U.S. Fish & Wildlife Service

Great Thicket National Wildlife Refuge (Proposed)

Draft Land Protection Plan/ Environmental Assessment

January 2016

Front cover:

Shrublands in Maine
Kirk Rogers

Clockwise from top right:
New England cottontail
Meagan Racey/USFWS

Prairie warbler
Kevin Fleming

Monarch butterfly
Bill Thompson

Amercian woodcock
Carlos Guindon/USFWS

Back cover:

Shrublands in Maine
Kirk Rogers

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

The *U.S. Fish and Wildlife Service* is the principal Federal agency responsible for conserving, protecting, and enhancing fish, wildlife, plants, and their habitats for the continuing benefit of the American people. The Service manages the 150-million acre National Wildlife Refuge System comprised of more than 560 national wildlife refuges and thousands of waterfowl production areas. It also operates 70 national fish hatcheries and 81 ecological services field stations. The agency enforces Federal wildlife laws, manages migratory bird populations, restores nationally significant fisheries, conserves and restores wildlife habitat such as wetlands, administers the Endangered Species Act, and helps foreign governments with their conservation efforts. It also oversees the Federal Assistance Program which distributes hundreds of millions of dollars in excise taxes on fishing and hunting equipment to State wildlife agencies.

Executive Summary

Executive Summary ES-1

Chapters

Chapter 1 The Purpose of, and Need for, Action

Introduction 1-1
Relationship to Service Policies and Landscape-level Conservation Goals 1-1
Status of Shrubland-Dependent Wildlife 1-5
Threats to Resources 1-9
Purpose of this Proposal 1-10

Chapter 2 Alternatives

Introduction 2-1
Alternative A – No Action 2-1
Alternative B – The Service-Preferred Alternative 2-5
Alternatives or Actions Considered but Eliminated from Detailed Study 2-18

Chapter 3 Affected Environment

Resources of the Area of Interest

Cultural Resources and Historic Preservation 3-1
Physical Environment 3-2
Socio-Economic Environment 3-6
Biological Environment 3-11

Description of Sub-Regions Containing Refuge Acquisition Focus Areas

Maine/New Hampshire Coast Sub-Region 3-22
Merrimack Valley-New Hampshire Sub-Region 3-31
Southeastern Massachusetts Sub-Region 3-35
Southeastern Connecticut/Rhode Island Coast Sub-Region 3-40
New York/Connecticut Border Sub-Region 3-46

Chapter 4 Environmental Consequences

Introduction 4-1
Impact Analysis and Relationship to Scale 4-2
Effects on Cultural Resources and Historic Preservation 4-3
Effects on the Physical Environment 4-4
Effects on the Socio-Economic Environment 4-9
Effects on the Biological Environment 4-14
Cumulative Impacts 4-27

Chapter 5 Coordination and Consultation

Partners 5-1
New England Cottontail Coordination 5-1
Refuge Acquisition Focus Areas 5-2
Public Involvement 5-3

Bibliography

Bibliography Bibl-1

Chapters (cont.)

Acronyms

Acronyms Acro-1

Glossary

Glossary Glos-1

Appendixes

Appendix A Conceptual Management Plan

Introduction A-1
Criteria and Target Acreages A-1
Managing Habitat for Priority Shrubland Species A-3
Acquisition Decisions and Management Planning A-9
Bibliography A-9

Appendix B FAQs about Refuge Land Acquisition

FAQs about Refuge Land Acquisition B-1

List of Tables

Table 1 Refuge Acquisition Focus Areas 2-8
Table 2 Fee and Easement Costs by RAFA 2-15
Table 3 Counties Associated with Geographic Regions and Refuge Acquisition Focus Areas 3-6
Table 4 Populations of Affected Counties and States (2014) 3-7
Table 5 Population by Geographic Region (2014) 3-7
Table 6 Population Projections 3-7
Table 7 Occupation by Industry, 2009 to 2013 3-8
Table 8 Relative Occupation by Industry, 2009 to 2013 3-8
Table 9 Changes in Occupations by Industry: 2005 to 2013 3-9
Table 10 Regional Conservation Plans and Priority Species for Shrublands and Young Forest Habitats 3-16
Table 11 Current Breeding Bird and Habitat Estimates for all RAFAs combined . 3-18
Table 12 Maine/New Hampshire Coast Sub-Region Conserved Lands 3-22
Table 13 Maine/New Hampshire Coast Sub-Region Land Cover Types 3-26
Table 14 Merrimack Valley North Conserved Lands 3-31
Table 15 Merrimack Valley North Land Cover Types 3-31
Table 16 Southeastern Massachusetts Sub-Region Conserved Lands 3-35
Table 17 Southeastern Massachusetts Sub-Region Land Cover Types 3-35
Table 18 Southeastern Connecticut/Rhode Island Coast Sub-Region Conserved Lands 3-41
Table 19 Southeastern Connecticut/Rhode Island Coast Sub-Region Land Cover Types 3-41

List of Tables (cont.)

