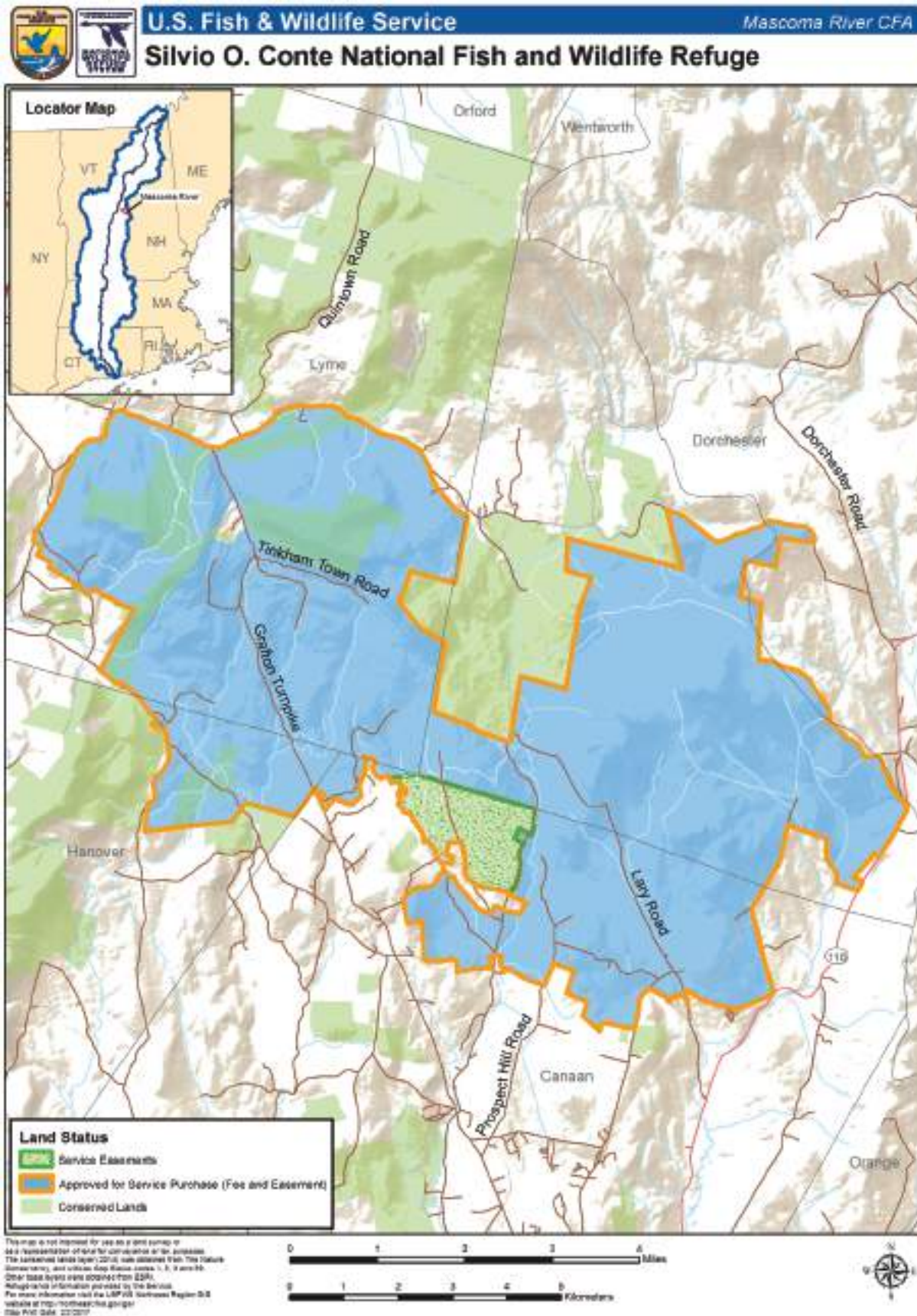
Map 4.33. Ashuelot River CFA, New Hampshire



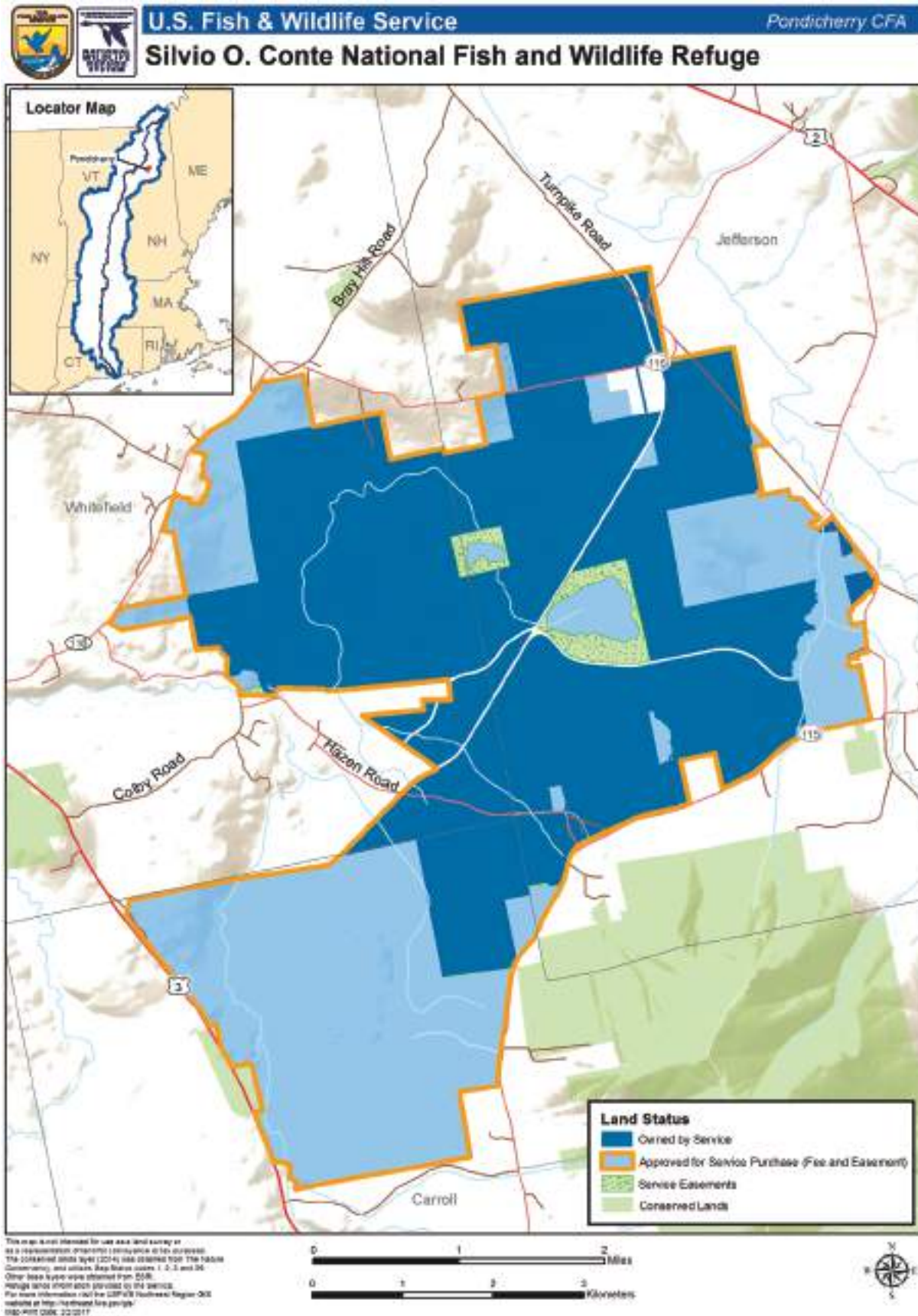
Map 4.34. Blueberry Swamp CFA, New Hampshire