Table 20 New York/Connecticut Border Sub-Region Conserved Lands 3-46
Table 21 New York/Connecticut Border Sub-Region Land Cover Types 3-46
Table 22 Context for Impact Analysis 4-2
Table 23 Revenue-to-Expenditure Ratios by Land Use in New Hampshire Communities Studied 4-11
Table 24 Current and Proposed Breeding Bird and Habitat Estimates for all RAFAs Combined 4-16
Table 25 NEC Conservation Strategy-Recovery Goals 4-25
Table A.1 Refuge Acquisition Focus Area Target Acres A-2

List of Maps

Map 1 Bird Conservation Regions 1-6
Map 2 Area of Interest 1-12
Map 3 Proposed Refuge Acquisition Focus Areas: Overview 2-7
Map 4 Cape Elizabeth-Scarborough Refuge Acquisition Focus Area 3-23
Map 5 Berwick-York and Rollinsford Refuge Acquisition Focus Areas 3-24
Map 6 Oyster-Dover-Bellamy Refuge Acquisition Focus Area 3-25
Map 7 Cape Elizabeth-Scarborough Refuge Acquisition Focus Area: Land Cover Types 3-27
Map 8 Berwick-York and Rollinsford Refuge Acquisition Focus Areas: Land Cover Types 3-28
Map 9 Oyster-Dover-Bellamy Refuge Acquisition Focus Area: Land Cover Types 3-29
Map 10 Merrimack Valley North Refuge Acquisition Focus Area 3-32
Map 11 Merimack Valley North Refuge Acquisition Focus Area: Land Cover Types 3-33
Map 12 Plymouth Refuge Acquisition Focus Area 3-36
Map 13 Mashpee Refuge Acquisition Focus Area 3-37
Map 14 Plymouth Refuge Acquisition Focus Area: Land Cover Types 3-38
Map 15 Mashpee Refuge Acquisition Focus Area: Land Cover Types 3-39
Map 16 Rhode Island East-West Refuge Acquisition Focus Area 3-42
Map 17 Pachaug-Ledyard Refuge Acquisition Focus Area 3-43
Map 18 Rhode Island East-West Refuge Acquisition Focus Area: Land Cover Types 3-44
Map 19 Pachaug-Ledyard Refuge Acquisition Focus Area: Land Cover Types . 3-45
Map 20 Northern Housatonic Refuge Acquisition Focus Area 3-48
Map 21 Northern Housatonic Refuge Acquisition Focus Area: Land Cover Types 3-49

List of Figures

Figure 1 Predicted Stopover Bird Densities Based on Radar Data 3-19
Figure A.1 Conceptual Model for the Conservation of the New England Cottontail: An example configuration of habitat networks or metapopulations . A-3

Bill Thompson

Blue-winged warbler

Executive Summary

■ Executive Summary

Shrublands and young forest habitats in the Northeastern United States have declined dramatically over the past century, primarily as a result of the decline of agricultural land use, forest maturation, development pressures, and wetland draining and filling. Many shrubland-dependent wildlife species are rapidly disappearing along with their now-imperiled habitat, and have been identified as high priorities for conservation by the U.S. Fish and Wildlife Service (Service) and state wildlife agencies. Due to the urgency of this situation, state, Federal and non-governmental partners have begun 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 Refuge System (NWRS) lands. This partnership effort has identified a need for additional secured acreage and management capability to meet population and habitat goals.

In this draft Land Protection Plan/Environmental Assessment (draft LPP/EA), we propose to establish the Great Thicket National Wildlife Refuge (NWR) as an additional Service contribution to help stem the decline of shrubland-dependent wildlife species. As part of our proposal, we have identified 10 Refuge Acquisition Focus Areas (RAFAs) encompassing approximately 298,820 acres across six northeast states. Within these larger focus areas, the Service would acquire approximately 15,000 acres total in fee title or easements. This approach allows us the flexibility to assist partner efforts over time as needed in areas most critical to landscape connectivity.