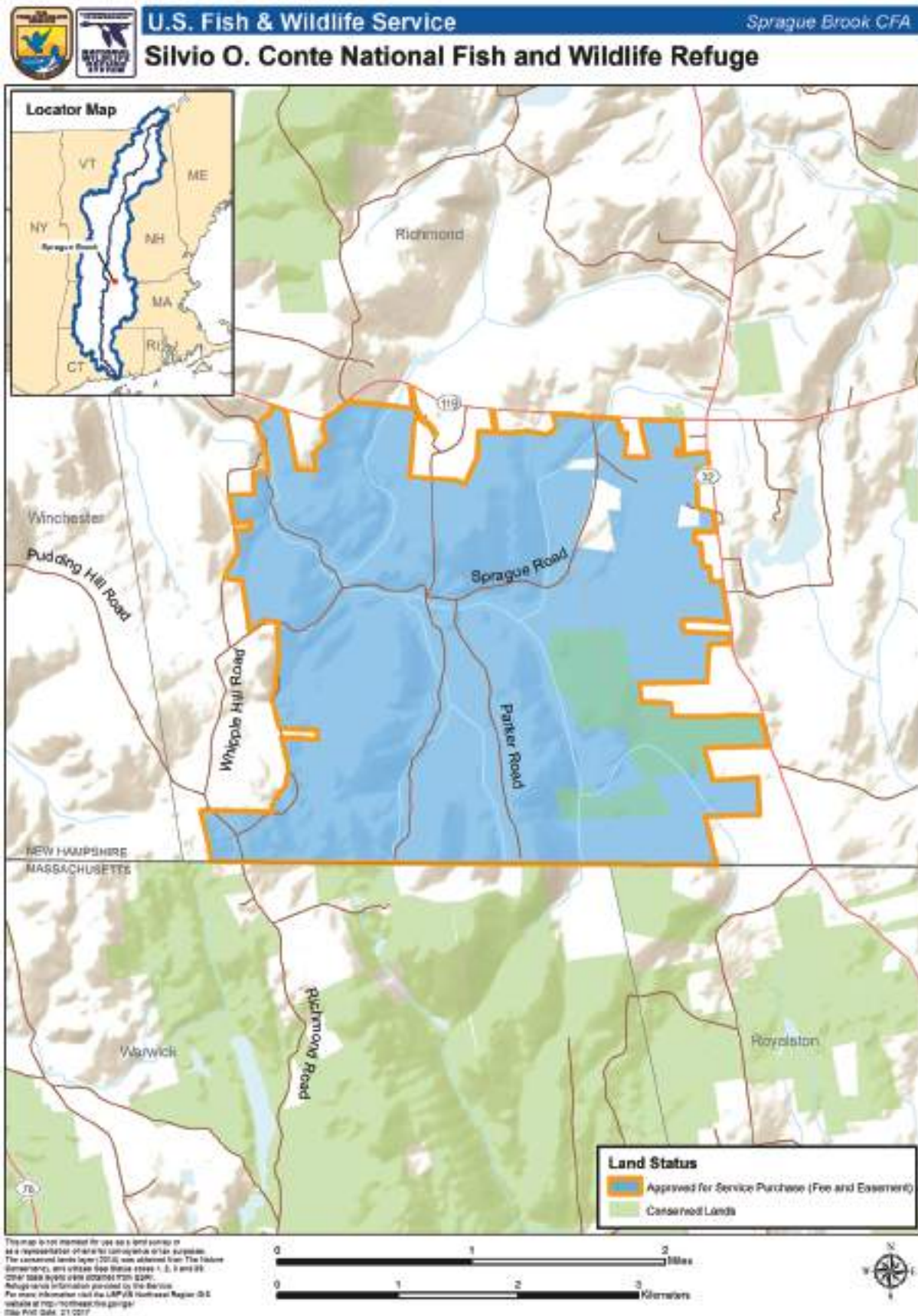
Map 4.35. Mascoma CFA, New Hampshire



Map 4.36. Pondicherry CFA, New Hampshire

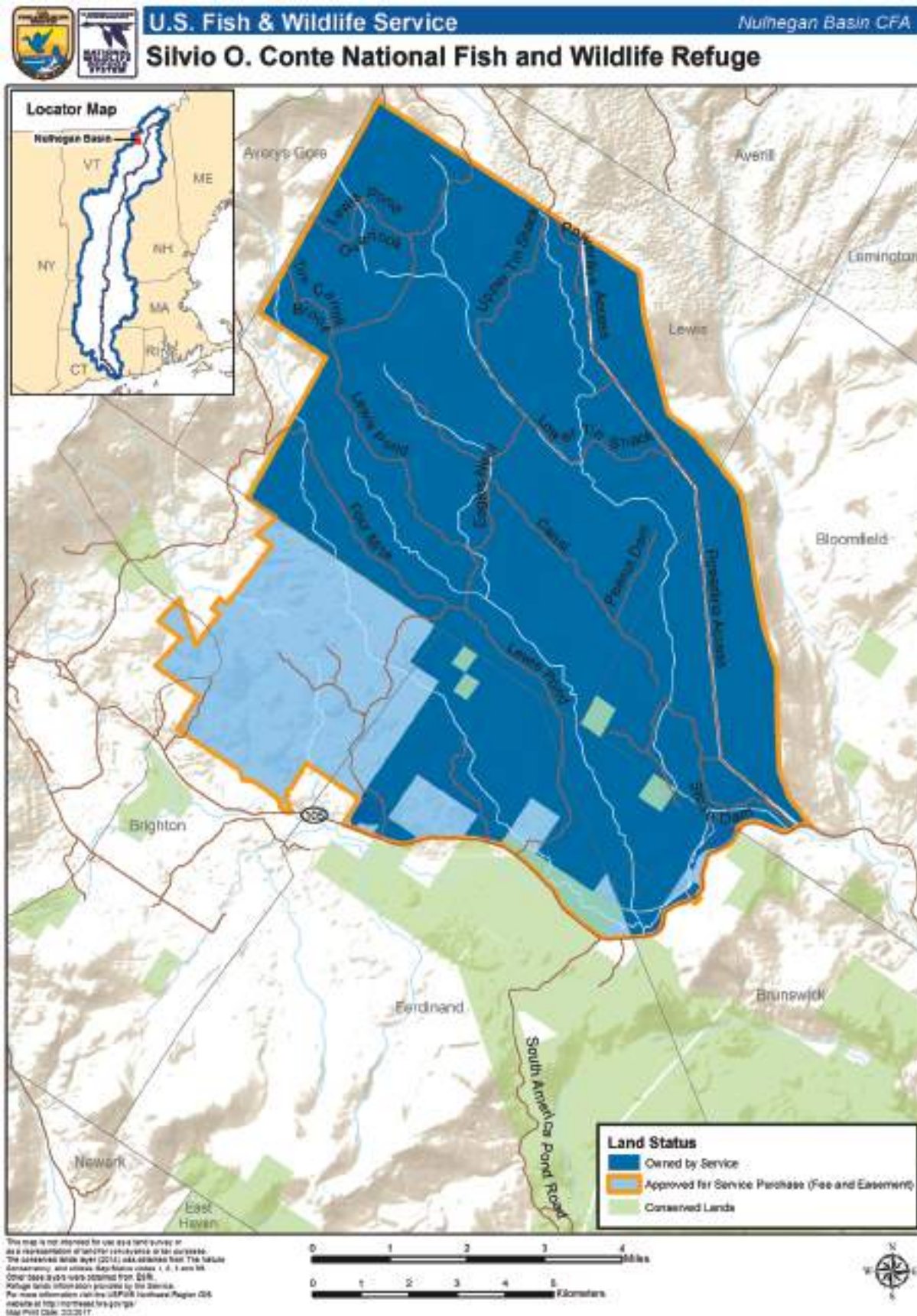


Map 4.37. Sprague Brook CFA, New Hampshire and Massachusetts

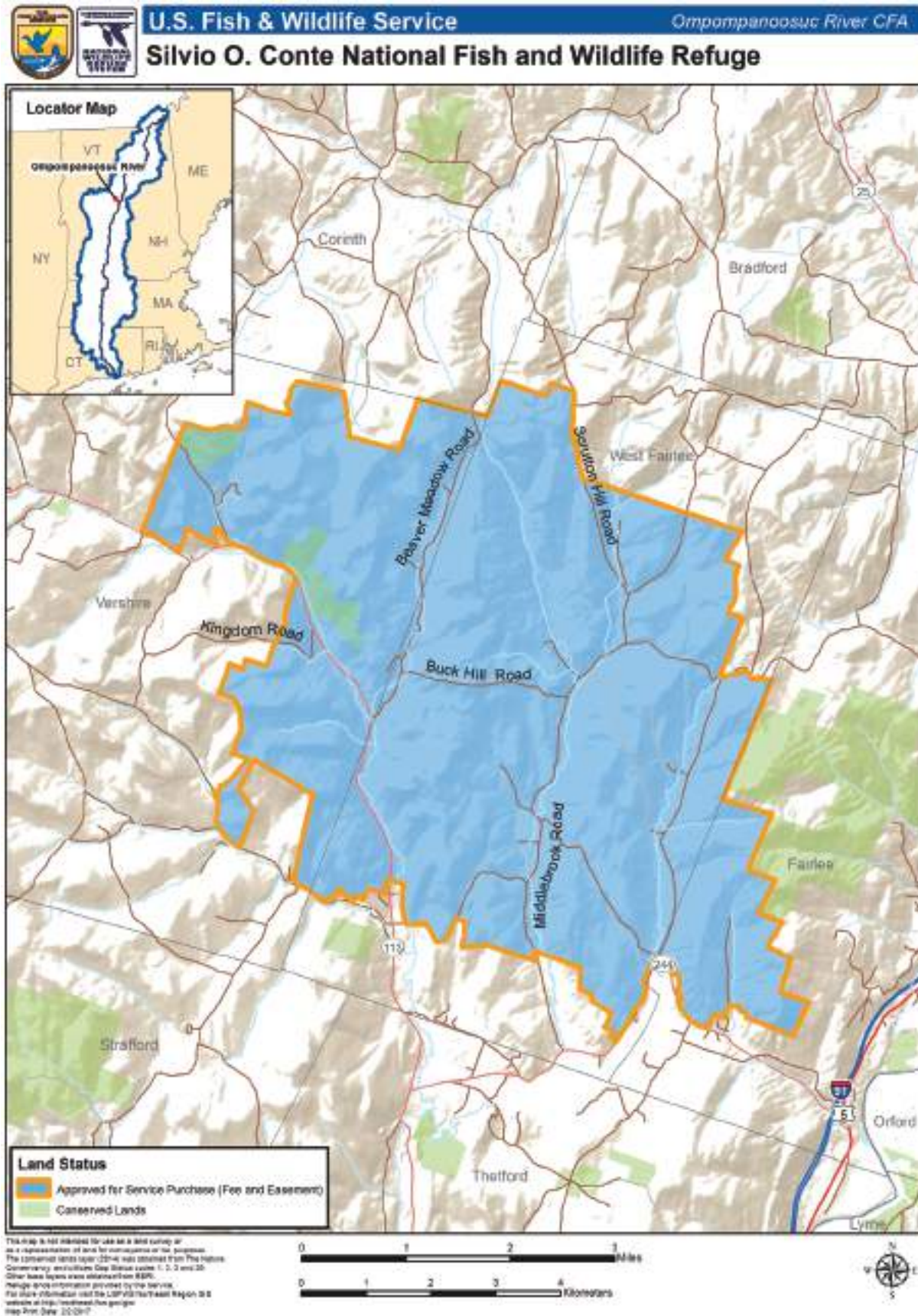




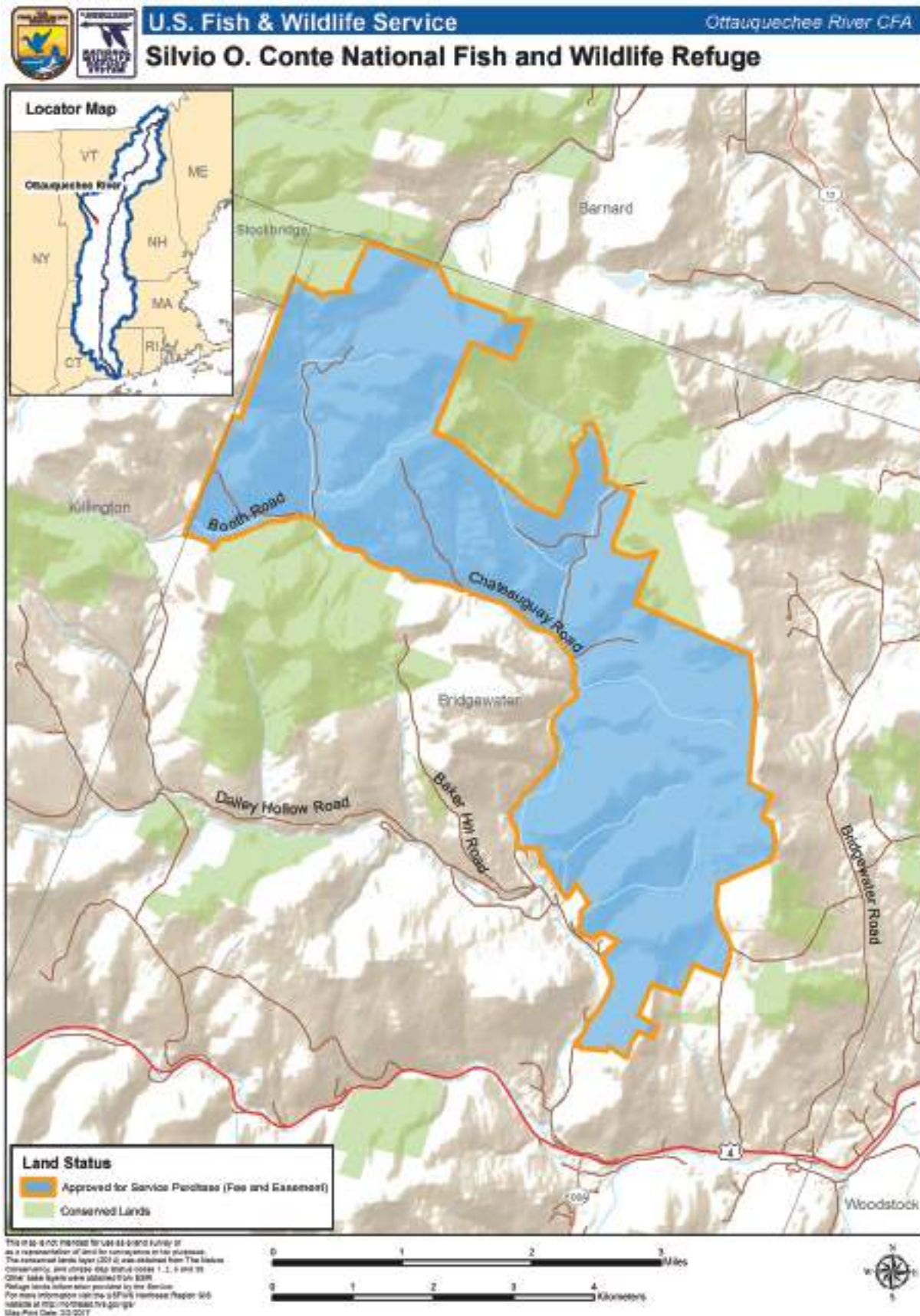
Map 4.38. Nulhegan Basin CFA, Vermont



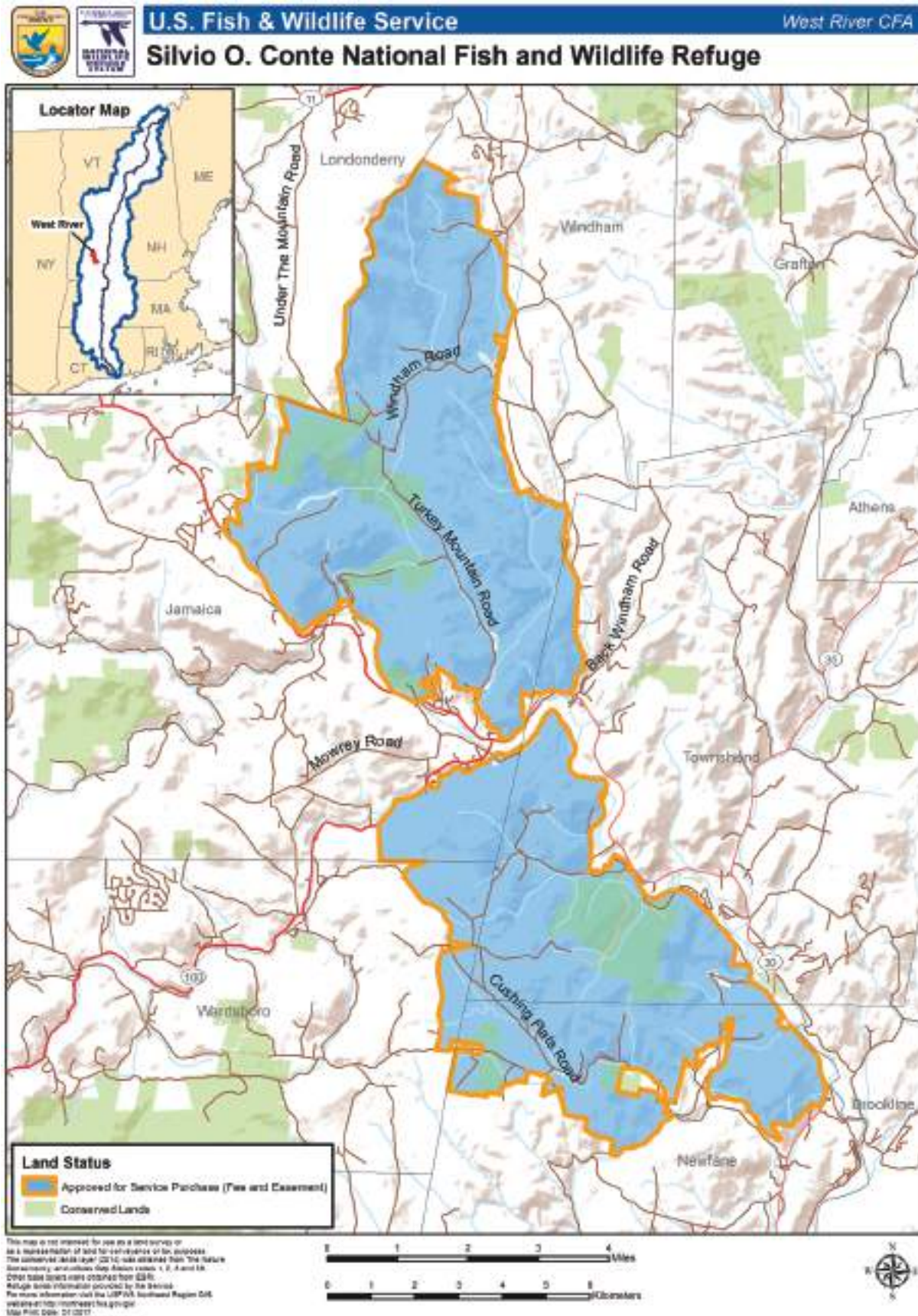
Map 4.39. Ompompanoosuc River CFA, Vermont



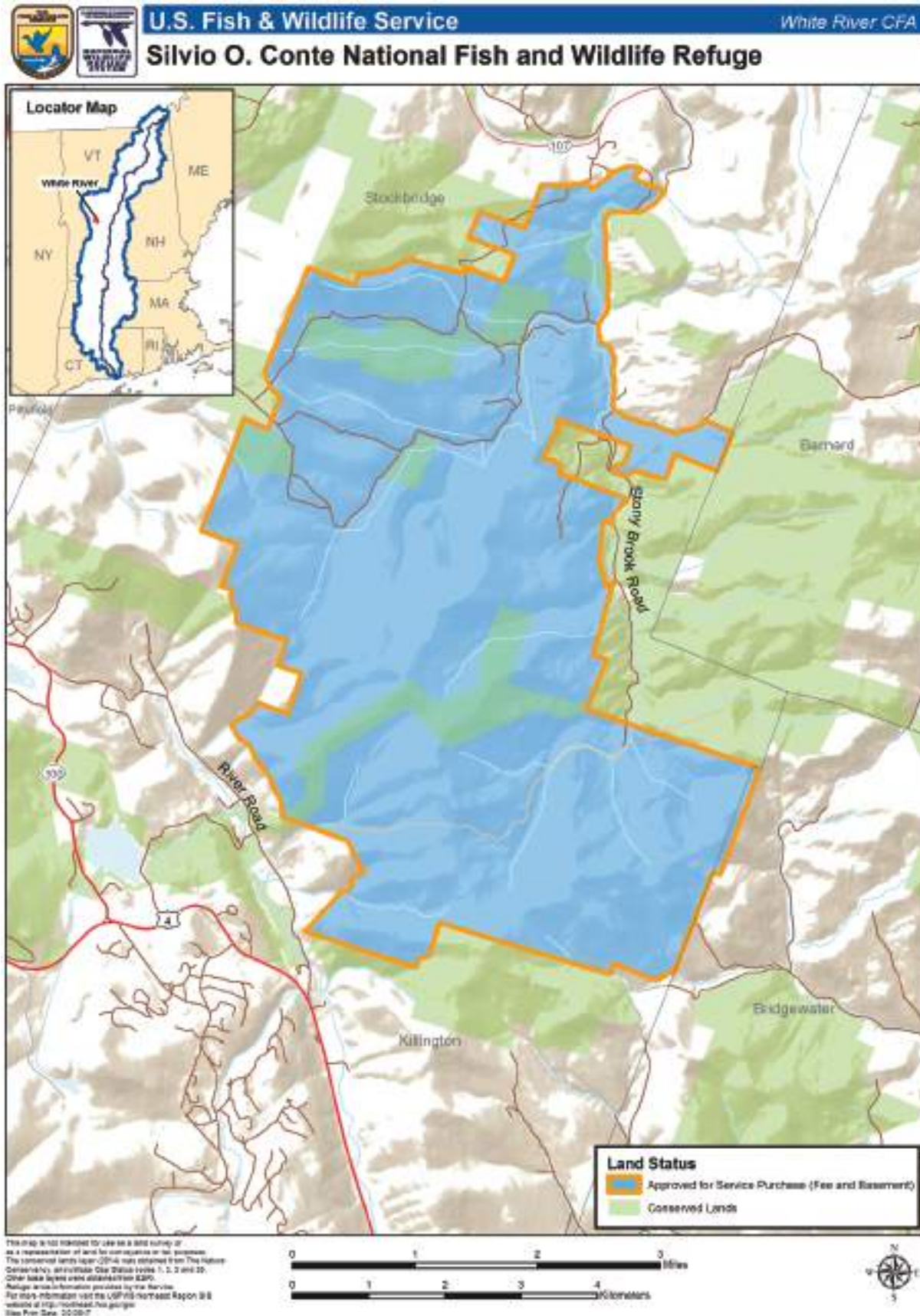
Map 4.40. Ottauquechee River CFA, Vermont



Map 4.41. West River CFA, Vermont



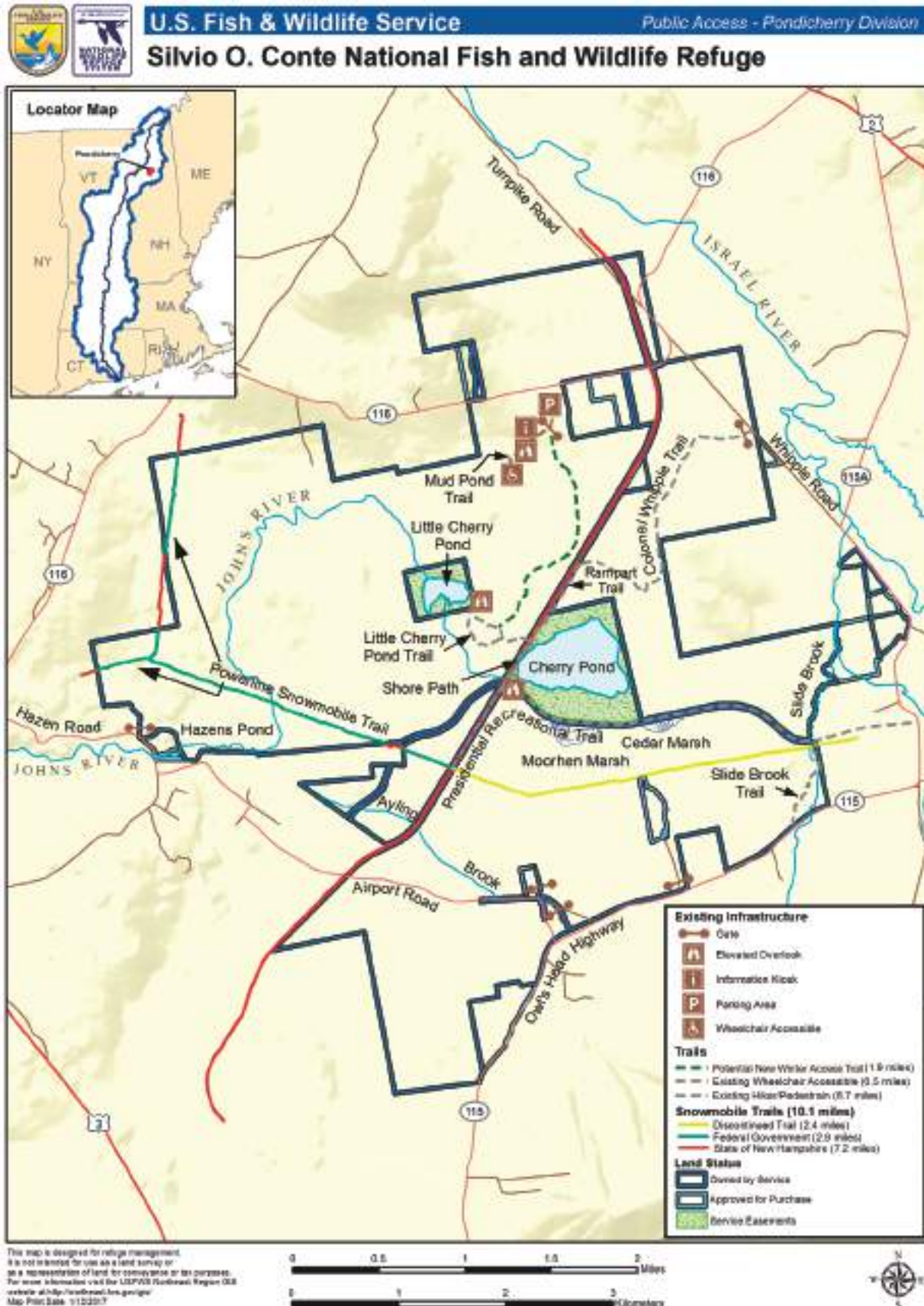
Map 4.42. White River CFA, Vermont



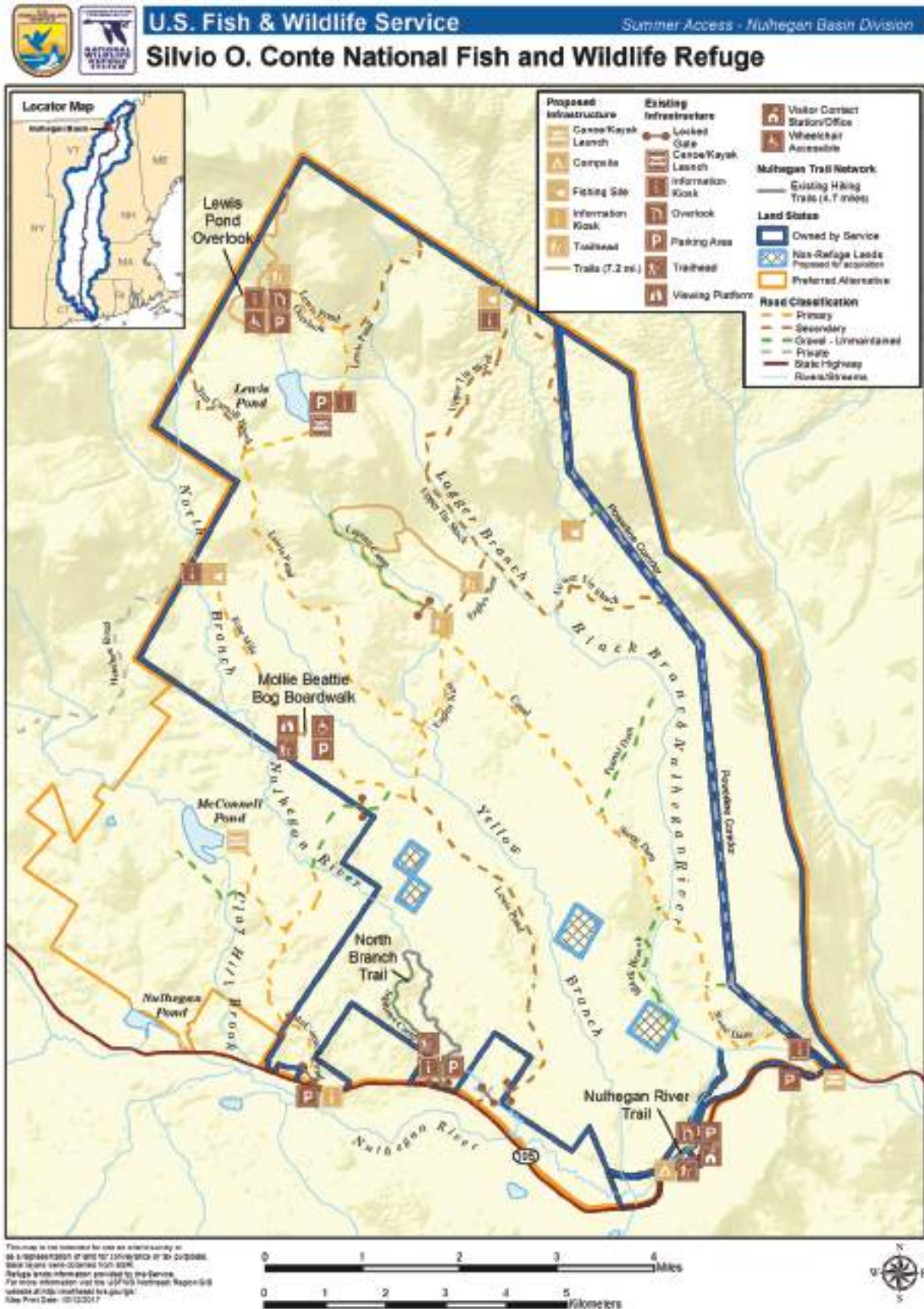
**Maps of Recreational  
Access for the Nulhegan  
Basin and Pondicherry  
Divisions**

The following maps show the public use access and facilities at the Pondicherry and Nulhegan Basin Divisions, the largest existing divisions. Public use maps for other divisions are included in appendix A, Conservation Focus Areas or appendix D, Findings of Appropriateness and Compatibility Determinations.

Map 4.43. Public Use Access at Pondicherry Division



Map 4.44. Summer Public Use Access at Nulhegan Basin Division









## Chapter 5



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*CCP Public Scoping Meeting, Island Pond, Vermont*

## Coordination and Consultation

- Introduction
- Public and Partner Involvement
- Public and Partner Meetings



## Introduction

Effective conservation begins with effective community involvement. To ensure that our future management of the refuge considers the issues, concerns, and opportunities expressed by the public and our partners, we used a variety of public and partner involvement techniques in our planning process. What follows is the chronology of public outreach activities we conducted while preparing the Comprehensive Conservation Plan (CCP) for Silvio O. Conte National Fish and Wildlife Refuge (Conte Refuge).

## Public and Partner Involvement

We began the CCP process for Silvio O. Conte National Fish and Wildlife Refuge in 2006. We published our original Notice of Intent to prepare a CCP and EIS in the *Federal Register* on October 20, 2006 (71 FR 62006). This notice also announced a public scoping period and requested public and partner input into the planning process. During scoping, we solicited comments on the major issues that the public and others felt we should address in the CCP. We also held numerous public meetings throughout the Connecticut River watershed. In fall 2014, we distributed an internal review draft to over 50 individuals from at least 5 State conservation agencies, 6 federally recognized Tribes, and 5 Federal agencies, including numerous divisions of the U.S. Fish and Wildlife Service and the White and Green Mountain National Forests.

We published a Notice of Availability of the draft CCP and EIS in the *Federal Register* on August 18, 2015 (80 FR 50023). This notice announced a 90-day public review and comment period and requested public and partner input. The draft CCP/EIS document was made available in digital format on the refuge website and on CD-ROM by request; in hardcopy at the Northeast Regional Office, Conte Refuge's Nulhegan Basin Division Office, and Conte Refuge Headquarters Office; and in hardcopy at 20 town and city clerk's offices across all 4 affected states. Fourteen informal informational open houses and four formal public hearings were held. During this comment period, we solicited written comments electronically (via regulations.gov), by mail, and by oral public testimony at one of the four public hearings. Based on comments we received during the public review period for the draft CCP/EIS, we made several modifications to alternative C in the final CCP/EIS. All substantive issues were addressed through revisions made to text in the final CCP/EIS, or in our responses to comments contained in appendix O of the final document.

After reviewing over 360 comments received during the 90-day review and comment period, we identified a preferred alternative (alternative C) and made minor changes and clarifications to the CCP and EIS. On December 16, 2016, we published a Notice of Availability in the *Federal Register*, announcing the release of the final CCP/EIS (81 FR 91185). We notified everyone on the CCP mailing list by newsletter or email of the final CCP and EIS's availability for a 30-day review period. During this latter review period, we received additional comments from 9 individuals and organizations, principally from those who commented on the draft plan.

None of the comments received on the final CCP/EIS raised significant new issues, nor did the comments require significant changes to either alternative C or our analysis of impacts. All substantive comments were previously addressed in appendix O.

Following review of the final CCP/EIS comments, the Regional Director approved the final CCP/EIS and signed a Record of Decision (ROD) on January 18, 2017, selecting the Service-preferred alternative C for implementation.

**Public and Partner Meetings**

Refuge staff attended the following meetings where aspects of the CCP planning process were discussed.

<b>2007</b>	5/17/2007	Friends of Silvio O. Conte National Fish and Wildlife Refuge—Norwich, Vermont
	5/22/2007	Friends of Silvio O. Conte National Fish and Wildlife Refuge—Longmeadow, Massachusetts
	12/10/2007	Public Scoping Meeting—Norwich, Vermont
	12/11/2007	Public Scoping Meeting—Winchester, New Hampshire
	12/12/2007	Public Scoping Meeting—Brattleboro, Vermont
	12/17/2007	Public Scoping Meeting—Colebrook, New Hampshire
	12/18/2007	Public Scoping Meeting—Island Pond, Vermont
	12/19/2007	Public Scoping Meeting—Jefferson, New Hampshire
<b>2008</b>	1/8/2008	Public Scoping Meeting—Hadley, Massachusetts
	1/10/2008	Public Scoping Meeting—Chesterfield, Massachusetts
	1/14/2008	Public Scoping Meeting—Middletown, Connecticut
	1/16/2008	Public Scoping Meeting—Burlington, Connecticut
	1/17/2008	Public Scoping Meeting—Old Lyme, Connecticut
	2/20/2008	Public Scoping Meeting—Richmond, New Hampshire
	3/27/2008	Quabbin to Cardigan Partnership—Hancock, New Hampshire
	4/9/2008	Connecticut River Joint Commission—Headwaters Subcommittee
	4/22/2008	Norton VT Planning Commission—Ecotourism Discussion
	4/28/2008	Friends of Silvio O. Conte National Fish and Wildlife Refuge “Experts” Workshop—Hanover, New Hampshire
	5/8/2008	Unified Towns and Gores Board of Governors—Island Pond, Vermont <i>(Discussed desire for recreational opportunities, including bicycling)</i>
	5/16/2008	NorthWoods Stewardship Center Annual Board Meeting—Brunswick, Vermont
	6/11/2008	Vermont Trappers Association Monthly Meeting—Barre, Vermont
	8/14/2008	Meeting with Island Pond Business Leaders and the Northeast Kingdom Travel and Tourism Association—Island Pond, Vermont