Several surrogate species, including the New England cottontail (NEC), prairie warbler, blue-winged warbler, field sparrow, American woodcock, and brown thrasher, have been identified to represent the entire suite of declining shrubland wildlife. Modeling and spatial analysis related to several of these species and other Federal trust resources were used to guide the design and development of this proposal. As a result, several areas within the proposed Great Thicket NWR represent overlapping opportunities to benefit populations of species currently listed as threatened or endangered, such as the bog turtle and the northern red-bellied cooter, as well as numerous declining priority breeding landbirds identified in the New England/Mid-Atlantic Bird Conservation Region Plan 30 (BCR 30). For example, we estimate that we will contribute up to 5.4 percent of the BCR 30 population goal for the blue-winged warbler and 6.8 percent for the prairie warbler, both BCR highest-priority species, on a relatively small number of acres compared to the total amount of BCR acres. We also expect this proposal to make measurable contributions towards habitat and population goals identified in the multi-agency Conservation Strategy for the NEC by increasing the long-term certainty of shrubland management and success in strategic locations throughout the northeast.

Prairie warbler

Kevin Fleming

This proposal represents the application and implementation of multiple Service directives, policies and planning guidance, including the concept of Strategic Habitat Conservation, Landscape Conservation Design, and strategic growth of the NWRS. This draft LPP/EA closely aligns with the conservation priorities of many Service programs as well as Service partners including the states of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, and New York, the NEC Executive and Technical committees, the Natural Resources Conservation Service (NRCS), and the Wildlife Management Institute. To

date, these partners have committed significant resources toward protecting, maintaining and managing shrubland habitat and will continue to do so in the future. For example, as of January 2015, the NRCS has created or maintained approximately 1,500 acres of NEC habitat through the Working Lands for Wildlife program, which provides financial assistance to landowners who voluntarily participate in habitat-related projects that can reverse population declines for certain wildlife species. The proposed Great Thicket NWR will complement these commitments made by our partners.

The estimated cost to acquire the entire 15,000 acres for the proposed Great Thicket NWR is between $84 million and $129 million. Because the method of acquisition would be decided on a case-by-case basis for each landowner, it is impossible to determine exactly how many acres would be acquired in fee title and how many acres would be acquired in conservation easements. Therefore, we have provided a low range based on the acquisition of conservation easements on all 15,000 acres and a high range based on the fee title acquisition of all 15,000 acres. The cost-per-acre values used in this rough estimation are based on land purchases associated with nearby national wildlife refuges for each RAFA.

Given the costs associated with this project and in light of our willing-seller-only approach, it could take 30 years or more to acquire fee or easements for the entire proposed 15,000-acre refuge. A long-term commitment of this nature is not at all uncommon when compared to the status of other NWRS land protection projects. However, unlike some wildlife species that require large unbroken blocks of habitat, shrubland-dependent species can be sustained on smaller, scattered parcels connected by linear features such as power lines. Indeed, existing shrublands that currently support targeted species occur in smaller patches across the landscape identified in this proposal (i.e. within RAFAs). This has positive implications for the timing of future acquisitions in that we are already working in a fragmented landscape and our efforts will not be compromised by projected future land use changes or human population growth.

In areas with more persistent and stable types of shrublands we encourage passive management techniques and allow for natural vegetative growth. In other areas, we will engage in active restoration and maintenance of shrublands and young forest habitat types, where appropriate. Managing habitat for shrubland species can take many forms, depending on the acreage and current condition of the tract of land and how much effort we are able to commit to management. Depending on soils, hydrologic regimes, and vegetation, we may consider mechanical cutting, prescribed burning, herbicides, riparian area restoration, or planting habitat areas to create and maintain optimal conditions.

Shrublands

USFWS

While national wildlife refuges are managed specifically for wildlife and wildlife habitat, public uses are often allowed. The National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57; 111 Stat. 1235) directs the Service to give special consideration to allowing wildlife-dependent recreational activities-namely hunting, fishing, wildlife observation, wildlife photography, environmental interpretation, and environmental education-on national wildlife refuges when these uses are compatible with the mission of the NWRS and the purposes of the refuge. As lands are added to the proposed Great Thicket NWR, we will complete our agency's process for determining when, where, and how to permit public uses.

Chapter 1

Carlos Guindon/USFWS

American woodcock

The Purpose of, and Need for, Action

- Introduction
- Relationship to Service Policies and Landscape-level Conservation Goals
- Status of Shrubland-Dependent Wildlife
- Threats to Resources
- Purpose of this Proposal

Introduction

Shrublands and young forest habitats in the northeast have declined dramatically over the past century, primarily as a result of the decline of agricultural land use, forest maturation, development pressures, and wetland draining and filling. As a result, many shrubland-dependent wildlife species have declined and have therefore been identified as high priorities for conservation in the Northeastern United States. The intent of this draft Land Protection Plan/Environmental Assessment (draft LPP/EA) for the establishment of Great Thicket National Wildlife Refuge (NWR, the refuge) is to help reverse this disturbing trend of shrubland habitat and species loss in strategic locations across the northeast landscape and to restore the mosaic of habitats that wildlife need.

Shrubland and young forest habitat, also known as "early successional" habitat, are frequently described as thickets (Litvaitis 2001). (Throughout this document we use several terms when referring to this habitat, including "shrublands," "shrublands and young forest," "early successional," and "thicket.") This habitat is generally characterized as dense, primarily deciduous understory cover created when trees and other woody vegetation are growing back following disturbances caused by factors such as logging, fire, flooding, mortality from disease or insects, and high winds. Historically, the presence of these habitats was related to the frequency and distribution of these natural disturbances across the landscape, with certain areas such as coastal zones and sand plains much more prone to frequent or extreme storms or fires and, therefore, characterized by greater amounts of these habitats. However, human populations and the accompanying housing, agricultural and industrial development have been most concentrated in coastal zones and river valleys, resulting in severe losses of the early-successional habitats in much of the region (USFWS 2009a). Because of this habitat loss and forest maturation across the region, along with now limited natural disturbance, most wildlife and plant populations restricted to these habitats are in serious decline. These species are increasingly reliant upon managed areas such as relatively small protected barrens, power line rights-of-way or recent timber harvests.

Numerous conservation tools are currently being applied on the landscape by state, Federal and non-governmental partners, in a six-state shrublands restoration and protection effort within the Northeastern United States. This effort includes restoration on existing state and Federal secured lands, assistance by numerous agencies and organizations to restore shrublands on private lands, and shrubland management on existing National Wildlife Refuge System (NWRS, Refuge System) lands. If approved by the Director of the U.S. Fish and Wildlife Service (USFWS, Service, we, us), this draft LPP/EA will allow an expanded Refuge System contribution to this effort by allowing us to secure lands or easements in key locations.

Over the past year, we have collaborated with six states (Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut and New York), the New England Cottontail (NEC) Executive and Technical committees, state NEC/shrubland land management teams, state and Service migratory bird biologists, and other partners to develop this draft LPP/EA.

Relationship to Service Policies and Landscape-level Conservation Goals

This draft LPP/EA represents the application and implementation of multiple Service directives, policies and planning guidance. The concept of Strategic Habitat Conservation (SHC) has been adopted by the Service to guide us to work strategically with partners to conserve landscapes capable of supporting self-sustaining populations of fish and wildlife, and to address conservation challenges that cross jurisdictional boundaries. In addition, the Refuge System has adopted an approach in which refuge land protection proposals result from participation in Landscape Conservation Design (LCD) efforts, developed by the

greater conservation community, and facilitated through multi-partner regional landscape conservation cooperatives. LCD efforts are consistent with SHC and involve the development of a partnership-driven conservation strategy.

Strategic Habitat Conservation

The Service has adopted SHC as a science-based approach for determining where and how to deliver conservation efficiently to achieve specific biological outcomes, in collaboration with partners, the public, and landowners. It requires us to set specific biological goals, allows us to make strategic decisions about our work, and encourages us to constantly reassess and improve our actions. The SHC approach integrates:

- *Biological planning*—development of a comprehensive landscape vision with partners, including identifying common goals, objectives, and surrogate species.
- *Conservation design*—development of a spatially explicit design needed to meet population objectives, and identification of management objectives.
- *Conservation delivery*—cost/benefit evaluation, selection and implementation of best actions to meet objectives.
- *Monitoring*—to evaluate delivery, progress, success, and adapt as necessary.