	8/26/2008	Friends of Maromas—Middletown, Connecticut
	9/27/2008	Champion Land Leaseholder and Traditional Interests Coalition—Ferdinand, Vermont
	10/7/2008	Nulhegan Gateway Association General Monthly Meeting—Island Pond, Vermont
	11/4/2008	Nulhegan Gateway Association General Monthly Meeting—Island Pond, Vermont
	12/11/2008	Unified Towns and Gores Board of Governors — Ferdinand, Vermont <i>(Discussed desire for recreational opportunities, including requesting snowmobile access)</i>
<b>2009</b>	2/17/2009	Nulhegan Gateway Association General Monthly Meeting—Island Pond, Vermont
	3/11/2009	Brighton Snowmobile Club/Canaan Border Riders — Brunswick, Vermont <i>(Discussed trail sharing and access to Nulhegan Basin Division visitor contact station)</i>
	4/6/2009	Nulhegan Gateway Association General Monthly Meeting—Island Pond, Vermont
	5/4/2009	Nulhegan Gateway Association General Monthly Meeting—Island Pond, Vermont
	5/23/2009	Northeast Kingdom (NEK) Audubon Annual Meeting—Brunswick, Vermont
	6/19/2009	NorthWoods Stewardship Center—YCC Crew Leader Trainings—East Charleston, Vermont
	6/29/2009	Nulhegan Gateway Association General Monthly Meeting—Island Pond, Vermont
	7/2/2009	Nulhegan Gateway Association General Monthly Meeting—Island Pond, Vermont
	8/10/2009	Nulhegan Gateway Association General Monthly Meeting—Island Pond, Vermont
	9/26/2009	Champion Land Leaseholder and Traditional Interests Coalition—Ferdinand, Vermont
	10/26/2009	Nulhegan Gateway Association General Monthly Meeting—Island Pond, Vermont
	10/27/2009	Northern Forest Canoe Trail Meeting—Island Pond, Vermont <i>(included site visit to discuss portage/campsite on the Nulhegan Basin Division)</i>
	11/9/2009	Nulhegan Gateway Association—Island Pond, Vermont

<b>2010</b>	1/28/2010	Friends of the Silvio O. Conte National Fish and Wildlife Refuge General Meeting
	4/10/2010	Northeast Kingdom (NEK) Audubon Annual Meeting—St. Johnsbury, Vermont
	9/14/2010	Vermont Bearhound Association—Barre, Vermont <i>(included discussion on potential changes to bearhound training season)</i>
<b>2011</b>	1/6/2011	Brunswick, Vermont Selectboard Meeting—Brunswick, Vermont <i>(included discussion on public use and land acquisition)</i>
	6/4/2011	Vermont Coverts: Woodland for Wildlife Meeting—Derby, Vermont
	9/11/2011	Vermont Trappers Association Annual Meeting—Barton, Vermont
	11/9/2011	Salmon River Division Friends Group—Haddam Neck, Connecticut
	11/16/2011	Mt Tom Partnership—Holyoke, Massachusetts
<b>2012</b>	3/30/2012	Friends of the Silvio O. Conte National Fish and Wildlife Refuge General Meeting
	9/9/2012	Nulhegan Gateway Association General Monthly Meeting—Island Pond, Vermont
	10/6/2012	Champion Land Leaseholder and Traditional Interests Coalition Meeting—Ferdinand, Vermont
	10/11/2012	NorthWoods Stewardship Center–Youth Conservation Corps Crew Leader Training—East Charleston, Vermont
<b>2013</b>	1/28/2013	Friends of the Silvio O. Conte National Fish and Wildlife Refuge General Meeting 1/28/2013 Friends of the Silvio O. Conte National Fish and Wildlife Refuge General Meeting
<b>2014</b>	8/ to 10/2014	Meetings with State Fish and Wildlife Agencies to collect comments on the internal review draft of the CCP/EIS
<b>2015</b>	8/31/2015	Public Meeting—Columbia, New Hampshire
	9/1/2015	Public Meeting—Island Pond, Vermont
	9/2/2015	Public Meeting—Whitefield, New Hampshire
	9/9/2015	Public Meeting—Woodstock, Vermont
	9/10/2015	Public Meeting—Bradford, Vermont
	9/14/2015	Public Meeting—Beckett, Massachusetts
	9/15/2015	Public Meeting—Hadley, Massachusetts



	9/16/2015	Public Meeting—Townshend, Vermont
	9/17/2015	Public Meeting—Keene, New Hampshire
	9/21/2015	Public Meeting—Colebrook, Connecticut
	9/22/2015	Public Meeting—Glastonbury, Connecticut
	9/23/2015	Public Meeting—Chesterfield, Massachusetts
	9/24/2015	Public Meeting—Higganum, Connecticut
	10/3/2015	Champion Lands Leaseholder and Traditional Coalition Annual Meeting—Refuge staff provided an update on the status of the draft CCP/EIS and reminded attendees how they could provide comments. There were approximately 80 attendees.
	10/15/2015	Public Meeting—Lancaster, New Hampshire
	10/19/2015	Connecticut River Joint Commission—Lebanon, New Hampshire. Refuge staff provided an update on the status of the draft CCP/EIS and reminded attendees how they could provide comments.
	10/22/2015	Lower Connecticut River Gateway Commission—Essex, Connecticut. Refuge Manager provided an update on the status of the draft CCP/EIS and reminded attendees how they could provide comments.
	11/2/2015	Public Hearing—St. Johnsbury, Vermont
	11/5/2015	Public Hearing—Keene, New Hampshire
	11/9/2015	Public Hearing—Hadley, Massachusetts
	11/12/2015	Public Hearing—Burlington, Connecticut
	12/2/2015	Associated Industries of Vermont Forest Policy Task Force—Refuge staff provided an update on the status of the draft CCP/EIS and reminded attendees how they could provide comments. Additionally, information was provided on the role of habitat management within the Refuge System, and more specifically, the proposed use of commercial forest practices to achieve desired habitat conditions for our Federal trust wildlife species.
<b>2016</b>	5/3/2016	Information Meeting—West Lebanon, New Hampshire. This meeting was sponsored by Senator Shaheen and hosted by The Nature Conservancy of New Hampshire and the New Hampshire Timberland Owners Association. The meeting was open to all. Approximately 130 people attended the Q&A discussion session.
	6/29/2016	Columbia, New Hampshire. This meeting was hosted by Senator Ayotte. The meeting was open to all. Approximately 25 people attended the Q&A discussion session.



## Chapter 6



USFWS

*CCP scoping meeting*

## List of Preparers

- **Planning Team**
- **Other Service Program Involvement**
- **Partners Involved in Refuge Planning**



**Planning Team**

<b>Sarah Bevilacqua</b>	<i>Retired, Outdoor Recreation Planner, Silvio O. Conte National Fish and Wildlife Refuge, U.S. Fish and Wildlife Service, National Wildlife Refuge System, Northeast Region</i>
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<b>Laurel Carpenter</b>	<i>Park Ranger (Former), Silvio O. Conte National Fish and Wildlife Refuge, U.S. Fish and Wildlife Service, National Wildlife Refuge System, Northeast Region. Transferred to private sector.</i>
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<b>Mark Maghini</b>	<i>Realty Chief, U.S. Fish and Wildlife Service, National Wildlife Refuge System, Northeast Region</i>
<b>Nancy McGarigal</b>	<i>Lead Natural Resource Planner, U.S. Fish and Wildlife Service, National Wildlife Refuge System, Northeast Region</i>
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<b>Barry Parrish</b>	<i>Retired, Wildlife Refuge Manager, Silvio O. Conte National Fish and Wildlife Refuge, U.S. Fish and Wildlife Service, National Wildlife Refuge System, Northeast Region</i>
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<b>Ralph Taylor</b>	<i>District Fish and Wildlife Supervisor, Connecticut Valley Wildlife District, Massachusetts Division of Fisheries and Wildlife</i>
<b>Mark Scott</b>	<i>Certified Wildlife Biologist, Director of Wildlife, Vermont Fish and Wildlife Department</i>
<b>Jim Horton</b>	<i>Retired, Forester-Public Lands Coordinator, Vermont Department of Forests, Parks, and Recreation</i>

**Other Service Program Involvement**

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<b>Jennifer Casey</b>	<i>Assistant Regional Biologist</i> , U.S. Fish and Wildlife Service, National Wildlife Refuge System, Northeast Region
<b>Donita Cotter</b>	<i>Wild and Scenic Rivers Coordinator</i> , U.S. Fish and Wildlife Service, Arlington Office
<b>Randy Dettmers</b>	<i>Nongame Bird Coordinator</i> , U.S. Fish and Wildlife Service, Division of Migratory Birds, Northeast Region
<b>John Eaton</b>	<i>Cartographer</i> , U.S. Fish and Wildlife Service, National Wildlife Refuge System, Northeast Region
<b>Kathryn Fox</b>	<i>Assistant Planner (Former)</i> , U.S. Fish and Wildlife Service, National Wildlife Refuge System, Northeast Region. Transferred to private sector.
<b>Kathleen Johnson</b>	<i>Student Conservation Association Intern (Former)</i> , Silvio O. Conte National Fish and Wildlife Refuge, U.S. Fish and Wildlife Service, National Wildlife Refuge System, Northeast Region
<b>Tom LaPointe</b>	<i>Forest Ecologist</i> , U.S. Fish and Wildlife Service, National Wildlife Refuge System, Northeast Region
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<b>Allison McCluskey</b>	<i>Assistant Realty Specialist</i> , National Wildlife Refuge System, Northeast Regional Office
<b>Arthur McCollum</b>	<i>Migratory Bird Program Permit Specialist</i> , U.S. Fish and Wildlife Service, Northeast Region
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**Janith Taylor**      *Regional Program Chief, Natural Resources and Conservation Planning Division, National Wildlife Refuge System, Northeast Regional Office*

**John Wilson**      *Retired, Cultural Resources Team Leader, U.S. Fish and Wildlife Service, National Wildlife Refuge System, Northeast Regional Office*

**Partners Involved in Refuge Planning**

We receive a great deal of support from outside the Service as implement our programs. We identify many of our partners in appendix M who help us with biological surveys, enhancing public use and refuge programs, restoring habitat, law enforcement, and protecting land. Our partnerships will continue to expand under the increasing interest in conserving refuge resources. Our partners listed below were particularly helpful in compiling the draft and final plans because they provided important data or resources.

- Trust for Public Land.
- The Nature Conservancy.
- National Wildlife Refuge Association.
- Connecticut Department of Energy and Environmental Protection, Wildlife Division.
- Massachusetts Division of Fisheries and Wildlife.
- New Hampshire Fish and Game Department.
- Vermont Fish and Wildlife Department.
- U.S. Geological Survey, Policy Analysis and Science Assistance, Fort Collins Science Center.





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Patrick Comins

*Nulhegan River*

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## Glossary, Acronyms and Species Scientific Names



Bill Thompson

*Song sparrow*

## Glossary, Acronyms, and Species Scientific Names

- Glossary
- Acronyms
- Species Scientific Names



## Glossary

<b>active adaptive management</b>	Management that involves deliberately implementing and testing a range of management option or actions in order to learn which is most effective.
<b>adaptive capacity</b>	The ability of a conservation feature or human community to adjust to the impacts of climate change.
<b>adaptive management</b>	The process of “learning by doing” by taking either a singular approach or intervention or a range of conservation interventions, monitoring the effectiveness of these approach(es), and using that feedback to make improvements in the management intervention(s).
<b>abiotic</b>	nonliving; a physical feature of the environment such as climate, temperature, geology, soils
<b>alternative</b>	a set of objectives and strategies needed to achieve refuge goals and the desired future condition.
<b>ambient</b>	of the surrounding area or outside environment
<b>anadromous fish</b>	fish that spend a large portion of their life cycle in the ocean and return to freshwater to breed.
<b>anuran</b>	relating to frogs and toads, any vertebrate of the order Anura
<b>appropriate use</b>	a proposed or existing use on a refuge that meets at least one of the following three conditions: <ol style="list-style-type: none"> <li>1. the use is a wildlife-dependent one;</li> <li>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</li> <li>3. the use has been determined appropriate as specified in section 1.11 of that act.</li> </ol>
<b>approved acquisition boundary</b>	a project boundary that the Director of the U.S. Fish and Wildlife Service approves upon completion of the planning and environmental compliance process. An approved acquisition boundary only designates those lands that the Service has authority to acquire or manage through various agreements. The approval of an acquisition boundary does not grant the Service jurisdiction or control over lands within the boundary, and it does not make lands within the refuge boundary part of the National Wildlife Refuge System. Lands do not become part of the System until the Service buys them or they are placed under an agreement that provides for their management as part of the System
<b>aquatic</b>	growing in, living in, or dependent upon water.
<b>aquatic barrier</b>	any obstruction to fish passage.
<b>archaeology</b>	the study of human cultures

<b>avian</b>	of or having to do with birds
<b>basin</b>	the surrounding land that drains into a water body.
<b>beaver deceiver</b>	a fence that discourages beaver from damming areas.
<b>best management practice</b>	land management practices that produce desired results (usually describing forestry or agricultural practices effective in reducing non-point source pollution.
<b>bioaccumulation</b>	an increase in concentration of a chemical in an organism at a higher level than expected.
<b>biological diversity</b>	the variety of life forms and its processes, including the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur.
<b>biological integrity</b>	biotic composition, structure, and functioning at genetic, organism, and community levels comparable with historic conditions, including natural biological processes that shape genomes, organisms, and communities.
<b>biological planning</b>	The process of identifying priority conservation species and measurable targets such as population objectives, assessing the current status of populations (increasing, decreasing, static), identifying threats and limiting factors, and building models to describe the relationship of populations to habitat and other limiting factors.
<b>biophysical region</b>	a geographic region described based on a broad pattern of geology, topography, climate, and species distribution.
<b>bird conservation region</b>	ecologically distinct regions in North America with similar bird communities, habitats, and resource management issues.
<b>birds of conservation concern</b>	A list we developed from the most current conservation assessments from three bird conservation plans: Partners in Flight, The United States Shorebird Conservation Plan, and the North American Waterbird Conservation Plan. We developed rules to narrow these lists by focusing on species, subspecies, or populations that have declining trends, small population sizes, and are facing severe threats at some point in their annual cycle.
<b>bog</b>	soggy, moist, spongy, or otherwise wet areas with peat soils—the partially or incompletely decomposed remains of dead plants and some animals. A type of peatland.
<b>buffer</b>	lands bordering water bodies that reduce runoff and nonpoint source pollution
<b>canopy</b>	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.

<b>catadromous</b>	refers to fish that migrate from freshwater to saltwater to spawn and reproduce.
<b>categorical exclusion</b>	a category of Federal agency actions that do not individually or cumulatively have a significant effect on the human environment.
<b>clear-cutting</b>	method of timber harvesting in which all trees in a forested area are removed in a single cutting.
<b>coarse filter</b>	Conservation features intended to compensate for our incomplete knowledge of all biodiversity by reflecting diversity at a higher level of ecological organization that can more readily observe, such as ecosystem types.
<b>community (ecological)</b>	Relatively distinct assemblages of species that co-occur in space.
<b>community</b>	a distinct assemblage of plants that develops on sites characterized by particular climates and soils, and the species and populations of wild animals that depend on the plants for food, cover and/or nesting.
<b>compatible use</b>	a wildlife-dependent recreational use, or any other use on a refuge that will not materially interfere with or detract from the fulfillment of the mission of the Service or the purposes of the refuge.
<b>compatibility determinations</b>	a required determination for wildlife-dependent recreational uses or any public uses of a refuge.
<b>Comprehensive Conservation Plan</b>	a document that describes the desired future conditions of the refuge, and specifies management direction to achieve refuge goals and the mission of the National Wildlife Refuge System.
<b>conceptual model</b>	A descriptive model of a system based on qualitative assumptions about its elements, their interrelationships, and system boundaries.
<b>conservation design</b>	the application of scientific information, expert opinion, and spatial data that helps us to establish estimates of where and how to achieve our mission through landscape sustainability. It is the integration of multiple objectives and the determination of how to efficiently apportion objectives across the landscape and among Refuge System units.
<b>conservation easement</b>	a legal agreement between a landowner and a land trust or governmental agency that permanently limits some uses of a property to protect its conservation values.
<b>constraint</b>	A condition that restricts potential options in a conservation plan (e.g., total budget or actions that have already been committed to).
<b>cool-season grass</b>	introduced grass for crop and pastureland that grows in spring and fall and is dormant during hot summer months.
<b>Cooperative Agreement</b>	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

<b>cost</b>	The money, staff time, capital equipment, and other resources necessary to plan for and more broadly implement a strategy, action, or conservation plan.
<b>cover-type</b>	the current vegetation of an area.
<b>critical habitat</b>	according to U.S. Federal Law, the ecosystems upon which endangered and threatened species depend.
<b>cultural resource</b>	those parts of the physical environment—natural and built—that have cultural values to some sociocultural group or institution. Cultural resources include historic sites, archaeological sites and associated artifacts, sacred sites, buildings, and structures.
<b>culvert</b>	a tunnel carrying a stream or an open drain under a road, trail, or railroad
<b>defoliate; defoliator</b>	remove a plant's leaves, something that removes a plants leaves
<b>designated landscape</b>	Landscapes, seascapes, and watersheds whose configuration and function have been heavily influenced by people, generally for their benefit.
<b>diameter at breast height</b>	(dbh)—the diameter of the stem of tree measure at breast height (usually 4.5 feet above the ground). The term is commonly used by foresters to describe tree size.
<b>disturbance</b>	a disruption in the natural plant succession of a community or ecosystem resulting in a new community.
<b>early successional habitat</b>	Succession is the gradual replacement of one plant community by another. In a forested ecosystem, tree cover can be temporarily displaced by natural or human disturbance (e.g., flooding by beaver, or logging). The open environments created by removal of tree cover are referred to as 'early-successional' habitats because as time passes, trees will return. The open conditions occur 'early' in the sequence of plant communities that follow disturbance. We define <i>early successional forest</i> in this CCP as: the shrub-sapling stage; 0-15 years old.
<b>ecological integrity</b>	The condition or health of an ecosystem or habitat; in particular, how intact it is.
<b>ecological succession</b>	the orderly progression of an area through time in the absence of disturbance from one vegetative community to another.
<b>ecoregion</b>	a territory defined by a combination of biological, social, and geographic criteria, rather than geopolitical considerations; generally, a system of related, interconnected ecosystems.
<b>ecosystem</b>	a dynamic and interrelated complex of plant and animal communities and their associated non-living environment.
<b>ecosystem approach</b>	a strategy or plan to protect and restore the natural function, structure, and species composition of an ecosystem, recognizing that all components are interrelated.



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<b>ecosystem process</b>	a natural phenomenon in an ecosystem
<b>ecosystem services</b>	the goods and services that natural ecosystems deliver to people.
<b>effluent</b>	outflow of water from a structure, such as wastewater discharge from a sewage treatment plant or industrial facility.
<b>emergent marsh</b>	wetlands dominated by erect, rooted, herbaceous plants.
<b>endangered species</b>	any species of plant or animal defined through the Endangered Species Act as being in danger of extinction throughout all or a significant portion of its range, and published in the <i>Federal Register</i> .
<b>Environmental Assessment</b>	a systematic analysis to determine if proposed actions would result in a significant effect on the quality of the environment.
<b>environmental health</b>	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.
<b>eutrophication</b>	the process by which a body of water acquires a high concentration of nutrients, particularly phosphates and nitrates, often leading to excessive algae growth. As the algae die and decompose, the amount of available oxygen decreases, causing the death of some aquatic organisms.
<b>even-aged management</b>	a forest management technique in which all the trees in an area are harvested at once or in several cuttings over a short time period to create stands of trees all approximately the same age.
<b>exotic species</b>	a species that is not native to an area and has been introduced intentionally or unintentionally by humans.
<b>expert judgment</b>	The opinion of an expert about a matter of fact.
<b>extinction</b>	the termination of existence of a lineage of organisms (e.g., a subspecies or species).
<b>extirpation</b>	the localized extinction of a species that is no longer found in a locality or country, but still exists elsewhere in the world.
<b>Federal-listed species</b>	a species listed either as endangered, threatened, or species at risk (formerly a “candidate” species) under the Endangered Species Act of 1973, as amended.
<b>fee-title acquisition</b>	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.
<b>fine filter</b>	Important aspects of biodiversity unlikely to be well represented with coarse filters, such as individual species.

<b>flowage</b>	refers to an area along a stream or river periodically flooded by beaver.
<b>flowage easement</b>	the right to control the flow of water from a source such as by impoundment, including the right to overflow, flood, and submerge lands affected.
<b>fragmentation</b>	the process of reducing the size and connectivity of habitat patches. The disruption of extensive habitats into isolated and small patches.
<b>fundamental objectives</b>	Those goals that we ultimately want our actions to achieve; they are statements about the things we value.
<b>furbearer</b>	any mammal that traditionally has been hunted and trapped primarily for fur.
<b>geographic information system</b>	a computer system capable of storing and manipulating spatial mapping data.
<b>glacial fluvial-drift</b>	material transported, sorted, and deposited by flowing glacial meltwater.
<b>glacial moraine</b>	a glacially formed accumulation of unconsolidated glacial debris (soil and rock)
<b>glacial outwash</b>	glacial drift deposited by water flowing from a melting glacier.
<b>glacial till</b>	a mixture of sand, silt, clay, and rock ground up by a glacier and dropped as it retreats.
<b>glide</b>	an area of smooth, fast-moving water in a stream that often separates pools (deep, slow-moving water) from riffles (shallow, fast-moving water).
<b>goals</b>	descriptive statements of desired future conditions.
<b>habitat</b>	an ecosystem, often linked to particular species.
<b>heathlands</b>	dwarf-shrub habitat, dominated by plants of the Ericaceae family, such as blueberry, cranberry, and azalea.
<b>hectare</b>	equal to 2.47 acres
<b>historic conditions</b>	the composition, structure, and functioning of ecosystems resulting from natural processes that we believe, based on sound professional judgment, were present prior to substantial human-related changes to the landscape.
<b>hotspot</b>	locations that harbor unusually high concentrations of species.
<b>hydro-axe</b>	a machinery attachment that mulches vegetation, including shrubs and trees up to 6 inches in diameter
<b>impoundment</b>	a body of water, such as a pond, confined by a dam, dike, floodgate, or other barrier, that is used to collect and hold water.

<b>indicator</b>	In conservation, something that is reported on as evidence of how well the plan objectives are being achieved.
<b>interjurisdictional fish</b>	populations of fish that are managed by two or more State or national or tribal governments because of the scope of their geographic distributions or migrations.
<b>interspersion</b>	refers to how different habitats occur (or are dispersed) across the landscape.
<b>invasive species</b>	a nonnative species whose introduction causes or is likely to cause economic or environmental harm or harm to human health.
<b>issue</b>	any unsettled matter that requires a management decision. For example, a resource management problem, concern, a threat to natural resources, a conflict in uses, or in the presence of an undesirable resource condition.
<b>juxtaposition</b>	the proximity (or arrangement) of distinctly different habitats to each other.
<b>Landscape Conservation Cooperative (LCC)</b>	public-private partnerships that define shared conservation goals and provide the expertise needed to support conservation planning at landscape scales. LCCs generate the tools, methods, and data that managers need to design and deliver conservation using the Strategic Habitat Conservation approach.
<b>landscape conservation design</b>	A partner-driven approach to achieve a sustainable, resilient socio-ecological landscape. It is an iterative, collaborative, and holistic process resulting in strategic and spatial products that provide information, analytical tools, maps, and strategies to achieve landscape goals collectively held among partners.
<b>land trust</b>	Usually nonprofit organizations whose missions are to conserve land through acquisition, conservation easement legislation, and/or ecological management activities.
<b>large saw timber</b>	a tree approximately 15 inches or greater diameter at breast height
<b>late-succession forest</b>	mature and old growth stages; greater than 70 years old
<b>likelihood of success</b>	The estimate that a project will deliver the desired outcomes. This analysis includes assessing the likelihood that the project will be implemented effectively, and, if implemented, will be successful. The estimate might be on a linguistic scale or as a probability.
<b>limiting factor</b>	an environmental limitation that prevents further population growth
<b>liquefied natural gas</b>	natural gas converted into a liquid form by cooling to a very low temperature
<b>mast</b>	fruits and nuts that provide food for wildlife. Soft mast includes most fruits with fleshy coverings. Hard mast includes nuts such as acorns, beech nuts, and hickory nuts.
<b>microhabitats</b>	a small, specific habitat, such as under a log or a hole in a tree.

<b>midden</b>	a pile or mound of mussel shells and other debris indicating the site of a human settlement
<b>mid-successional forest</b>	the pole-sawlog stage; 16-70 years old
<b>millinery trade</b>	the use of bird feathers in women's hats and other clothing.
<b>minimum variable population (MVP)</b>	The size at which a population's survival could be considered reasonably certain.
<b>National Wildlife Refuge System</b>	all lands, waters, and interests therein administered by the U.S. Fish and Wildlife Service as wildlife refuges, wildlife ranges, wildlife management areas, waterfowl production areas, and other areas for the protection and conservation of fish, wildlife and plant resources
<b>Neotropical migratory bird</b>	a bird species that breeds north of the United States/Mexico border migrate and winters primarily south of the U.S. border in Mexico, the West Indies, or Central or South America.
<b>Non-consumptive wildlife recreation</b>	wildlife observation, photography, hiking, environmental education and interpretation
<b>nonpoint source pollution</b>	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.
<b>nuisance species</b>	plants and animals (sometimes called nonnatives or exotics) that threaten the Lake Champlain Basin's native fish, wildlife, and plants and impede recreational activities.
<b>objectives</b>	actions to be accomplished to achieve a desired outcome or goal. Objectives are more specific, and generally more measurable, than goals.
<b>option</b>	An alternative strategy or action under consideration in a plan.
<b>overstory</b>	the upper canopy layer in a forest
<b>paleontology</b>	the study of prehistoric life
<b>parr</b>	the salmon life stage between fry and smolt; a young salmon distinguished by dark rounded patches evenly spaced along its side.
<b>passive adaptive management</b>	Management in which only one management option or action is selected based on existing information, but results of that choice are monitored, and future management decisions are made based on this additional knowledge.
<b>peatland</b>	a type of wetland with organic or peat soils--the partially or incompletely decomposed remains of dead plants and some animals.
<b>physiographic area</b>	a bird conservation planning unit with relatively uniform vegetative communities, bird populations, and species assemblages, as well as land use and conservation issues, developed by Partners in Flight.

<b>planning context</b>	The circumstances in which a conservation plan is developed. this usually involves considering the purpose of a plan, decisions to be made, decision makers, constraints on a planning process, level of investment in the plan, and audience for the plan.
<b>point source pollution</b>	a source of pollution that involves discharge of waste from an identifiable point, such as a smokestack or sewage-treatment plant.
<b>pole timber</b>	a tree approximately 5 to 10 inches diameter at breast height
<b>pool</b>	an area of relatively deep, slow-moving water is a stream or river; a body of water formed above a dam.
<b>population objectives</b>	describe the desired outcomes. We express objectives as abundance, trend, change of distribution, vital rates, or by using other measurable indices of population status based on the best biological information. We use these objectives, which are dependent on the scale of the population measured, to assess how well we are performing our management actions.
<b>preferred alternative</b>	the Service's selected alternative identified in the Draft Comprehensive Conservation Plan.
<b>prehistoric</b>	refers to the period before written history
<b>prescribed fire</b>	the application of fire to wildland fuels, either by natural or intentional ignition, to achieve identified land use objectives.
<b>priority conservation species</b>	those species requiring focused resource commitments due to legal status, management need, vulnerability, and geographic areas of importance.
<b>priority public use</b>	a compatible wildlife-dependent recreational use of a refuge involving hunting, fishing, wildlife observation and photography, or environmental education and interpretation.
<b>project proposal</b>	a document recommending the creation of a new refuge or the expansion of the boundary of an existing refuge as identified within a conservation design.
<b>quantitative</b>	An amount that can be measured and expressed numerically.
<b>range</b>	the geographic area within which a particular species is found.
<b>redd</b>	a nest of fish eggs covered by gravel.
<b>relative abundance</b>	an estimate of actual or absolute abundance, usually stated as an index.
<b>release (in forestry)</b>	freeing seedlings and saplings from competition with other trees, shrubs, and herbs. Techniques include removing mature trees in the canopy that are shading seedlings and saplings or thinning stands.
<b>research natural area</b>	part of a national network of reserved areas intended to represent the full array of North American ecosystems; natural processes are allowed to predominate without human intervention.
<b>resilience</b>	the capacity of a system to resist or recover quickly from a perturbation.

<b>restoration</b>	management of a disturbed or degraded habitat that results in the recovery of its original state (e.g., restoration may involve planting native species, removing invasive shrubs, prescribed burning).
<b>riffle</b>	a series of shallow rapids in a stream or river where the water flows quickly over completely or partially submerged rocks and other debris.
<b>riparian</b>	relating the floodplains, banks, and terraces that line rivers.
<b>riparian area</b>	habitat along the banks of a stream, river, or wetland.
<b>risk</b>	An uncertainty that might negatively affect the ability to achieve a project's objectives.
<b>riverine</b>	within the active channel of a river or stream.
<b>sapling</b>	a young tree, approximately 1 to 5 inches diameter at breast height
<b>scoping</b>	a process for determining the scope of issues to be addressed by a comprehensive conservation plan and for identifying the significant issues. Involved in the scoping process are federal, state and local agencies; private organizations; and individuals.
<b>secondary public use</b>	uses other than the six priority public uses-hunting, fishing, wildlife observation, photography, interpretation, and environmental education.
<b>second-growth forest</b>	forest that has re-grown after a major disturbance such as a fire, timber harvest, windstorm, or insect infestation.
<b>selective cutting</b>	the periodic removal of individual trees or groups of trees to improve or regenerate a stand.
<b>shifting mosaic</b>	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.
<b>silviculture</b>	the science and practice of managing forests.
<b>skid trail</b>	an unsurfaced, single lane trail used for removing harvested trees from the forest. It is usually narrower and steeper than ordinary truck roads.
<b>slash</b>	tree tops, branches, bark, and other residue left on the ground after logging.
<b>small saw timber</b>	a tree approximately 10 to 15 inches diameter at breast height
<b>snag</b>	standing, dead trees. Snags provide important habitat characteristics for many wildlife species. For example, many birds and small mammals will create or use existing cavities in snags for nests and burrows.
<b>spawn</b>	the act of reproduction of fishes--the mixing of the sperm from the male fish and the eggs of a female fish.

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<b>special use permit</b>	a permit authorized by the refuge manager for an activity that is not usually available to the general public.
<b>species</b>	a distinctive kind of plant or animal having distinguishable characteristics, and that can interbreed and produce young. In taxonomy, a category of biological classification that refers to one or more populations of similar organisms that can reproduce with each other but is reproductively isolated from—that is, incapable of interbreeding with—all other kinds of organisms.
<b>species richness</b>	a simple measure of species diversity calculated as the total number of species in a habitat or community.
<b>staff gauge</b>	an instrument used to measure water levels
<b>stakeholder</b>	An individual, group, or organization that is interested in some aspect of a conservation plan or project and may be affected by, or will potentially affect, project activities.
<b>stand</b>	an easily defined area of the forest that is relatively uniform in species composition or age and can be managed as a single unit.
<b>stand-replacing fire</b>	a fire that kills all or most living overstory trees in a forest and initiates regrowth. This type of fire can be a ground fire, surface fire, or crown fire, but is usually a combination of two or more types.
<b>stocking</b>	refers to releasing hatchery raised fish into streams and lakes
<b>stopover habitat</b>	habitat where birds rest and feed during migration. Also called staging area.
<b>Strategic Habitat Conservation (SHC)</b>	the adaptive management framework for making management decisions about where and how to deliver conservation efficiently to achieve specific biological outcomes. It requires us to set goals, make strategic decisions about our actions, and constantly reassess and improve our approaches—all critical steps in dealing with a range of landscape-scale resource issues.
<b>strategies</b>	a general approach or specific actions to achieve objectives.
<b>structure</b>	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.
<b>succession</b>	the natural, sequential change of species composition of a community in a given area
<b>surrogate</b>	A conservation feature used to represent another feature(s) and generally easier to observe, map, or measure than those features it is representing.
<b>surrogate species</b>	Used to define measurable targets and guide conservation design. Represent multiple species and habitats within a defined landscape, geographic area, or specific national wildlife refuge.
<b>swale</b>	a low place, especially a marshy depression.

<b>target</b>	quantitative statements of the outcomes planners want to achieve for each objective.
<b>taxon, <i>pl. taxa</i></b>	in biology, a classification or group, such as a phylum, family, genus, or species
<b>terrestrial</b>	living on land.
<b>territory</b>	an area occupied by a single animal, mated pair, or group that is defended against intruders, especially others of the same species.
<b>threatened species</b>	those plant or animal species likely to become endangered species throughout all of or a significant portion of their range within the foreseeable future. A plant or animal identified and defined in accordance with the 1973 Endangered Species Act and published in the <i>Federal Register</i> .
<b>trade-off</b>	A situation where achievement of one objectives comes at the expense of achieving another objective.
<b>trust resources</b>	national resources entrusted by Congress to the U.S. Fish and Wildlife Service for conservation and protection. These “trust resources” include migratory birds, federal-listed endangered and threatened species, inter-jurisdictional fishes, wetlands, and certain marine mammals.
<b>turbidity</b>	a measure of water clarity that measures the amount of material suspended in water, such as clay, silt, sand, algae, plankton, microbes, etc. The more turbid water is, the cloudy or hazier it is. High turbidity is a water quality concern because suspended particles absorb more heat, leading to higher water temperatures, and subsequent reduced dissolved water concentrations that reduce photosynthesis rates. Also, suspended particles can clog fish gills and smother fish eggs and organisms that live along the bottom of streams.
<b>uncertainty</b>	A situation characterized by imperfect and/or unknown information.
<b>understory</b>	the lower layer of vegetation in a stand, which may include short trees, shrubs, and herbaceous plants
<b>uneven-aged management</b>	a forest management technique that removes some trees in each age or size class, either singly, in groups, or in strips, to maintain a multi-aged stand.
<b>vernal pool</b>	depressions holding water for a temporary period in spring and other high water periods, and in which several species of amphibians lay eggs.
<b>vision statement</b>	A brief and inspirational statement about what the future of a conservation project, initiative, program, or area might look like.
<b>warm-season grass</b>	native prairie grass that grows the most during the summer, when cool-season grasses are dormant.



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<b>warm-water fishery</b>	a water system that supports fish that are able to tolerate water temperatures above 80 degrees Fahrenheit. Examples of warm-water species are sunfish, yellow perch, catfish, and small and largemouth bass.
<b>water rights</b>	the right of a user to use water from a source such as a river, stream, pond, or groundwater source.
<b>watershed</b>	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.
<b>Wilderness Area</b>	An area designated by Congress as part of the National Wilderness Preservation System
<b>wilderness study area</b>	Lands and waters identified by inventory as meeting the definition of wilderness and being evaluated for a recommendation that they be included in the Wilderness System.
<b>wildlands reserve</b>	large landscape reserves subject to minimal human impact (largely free from active management) and shaped by natural processes, the ambient environment, and legacies of prior history. They strive to accomplish four objectives: 1) slow the pace of climate change by supporting complex, aging forests that can store twice as much carbon as young forests; 2) provide rare habitats for a diverse array of plants, animals, and micro-organisms; 3) safeguard lands of natural, cultural, and spiritual significance; and 4) serve as unique scientific reference points for evaluation and improvement of management practices elsewhere (Foster et al. 2010).
<b>wildlife-dependent recreation</b>	A use of a Refuge involving hunting, fishing, wildlife observation, wildlife photography, environmental education, or interpretation. The National Wildlife Refuge System Improvement Act of 1997 specifies that these are the six priority general public uses of the National Wildlife Refuge System.
<b>windthrow</b>	the uprooting of and knocking over trees by wind.
<b>woody debris</b>	any pieces of dead woody material on the ground in forests or in streams, such as trunks, branches, and roots.

**Acronyms**

<b>Acronym</b>	<b>Full Name</b>
<b>ACJV</b>	Atlantic Coast Joint Venture
<b>ADA</b>	Americans with Disabilities Act
<b>AGO</b>	America's Great Outdoors Initiative
<b>AHPA</b>	Archaeological and Historic Preservation Act
<b>AHWP</b>	Annual Habitat Work Plan
<b>AMC</b>	Appalachian Mountain Club
<b>AQI</b>	Air Quality Index
<b>ARPA</b>	Archaeological Resources Protection Act
<b>ASMFC</b>	Atlantic States Marine Fisheries Commission
<b>ATV</b>	All-terrain vehicle
<b>BAT</b>	Biological Assessment Trailer
<b>BBD</b>	Beech bark disease
<b>BCR</b>	Bird Conservation Region
<b>BIDEH</b>	Biological Integrity, Diversity, and Environmental Health
<b>BLM</b>	Bureau of Land Management
<b>BMP</b>	Best management practices
<b>CAA</b>	Clean Air Act
<b>CCC</b>	Civilian Conservation Corps
<b>CCP</b>	Comprehensive Conservation Plan
<b>CCS</b>	Challenge Cost-share
<b>CD</b>	Compatibility determination
<b>CDIP</b>	Career Discovery Internship Program
<b>CE</b>	Categorical exclusion
<b>CEQ</b>	Council of Environmental Quality
<b>CFA</b>	Conservation Focus Area
<b>CFR</b>	Code of Federal Regulations

<b>Acronym</b>	<b>Full Name</b>
<b>cfs</b>	Cubic feet per second
<b>CISA</b>	Community Involved in Sustaining Agriculture
<b>CISMA</b>	Cooperative Invasive Species Management Areas
<b>Conte Act</b>	Silvio O. Conte National Fish and Wildlife Refuge Act of 1991
<b>Conte Refuge</b>	Silvio O. Conte National Fish and Wildlife Refuge
<b>CPA</b>	Conservation Partnership Area
<b>CRASC</b>	Connecticut River Atlantic Salmon Commission
<b>CRCO</b>	Connecticut River Coordinator's Office
<b>CSA</b>	Community Supported Agriculture
<b>CT</b>	Connecticut
<b>CTDEEP</b>	Connecticut Department of Energy and Environmental Protection
<b>dbh</b>	diameter at breast height
<b>DCR</b>	Massachusetts Department of Conservation and Recreation
<b>DDE</b>	dichloro-diphenyl-dichloroethylene
<b>DDT</b>	dichloro-diphenyl-trichloroethane
<b>DED</b>	Dutch elm disease
<b>DO</b>	Dissolved oxygen
<b>DOI</b>	Department of the Interior
<b>DOT</b>	Department of Transportation
<b>DWA</b>	Deer wintering area
<b>EA</b>	Environmental Assessment
<b>EAB</b>	Emerald ash borer
<b>EBTJV</b>	Eastern Brook Trout Joint Venture
<b>EE</b>	Environmental Education
<b>EIS</b>	Environmental Impact Statement
<b>EPA</b>	United States Environmental Protection Agency
<b>FEIS</b>	1995 Final Environmental Impact Statement for Silvio O. Conte National Fish and Wildlife Refuge

<b>Acronym</b>	<b>Full Name</b>
<b>FERC</b>	Federal Energy Regulatory Commission
<b>FMP</b>	Fire Management Plan
<b>FOA</b>	Finding of Appropriateness
<b>FR</b>	Federal Register
<b>Friends of Conte</b>	Friends of Silvio O. Conte National Fish and Wildlife Refuge
<b>GCN</b>	Greatest Conservation Need
<b>GFDC</b>	Great Falls Discovery Center
<b>HMP</b>	Habitat Management Plan
<b>HRI</b>	Habitat Restoration Initiative
<b>HUC</b>	Hydrological Unit Code
<b>HWA</b>	Hemlock wooly adelgid
<b>IBA</b>	Important Bird Area
<b>IMP</b>	Inventory and Monitoring Plan
<b>IPANE</b>	Invasive Plant Atlas of New England
<b>IPCC</b>	Intergovernmental Panel of Climate Change
<b>IUCN</b>	International Union for the Conservation of Nature
<b>LCC</b>	Landscape Conservation Cooperatives
<b>LCHIP</b>	New Hampshire's Land and Community Heritage Investment Program
<b>LISS</b>	Long Island Sound Study
<b>LMRD</b>	Land Management Research Demonstration
<b>LPP</b>	Land Protection Plan
<b>LRTP</b>	Long-range Transportation Plan
<b>LWCF</b>	Land and Water Conservation Fund
<b>MA</b>	Massachusetts
<b>MBCF</b>	Migratory Bird Conservation Fund
<b>MOA</b>	Memorandum of Agreement
<b>MOU</b>	Memorandum of Understanding

<b>Acronym</b>	<b>Full Name</b>
<b>NAAEE</b>	North American Association of Environmental Education
<b>NAAQS</b>	National Ambient Air Quality Standard
<b>NAI</b>	National Association for Interpretation
<b>NALCC</b>	North Atlantic Landscape Conservation Cooperative
<b>National Register</b>	National Register of Historic Places
<b>NAWMP</b>	North American Waterfowl Management Plan
<b>NBS</b>	National Blueway System
<b>NEC</b>	New England cottontail
<b>NECIA</b>	Northeast Climate Impacts Assessment
<b>NEK</b>	Northeast Kingdom (Region of Northern Vermont)
<b>NEPA</b>	National Environmental Policy Act of 1969
<b>NEPCoP</b>	New England Plant Conservation Program
<b>NETHC</b>	Northeast Terrestrial Habitat Classification System
<b>NFWPCAS</b>	National Fish, Wildlife and Plants Climate Adaptation Strategy
<b>NGO</b>	Non-governmental organization
<b>NH</b>	New Hampshire
<b>NHFG</b>	New Hampshire Fish and Game Department
<b>NHPA</b>	National Historic Preservation Act
<b>NIPGro</b>	New England Invasive Plant Group
<b>NNL</b>	National Natural Landmark
<b>NOAA</b>	National Oceanic and Atmospheric Administration
<b>NPS</b>	National Park Service
<b>NRCS</b>	Natural Resources Conservation Service
<b>NSPS</b>	New Source Performance Standards
<b>NWPS</b>	National Wilderness Preservation System
<b>NWRS</b>	National Wildlife Refuge System
<b>OHVs</b>	Off-highway vehicles

<b>Acronym</b>	<b>Full Name</b>
<b>ORV</b>	Off-road vehicles
<b>Partners</b>	Partners for Fish and Wildlife
<b>PCB</b>	polychlorinated biphenyl
<b>ppm</b>	parts per million
<b>PRRC</b>	Priority Refuge Resources of Concern
<b>PUP</b>	Pesticide Use Proposal
<b>QR Code</b>	Quick Response Code
<b>RAPP</b>	Refuge Annual Performance Plans
<b>Refuge System</b>	National Wildlife Refuge System
<b>RGGI</b>	Regional Greenhouse Gas Initiative
<b>RHPO</b>	Regional Historic Preservation Officer
<b>RNA</b>	Research Natural Area
<b>ROD</b>	Record of Decision
<b>RONS</b>	Refuge Operations Need System
<b>SAMMS</b>	Service Asset Management and Maintenance System
<b>SCA</b>	Student Conservation Association
<b>Service</b>	United States Fish and Wildlife Service
<b>SFA</b>	Special Focus Area
<b>SGCN</b>	Species of greatest conservation concern
<b>SHC</b>	Strategic Habitat Conservation
<b>SHPO</b>	State Historic Preservation Officer
<b>SLAMM</b>	Sea Level Affecting Marshes Model
<b>STEM</b>	Science, Engineering, and Math
<b>SUV</b>	Sport Utility Vehicle
<b>THPO</b>	Tribal Historic Preservation Officer
<b>TNC</b>	The Nature Conservancy
<b>TPL</b>	Trust for Public Land

<b>Acronym</b>	<b>Full Name</b>
<b>TU</b>	Trout Unlimited
<b>TWS</b>	The Wildlife Society
<b>UCS</b>	Union of Concerned Scientists
<b>USACE</b>	United States Army Corps of Engineers
<b>USCB</b>	United States Census Bureau
<b>USDA</b>	United States Department of Agriculture
<b>USFWS</b>	United States Fish and Wildlife Service
<b>USGS</b>	United States Geological Survey
<b>VAST</b>	Vermont Association of Snow Travelers
<b>VFWD</b>	Vermont Fish and Wildlife Department
<b>VINS</b>	Vermont Institute of Natural Science
<b>VOC</b>	Volatile organic compounds
<b>VT</b>	Vermont
<b>WAP</b>	State Wildlife Action Plan
<b>watershed</b>	Connecticut River watershed
<b>WDMU</b>	Woodcock Demonstration Management Units
<b>WMA</b>	Wildlife Management Area
<b>WoW Express</b>	Watershed-on-Wheels Express Mobile Visitor Center
<b>WRDA</b>	Water Resources Development Act
<b>WSA</b>	Wilderness Study Area
<b>WUI</b>	Wildland-urban interface
<b>YCC</b>	Youth Conservation Corps

## Species Scientific Names

Common Name	Scientific Name
Alder species	<i>Alnus</i> spp.
Alewife	<i>Alosa pseudoharengus</i>
Alewife floater	<i>Anodonta implicata</i>
American beach grass	<i>Ammophila breviligulata</i>
American beaver	<i>Castor canadensis</i>
American beech	<i>Fagus grandifolia</i>
American bittern	<i>Botaurus lentiginosus</i>
American black duck	<i>Anas rubripes</i>
American chestnut	<i>Castanea dentata</i>
American clam shrimp	<i>Limnadia lenticularis</i>
American crow	<i>Corvus brachyrhynchos</i>
American eel	<i>Anguilla rostrata</i>
American elm	<i>Ulmus americana</i>
American goldfinch	<i>Carduelis tristis</i>
American hornbeam	<i>Carpinus caroliniana</i>
American kestrel	<i>Falco sparverius</i>
American marten	<i>Martes americana</i>
American oystercatcher	<i>Haematopus palliatus</i>
American pipit	<i>Anthus rubescens</i>
American redstart	<i>Setophaga ruticilla</i>
American robin	<i>Turdus migratorius</i>
American shad	<i>Alosa sapidissima</i>
American wigeon	<i>Anas americana</i>
American woodcock	<i>Scolopax minor</i>
Amur corktree	<i>Phellodendron amurense</i>
Apple species	<i>Malus</i> spp.
Arrow arum	<i>Peltandra virginica</i>
Ash species	<i>Fraxinus</i> spp.
Asian longhorn beetle	<i>Anoplophora glabripennis</i>



<b>Common Name</b>	<b>Scientific Name</b>
Asiatic clam	<i>Coribicula fluminea</i>
Atlantic salmon	<i>Salmo salar</i>
Atlantic sturgeon	<i>Acipenser oxyrhynchus</i>
Atlantic white cedar	<i>Chamaecyparis thyoides</i>
Auricled twayblade	<i>Listera auriculata</i>
Autumn olive	<i>Elaeagnus umbellata</i>
Bald eagle	<i>Haliaeetus leucocephalus</i>
Balsam fir	<i>Abies balsamea</i>
Balsam poplar	<i>Populus balsamifera</i>
Baltimore oriole	<i>Icterus galbula</i>
Banded sunfish	<i>Enneacanthus obesus</i>
Barn owl	<i>Tyto alba</i>
Barred owl	<i>Strix varia</i>
Basswood	<i>Tilia americana</i>
Bayberry	<i>Myrica pensylvanica</i>
Bay-breasted warbler	<i>Dendroica castanea</i>
Beach heather	<i>Hudsonia tomentosa</i>
Beach plum	<i>Prunus maritima</i>
Beaked-rush	<i>Rhynchospora capillacea</i>
Bearberry	<i>Arctostaphylos alpina</i>
Bicknell's thrush	<i>Catharus bicknelli</i>
Big brown bat	<i>Eptesicus fuscus</i>
Bigtooth aspen	<i>Populus grandidentata</i>
Birch species	<i>Betula</i> spp.
Bitternut hickory	<i>Carya cordiformis</i>
Black ash	<i>Fraxinus nigra</i>
Black bear	<i>Ursus americanus</i>
Black cherry	<i>Prunus serotina</i>
Black fly	Family Simuliidae

*Species Scientific Names*

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<b>Common Name</b>	<b>Scientific Name</b>
Black grass (salt meadow rush)	<i>Juncus gerardii</i>
Black gum	<i>Nyssa sylvatica</i>
Black huckleberry	<i>Gaylussacia baccata</i>
Black locust	<i>Robinia pseudoacacia</i>
Black oak	<i>Quercus velutina</i>
Black rail	<i>Laterallus jamaicensis</i>
Black rat snake	<i>Pantherophis alleghaniensis</i>
Black spruce	<i>Picea mariana</i>
Black willow	<i>Salix nigra</i>
Black-and-white warbler	<i>Mniotilta varia</i>
Black-backed woodpecker	<i>Picoides arcticus</i>
Black-billed cuckoo	<i>Coccyzus erythrophthalmus</i>
Blackburnian warbler	<i>Setophaga fusca</i>
Black-crowned night heron	<i>Nyctanassa nycticorax</i>
Blacknose dace	<i>Rhinichthys atratulus</i>
Blackpoll warbler	<i>Setophaga striata</i>
Black-throated blue warbler	<i>Dendroica caerulescens</i>
Black-throated green warbler	<i>Setophaga virens</i>
Blueback herring	<i>Alosa aestivalis</i>
Blueberry species	<i>Vaccinium</i> spp.
Bluefish	<i>Pomatomus saltatrix</i>
Bluegill	<i>Lepomis macrochirus</i>
Bluejoint	<i>Calamagrostis canadensis</i>
Blue-spotted salamander	<i>Ambystoma laterale</i>
Blue-winged teal	<i>Anas discors</i>
Blue-winged warbler	<i>Vermivora pinus</i>
Bobcat	<i>Lynx rufus</i>
Bobolink	<i>Dolichonyx oryzivorus</i>
Bog sedge	<i>Carex paupercula</i>

<b>Common Name</b>	<b>Scientific Name</b>
Boreal chickadee	<i>Poecile hudsonicus</i>
Boreal owl	<i>Aegolius funereus</i>
Boreal turret snail	<i>Valvata sincera</i>
Broad-winged hawk	<i>Buteo platypterus</i>
Brook floater	<i>Alasmindonta varicosa</i>
Brown bullhead (Horned pout)	<i>Ameiurus nebulosus</i>
Brown thrasher	<i>Toxostoma rufum</i>
Brown trout	<i>Salmo trutta</i>
Bufflehead	<i>Bucephala albeola</i>
Burdot (cusk)	<i>Lota lota</i>
Burning bush, winged euonymus	<i>Euonymus alata</i>
Buttonbush	<i>Cephalanthus occidentalis</i>
Caddisflies	Order: Trichoptera
Calmyweed	<i>Polanisia dodecandra</i>
Canada geese	<i>Branta canadensis</i>
Canada lynx	<i>Lynx canadensis</i>
Canada thistle	<i>Cirsium arvense</i>
Canada warbler	<i>Wilsonia canadensis</i>
Canvasback	<i>Aythya valisineria</i>
Cape May warbler	<i>Setophaga tigrina</i>
Cedar waxwing	<i>Bombycilla cedrorum</i>
Cerulean warbler	<i>Setophaga cerulea</i>
Chain pickerel	<i>Esox niger</i>
Channel catfish	<i>Ictalurus punctatus</i>
Cherry species	<i>Prunus</i> spp.
Chestnut oak	<i>Quercus prinus</i>
Chestnut-colored sedge	<i>Carex lasiocarpa</i>
Chestnut-sided warbler	<i>Setophaga pensylvanica</i>
Chimney swift	<i>Chaetura pelagica</i>

*Species Scientific Names*

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<b>Common Name</b>	<b>Scientific Name</b>
Clapper rail	<i>Rallus longirostris</i>
Cocklebur	<i>Xanthium</i> spp.
Coltsfoot	<i>Tussilago farfara</i>
Common buckthorn	<i>Rhamnus cathartica</i>
Common carp	<i>Cyprinus carpio</i>
Common gallinule (Common moorhen)	<i>Gallinula galeata</i>
Common goldeneye	<i>Bucephala clangula</i>
Common loon	<i>Gavia immer</i>
Common merganser	<i>Mergus merganser</i>
Common mudpuppy	<i>Necturus maculosus</i>
Common reed ( <i>Phragmites</i> )	<i>Phragmites australis</i>
Common shiner	<i>Luxilus cornutus</i>
Common snapping turtle	<i>Chelydra serpentina</i>
Common yellowthroat	<i>Geothlypis trichas</i>
Coontail	<i>Ceratophyllum demersum</i>
Cooper's hawk	<i>Accipiter cooperii</i>
Coyote	<i>Canis latrans</i>
Crappie	<i>Pomoxis</i> spp.
Creek chub	<i>Semotilus atromaculatus</i>
Creeper	<i>Strophitus undulatus</i>
Cuckoos	Family Cuculidae
Deer mouse	<i>Peromyscus maniculatus</i>
Double-crested cormorant	<i>Phalacrocorax carbo</i>
Dowitcher	<i>Limnodromus</i> spp.
Drooping bluegrass	<i>Poa saltuensis</i>
Dwarf chinkapin oak	<i>Quercus prinoides</i>
Dwarf wedgemussel	<i>Alasmindonta heterondon</i>
Eastern American toad	<i>Bufo americanus</i>
Eastern bluebird	<i>Sialia sialis</i>

<b>Common Name</b>	<b>Scientific Name</b>
Eastern box turtle	<i>Terrapene carolina</i>
Eastern brook trout	<i>Salvelinus fontinalis</i>
Eastern chipmunk	<i>Tamias striatus</i>
Eastern cottontail	<i>Sylvilagus floridanus</i>
Eastern cottonwood	<i>Populus deltoids</i>
Eastern cougar	<i>Puma concolor</i>
Eastern elk	<i>Cervus canadensis canadensis</i>
Eastern elliptio	<i>Elliptio complanata</i>
Eastern floater	<i>Pyganodon cataracta</i>
Eastern hemlock	<i>Tsuga canadensi</i>
Eastern hognose snake	<i>Heterodon platirhinos</i>
Eastern kingbird	<i>Tyrannus tyrannus</i>
Eastern lampmussel	<i>Lampsilis radiate radiata</i>
Eastern meadowlark	<i>Sturnella magna</i>
Eastern milksnake	<i>Lampropeltis triangulum</i>
Eastern pearlshell	<i>Margaritifera margaritifera</i>
Eastern phoebe	<i>Sayornis phoebe</i>
Eastern pipistrelle bat	<i>Pipistrellus subflavus</i>
Eastern pond mussel	<i>Ligumia nasuta</i>
Eastern red bat	<i>Lasiurus borealis</i>
Eastern red cedar	<i>Juniperus virginiana</i>
Eastern ribbon snake	<i>Thamnophis sauritus</i>
Eastern small-footed bat	<i>Myotis leibii</i>
Eastern spadefoot toad	<i>Scaphiopus holbrookii</i>
Eastern timber rattlesnake	<i>Crotalus horridus</i>
Eastern towhee	<i>Pipilo erythrophthalmus</i>
Eastern wild turkey	<i>Meleagris gallopavo silvestris</i>
Eastern wolf	<i>Canis lupus lycao</i>
Emerald ash borer	<i>Agrilus planipennis</i>

*Species Scientific Names*

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<b>Common Name</b>	<b>Scientific Name</b>
Ermine	<i>Mustela erminea</i>
Eurasian milfoil	<i>Myriophyllum spicatum</i>
European honeybee	<i>Apis mellifera</i>
Fallfish	<i>Semotilus corporalis</i>
False nettle	<i>Boehmeria cylindrica</i>
Fanwort	<i>Cabomba</i> spp.
Faxon's clam shrimp	<i>Eulimnadia agassizii</i>
Field sparrow	<i>Spizella pusilla</i>
Finescale dace	<i>Phoxinus neogaeus</i>
Fir species	<i>Abies</i> spp.
Fisher	<i>Martes pennanti</i>
Flowering dogwood	<i>Cornus florida</i>
Fowler's toad	<i>Bufo fowleri</i>
Freshwater cordgrass	<i>Spartina pectinmata</i>
Fringed sedge	<i>Carex crinita</i>
Gadwall	<i>Anas strepera</i>
Garber's sedge	<i>Carex garberi</i>
Garlic-mustard	<i>Alliaria petiolata</i>
Gizzard shad	<i>Dorosoma cepedianum</i>
Glasswort	<i>Salicornia depressa</i>
Glossy buckthorn	<i>Frangula alnus</i>
Golden club	<i>Orontium aquaticum</i>
Golden-winged warbler	<i>Vermivora chrysoptera</i>
Grasshopper sparrow	<i>Ammodramus savannarum</i>
Gray birch	<i>Betula populifolia</i>
Gray catbird	<i>Dumetella carolinensis</i>
Gray fox	<i>Urocyon cinereo-argenteus</i>
Gray jay	<i>Perisoreus canadensis</i>
Gray squirrel	<i>Sciurus carolinensis</i>

<b>Common Name</b>	<b>Scientific Name</b>
Gray wolf	<i>Canis lupus</i>
Great blue heron	<i>Ardea herodias</i>
Great crested flycatcher	<i>Myiarchus crinitus</i>
Great egret	<i>Ardea albus</i>
Greater yellowlegs	<i>Tringa melanoleuca</i>
Green ash	<i>Fraxinus pennsylvanica</i>
Green dragon	<i>Arisaema dracontium</i>
Green-winged teal	<i>Anas carolinensis</i>
Grey-cheeked thrush	<i>Catharus minimus</i>
Gypsy moth	<i>Lymantria dispar</i>
Heath hen	<i>Tympanuchus cupido cupido</i>
Hemlock woolly adelgid	<i>Adelges tsugae</i>
Henslow's sparrow	<i>Ammodramus henslowii</i>
Hermit thrush	<i>Catharus guttatus</i>
Hickory species	<i>Carya</i> spp.
Hoary bat	<i>Lasiurus cinereus</i>
Hogchoker	<i>Trinectes maculatus</i>
Hooded merganser	<i>Lophodytes cucullatus</i>
Hooded warbler	<i>Setophaga citrina</i>
Horned lark	<i>Eremophila alpestris</i>
Huckleberry	<i>Vaccinium globulare</i>
Indiana bat	<i>Myotis sodalis</i>
Ipswich sparrow	<i>Passerculus sandwichensis princeps</i>
Japanese barberry	<i>Berberis thunbergii</i>
Japanese knotweed	<i>Fallopia japonica</i>
Japanese stiltgrass	<i>Microstegium vimineum</i>
Jefferson salamander	<i>Ambystoma jeffersonianum</i>
Jesup's milk-vetch	<i>Astragalus robbinsii</i>
Jewelweed	<i>Impatiens capensis</i>

*Species Scientific Names*

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<b>Common Name</b>	<b>Scientific Name</b>
Joe-pye weed	<i>Eutrochium purpureum</i>
Killifish	<i>Fundulus diaphanus</i>
King rail	<i>Rallus elegans</i>
Kudzu	<i>Pueraria montana</i>
Labrador tea	<i>Ledum groenlandicum</i>
Lake chub	<i>Couesius plumbeus</i>
Lake trout	<i>Salvelinus namaycush</i>
Largemouth bass	<i>Micropeterus salmoides</i>
Leafy spurge	<i>Euphorbia esula</i>
Least bitterns	<i>Ixobrychus exilis</i>
Least flycatcher	<i>Empidonax minimus</i>
Least tern	<i>Sterna antillarum</i>
Leatherleaf	<i>Chamaedaphne calyculata</i>
Lesser yellowlegs	<i>Tringa flavipes</i>
Lincoln's sparrow	<i>Melospiza lincolnii</i>
Lingonberry	<i>Vaccinium vitis-idaea</i>
Little blue heron	<i>Egretta caerulea</i>
Little bluestem	<i>Schizachyrium scoparium</i>
Little brown bat	<i>Myotis lucifugus</i>
Longnose dace	<i>Rhinichthys cataractae</i>
Lousiana waterthrush	<i>Parkesia motacilla</i>
Lowbush blueberry	<i>Vaccinium</i> spp.
Mallard	<i>Anas platyrhynchos</i>
Many-fruited false-loosestrife	<i>Ludwigia polycarpa</i>
Maple species	<i>Acer</i> spp.
Marbled salamander	<i>Ambystoma opacum</i>
Marsh elder	<i>Iva annua</i>
Marsh fern	<i>Thelypteris palustris</i>
Mayflies	Order Ephemeroptera



<b>Common Name</b>	<b>Scientific Name</b>
Meadow beauty	<i>Rhexia virginica</i>
Meadow jumping mouse	<i>Zapus hudsonius</i>
Meadow vole	<i>Microtus pennsylvanicus</i>
Merlin	<i>Falco columbarius</i>
Midges	Family: Chironomidae
Mile-a-minute	<i>Persicaria perfoliata</i>
Mink	<i>Mustela vison</i>
Mole salamander	<i>Ambystoma talpoideum</i>
Moose	<i>Alces alces</i>
Morrow's honeysuckle	<i>Lonicera morrowii</i>
Mountain ash	<i>Fraxinus texensis</i>
Mountain maple	<i>Acer spicatum</i>
Mourning dove	<i>Zenaida macroura</i>
Mullet	<i>Mugil cephalus</i>
Multiflora rose	<i>Rosa multiflora</i>
Mummichog	<i>Fundulus heteroclitus</i>
Musk flower	<i>Mimulus moschatus</i>
Musk turtle	<i>Sternotherus oderatus</i>
Muskrat	<i>Ondatra zibethicus</i>
Mute swans	<i>Cygnus olor</i>
Naiad	<i>Najas marina</i>
Narrow-leaved cattail	<i>Typha angustifolia</i>
Nelson's sparrow	<i>Ammodramus nelsoni</i>
New England cottontail	<i>Sylvilagus transitionalis</i>
Nodding bur marigold	<i>Bidens cernua</i>
Northeastern bulrush	<i>Scirpus ancistrochaetus</i>
Northen dusky salamander	<i>Desmognathus fuscus</i>
Northern black racer snake	<i>Coluber constrictor</i>
Northern bog lemming	<i>Synaptomys borealis</i>

<b>Common Name</b>	<b>Scientific Name</b>
Northern copperhead	<i>Agkistrodon contortrix mokasen</i>
Northern diamondback terrapin	<i>Malaclemys terrapin</i>
Northern dusky salamander	<i>Desmognathus fuscus</i>
Northern goshawk	<i>Accipter gentilis</i>
Northern harrier	<i>Circus cyaneus</i>
Northern leopard frogs	<i>Rana pipiens</i>
Northern myotis	<i>Myotis septentrionalis</i>
Northern parula	<i>Setophaga americana</i>
Northern pike	<i>Esox lucius</i>
Northern pintail	<i>Anas acuta</i>
Northern red-bellied turtle	<i>Pseudemys rubriventris</i>
Northern redbelly dace	<i>Phoxinus eos</i>
Northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>
Northern saw-whet owl	<i>Aegolius acadicus</i>
Northern shrike	<i>Lanius excubitor</i>
Northern spring peeper	<i>Pseudacris crucifer</i>
Northern two-lined salamander	<i>Eurycea bislineata</i>
Northern white cedar	<i>Thuja occidentalis</i>
Norway maple	<i>Acer platanoides</i>
Nuthatch species	<i>Sitta</i> spp.
Oak species	<i>Quercus</i> spp.
Olive-sided flycatcher	<i>Contopus cooperi</i>
Orchids	<i>Platanthera</i> spp.
Oriental bittersweet	<i>Celastrus orbiculatus</i>
Ornamental jewelweed	<i>Impatiens glandulifera</i>
Osprey	<i>Pandion haliaetus</i>
Ostrich fern	<i>Matteuccia struthiopteris</i>
Ovenbird	<i>Seiurus aurocapilla</i>
Painted turtle	<i>Chrysemys picta</i>

<b>Common Name</b>	<b>Scientific Name</b>
Pale swallow-wort	<i>Cynanchum rossicum</i>
Palm warbler	<i>Setophaga palmarum</i>
Paper birch	<i>Betula papyrifera</i>
Passenger pigeon	<i>Ectopistes migratorius</i>
Perch species	<i>Perca</i> spp.
Peregrine falcon	<i>Falco peregrinus</i>
Pickerel	<i>Esox</i> spp.
Pickerelweed	<i>Pontederia cordata</i>
Pied-billed grebe	<i>Podilymbus podiceps</i>
Pignut hickory	<i>Carya glabra</i>
Pigweed	<i>Chenopodium album</i>
Pileated woodpecker	<i>Dryocopus pileatus</i>
Pin oak	<i>Quercus palustris</i>
Pine shoot beetle	<i>Tomicus piniperda</i>
Pine warbler	<i>Dendroica pinus</i>
Piping plover	<i>Charadrius melodus</i>
Pitch pine	<i>Pinus rigida</i>
Porcupine	<i>Erethizon dorsatum</i>
Prairie warbler	<i>Dendroica discolor</i>
Precious underwing moth	<i>Catocala pretiosa pretiosa</i>
Puritan tiger beetle	<i>Cicindela puritana</i>
Purple finch	<i>Haemorhous purpureus</i>
Purple loosestrife	<i>Lythrum salicaria</i>
Pygmy shrew	<i>Sorex hoyi</i>
Quagga mussel	<i>Dreissena rostriformis</i>
Quaking aspen	<i>Populus tremuloides</i>
Raccoon	<i>Procyon lotor</i>
Rainbow smelt	<i>Osmerus mordax</i>
Rainbow trout	<i>Oncorhynchus mykiss</i>

*Species Scientific Names*

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<b>Common Name</b>	<b>Scientific Name</b>
Red fox	<i>Vulpes vulpes</i>
Red knot	<i>Calidris canutus</i>
Red maple	<i>Acer rubrum</i>
Red oak	<i>Quercus rubra</i>
Red pine	<i>Pinus resinosa</i>
Red spruce	<i>Picea rubens</i>
Red squirrel	<i>Tamiasciurus hudsonicus</i>
Red-backed salamander	<i>Plethodon cinereus</i>
Red-bellied woodpecker	<i>Melanerpes carolinus</i>
Red-breasted merganser	<i>Mergus serrator</i>
Red-shouldered hawk	<i>Buteo lineatus</i>
Red-tailed hawk	<i>Buteo jamaicensis</i>
Red-winged blackbird	<i>Agelaius phoeniceus</i>
Reed canary grass	<i>Phalaris arundinacea</i>
Ring-necked duck	<i>Aythya collaris</i>
River bulrush	<i>Scirpus fluviatilis</i>
River herring	<i>Alosa</i> spp.
River otter	<i>Lontra canadensis</i>
Riverweed	<i>Podostemum ceratophyllum</i>
Rock snot	<i>Didymosphenia geminata</i>
Rose-breasted grosbeak	<i>Pheucticus ludovicianus</i>
Round whitefish	<i>Prosopium cylindraceum</i>
Ruddy turnstone	<i>Arenaria interpres</i>
Ruffed grouse	<i>Bonasa umbellus</i>
Rusty blackbird	<i>Euphagus carolinus</i>
Rusty-patched bumble bee	<i>Bombus affinis</i>
Saltmarsh sparrow	<i>Ammodramus caudacutus</i>
Saltmeadow cordgrass	<i>Spartina patens</i>
Saltmeadow rush	<i>Juncus gerardii</i>

<b>Common Name</b>	<b>Scientific Name</b>
Sassafras	<i>Sassafras albidum</i>
Savannah sparrow	<i>Passerculus sandwichensis</i>
Scarlet tanager	<i>Piranga olivacea</i>
Scaup species	<i>Aythya</i> spp.
Scoter species	<i>Melanitta</i> spp.
Scrub oak	<i>Quercus ilicifolia</i>
Sea lamprey	<i>Petromyzon marinus</i>
Sea rocket	<i>Cakile edentula</i>
Sea-beach needlegrass	<i>Aristida tuberculosa</i>
Seaside goldenrod	<i>Solidago sempervirens</i>
Seaside sparrow	<i>Ammodramus maritimus</i>
Sedge wren	<i>Cistothorus platensis</i>
Semipalmated sandpiper	<i>Calidris pusilla</i>
Shagbark hickory	<i>Carya ovata</i>
Sharp-shinned hawk	<i>Accipiter striatus</i>
Sheep laurel	<i>Kalmia angustifolia</i>
Shining rose	<i>Rosa nitida</i>
Short-billed dowitcher	<i>Limnodromus griseus</i>
Shortnose sturgeon	<i>Acipenser brevirostrum</i>
Silky dogwood	<i>Cornus anomum</i>
Silver maple	<i>Acer saccharinum</i>
Silverweed	<i>Argentina anserina</i>
Slimy sculpin	<i>Cottus cognatus</i>
Small sundrops	<i>Oenothera perennis</i>
Small whorled pogonia	<i>Isotria medeoloides</i>
Smallmouth bass	<i>Micropterus dolomieu</i>
Smelt	Family Osmeridae
Smooth cordgrass	<i>Spartina alterniflora</i>
Snaketail dragonfly	<i>Ophiogomphus</i> spp.

*Species Scientific Names*

<b>Common Name</b>	<b>Scientific Name</b>
Snowshoe hare	<i>Lepus americanus</i>
Snowy egret	<i>Egretta thula</i>
Solitary sandpiper	<i>Tringa solitaria</i>
Sora rail	<i>Porzana carolina</i>
Southern bog lemming	<i>Synaptomys cooperi</i>
Southern red-backed vole	<i>Clethrionomys gapperi</i>
Speckled alder	<i>Alnus incana</i>
Sphagnum moss	<i>Sphagnum</i> spp.
Spikegrass (Salt grass)	<i>Distichlis spicata</i>
Spottail shinner	<i>Notropis hudsonius</i>
Spotted knapweed	<i>Centaurea stoebe</i>
Spotted sandpiper	<i>Actitis macularia</i>
Spotted turtle	<i>Clemmys guttata</i>
Spring salamander	<i>Ambystoma maculatum</i>
Spruce grouse	<i>Falcapennis canadensis</i>
Spruce species	<i>Picea</i> spp.
Star-nosed mole	<i>Condylura cristata</i>
Sticky false asphodel	<i>Tofieldia glutinosa</i>
Stoneflies	Order: Plecoptera
Striped bass	<i>Morone saxatilis</i>
Striped skunk	<i>Mephitis mephitis</i>
Suckers	<i>Catostomus</i> spp.
Sugar maple	<i>Acer saccharum</i>
Summer flounder	<i>Paralichthys dentatus</i>
Sunfish	<i>Lepomis</i> spp.
Swamp darter	<i>Etheostoma fusiforme</i>
Sweet fern	<i>Comptonia peregrine</i>
Sweet flag	<i>Acorus calamus</i>
Sweet gale	<i>Myrica gale</i>

<b>Common Name</b>	<b>Scientific Name</b>
Sweetgum	<i>Liquidambar styraciflua</i>
Switchgrass	<i>Panicum virgatum</i>
Tamarack	<i>Larix laricina</i>
Tapegrass	<i>Vallisneria spiralis</i>
Tennessee warbler	<i>Oreothlypis peregrina</i>
Tessellated darter	<i>Etheostoma olmstedii</i>
Three-square bulrush	<i>Scirpus americanus</i>
Tidewater mucket	<i>Leptodea ochracea</i>
Tiger beetles	Family: Carabidae
Toothcup	<i>Ammannia coccinea</i>
Tree swallow	<i>Tachycineta bicolor</i>
Triangle floater	<i>Alasmidonta undulata</i>
Tricolored bat	<i>Perimyotis subflavus</i>
Turkey vulture	<i>Cathartes aura</i>
Upland sandpiper	<i>Bartramia longicauda</i>
Veery	<i>Catharus fuscescens</i>
Vesper sparrow	<i>Pooecetes gramineus</i>
Viburnum spp.	<i>Viburnum</i> spp.
Virginia opossum	<i>Didelphis virginiana</i>
Virginia pine	<i>Pinus virginiana</i>
Virginia rail	<i>Rallus limicola</i>
Virginia rose	<i>Rosa virginiana</i>
Wall lettuce	<i>Lactuca muralis</i>
Walleye (Walleyed pike)	<i>Sander vitreus</i>
Warbling vireo	<i>Vireo gilvus</i>
Water chestnut	<i>Trapa natans</i>
Water lily	<i>Nymphaea</i> spp.
Water milfoil	<i>Myriophyllum</i> spp.
Water pipit	<i>Anthus spinoletta</i>

<b>Common Name</b>	<b>Scientific Name</b>
Water shrew	<i>Sorex palustris</i>
Waterweed	<i>Elodea canadensis</i>
Whimbrel	<i>Numenius phaeopus</i>
Whip-poor-will	<i>Caprimulgus vociferus</i>
White ash	<i>Fraxinus americana</i>
White meadowseet	<i>Spirea alba</i>
White oak	<i>Quercus alba</i>
White perch	<i>Morone americana</i>
White pine	<i>Pinus strobus</i>
White sucker	<i>Catostomus commersonii</i>
White walnut (Butternut)	<i>Juglans cinerea</i>
White-eyed vireo	<i>Vireo griseus</i>
White-fringed orchid	<i>Platanthera blephariglottis</i>
White-tailed deer	<i>Odocoileus virginianus</i>
White-throated sparrow	<i>Zonotrichia albicollis</i>
Widgeon grass	<i>Ruppia maritima</i>
Wild chervil	<i>Anthriscus sylvestris</i>
Wild rice	<i>Zizania aquatica</i>
Willet	<i>Catoptrophorus semipalmatus</i>
Willow flycatcher	<i>Empidonax traillii</i>
Willow species	<i>Salix</i> spp.
Winter flounder	<i>Pleuronectes americanus</i>
Wolverine	<i>Gulo gulo</i>
Woodchuck	<i>Marmota monax</i>
Wood duck	<i>Aix sponsa</i>
Wood frog	<i>Rana sylvatica</i>
Wood nettle	<i>Laportea canadensis</i>
Wood thrush	<i>Hylocichla mustelina</i>
Wood turtle	<i>Clemmys insculpta</i>



<b>Common Name</b>	<b>Scientific Name</b>
Woodland caribou	<i>Rangifer tarandus caribou</i>
Worm-eating warbler	<i>Helmitheros vermivorum</i>
Yarrow	<i>Achillea millefolium</i>
Yellow-bellied flycatcher	<i>Empidonax flaviventris</i>
Yellow birch	<i>Betula alleghaniensis</i>
Yellow corydalis	<i>Corydalis lutea</i>
Yellow lampmussel	<i>Lampsilis cariosa</i>
Yellow-bellied sapsucker	<i>Sphyrapicus varius</i>
Yellow-crowned night heron	<i>Nyctanassa violacea</i>
Yellow-rumped warbler	<i>Setophaga coronata</i>
Yellow-throated vireo	<i>Vireo flavifrons</i>
Zebra mussel	<i>Dreissena polymorpha</i>





**Silvio O. Conte National Fish and Wildlife Refuge**  
103 E. Plumtree Road  
Sunderland, MA 01375  
413/548 8002  
[http://www.fws.gov/refuge/Silvio\\_O\\_Conte/](http://www.fws.gov/refuge/Silvio_O_Conte/)

**Federal Relay Service**  
for the deaf and hard-of-hearing  
1 800/877 8339

**U.S. Fish & Wildlife Service**  
<http://www.fws.gov>

**For Refuge Information**  
1 800/344 WILD

**January 2017**