This draft LPP/EA is one result of several years of biological planning and conservation design accomplished through a multi-state partnership effort, involving close collaboration with all six state wildlife agencies and additional agencies and organizations. All six states have identified shrublands and young forest habitat as high priorities for conservation attention in their respective State Wildlife Action Plans (SWAPs), along with Species of Greatest Conservation Need (SGCN) dependent upon them. There is a high degree of land conservation commitment by all the entities involved, such as the dedication of competitive state wildlife grant and Pittman-Robertson funding for restoration and acquisition, the Natural Resources Conservation Service's (NRCS) Working Lands for Wildlife activities, and the Service's Partners for Fish and Wildlife Program which works with private landowners within the project area. Limited Refuge System acquisition is proposed as one additional tool, part of the regional cooperative effort to create and conserve early-successional habitat with suitable landscape connectivity for the species that depend on this resource.

Landscape Conservation Design using Surrogate Species

The Service is facilitating a coordinated network of Landscape Conservation Cooperatives (LCCs) across the United States, with the assistance of partners. The science provided by these partnerships is expected to inform biological planning and strategic conservation design, and help direct research and monitoring necessary to inform decisions about conservation delivery. The proposed Great Thicket NWR is located within the North Atlantic LCC (NALCC), which extends from Maine to Virginia. Early successional/shrubland/young forest habitat is listed as a NALCC priority habitat due to its importance in supporting populations of several designated NALCC highest priority species (USFWS 2009b).

The SHC approach recommends the use of a subset of priority trust species, or surrogates, to represent larger suites of priority species, as a tool for strategically conserving habitat at landscape scales. The NALCC has developed a list of surrogates for the major habitat types within the Northeastern United States to help focus biological planning and conservation design work. Conservation actions implemented for these species are intended to benefit associated priority species within a given habitat type. The NALCC further

sponsored the development of habitat capability models for selected surrogates, led by the University of Massachusetts, to enhance the capacity of partners to design sustainable landscape conservation in the northeast. These models are being used across the NALCC area to:

- Predict capability of current landscapes to support populations of surrogates.
- Predict impacts of landscape-level changes on capability of habitats to support surrogates.
- Target conservation programs to efficiently achieve habitat objectives and evaluate progress.
- Enhance coordination among partners to make conservation design more effective.

Several surrogate species, including the NEC (*Sylvilagus transitionalis*) (cottontail, rabbit), prairie warbler (*Dendroica discolor*), blue-winged warbler (*Vermivora pinus*) chestnut-sided warbler (*Setophaga pensylvanica*), field sparrow (*Spizella pusilla*), American woodcock (*Scolopax minor*), brown thrasher (*Toxostoma rufum*), eastern towhee (*Pipilo erythrophthalmus*), and bog turtle (*Clemmys muhlenbergii*), have been identified to represent the entire suite of declining shrubland wildlife. Modeling and spatial analysis related to several of these species has been used to guide the design and development of this proposal.

Bill Thompson

Eastern towhee

Habitat relationship models were developed for surrogates representing a range of habitats, including several early successional species such as the woodcock, prairie warbler, and ruffed grouse (*Bonasa umbellus).* An additional radar study, sponsored by our NWRS Program's Division of Natural Resources with recent support from the NALCC, the Migratory Bird Program, and several states, is helping to identify stopover sites in the Northeastern United States important for sustaining migratory landbird populations (Buler and Dawson 2012, 2014). Conservation efforts are increasingly focused on identifying these critical areas needed by migrants to rest and replenish energy reserves. This project is building upon prior work by the University of Delaware and U.S Geologic Survey (USGS) to use weather surveillance data and field surveys to map and predict important migratory bird stopover sites. These were used in conjunction with NEC model outputs to inform the development of areas of acquisition for the proposed Great Thicket NWR.

Strategic Growth of the National Wildlife Refuge System

The Service's recently adopted Strategic Growth policy directs that growth of the Refuge System must focus on acquiring interests in lands and waters that support the following:

- *Recovery of threatened and endangered species,* where land acquisition is prescribed in threatened or endangered species recovery plans or subsequent revisions.
- *Implementing the North American Waterfowl Management Plan,* where acquisition will contribute toward achieving the waterfowl population objectives identified in this plan and associated joint venture step-down management plans.
- *Conserving migratory birds of conservation concern,* where acquisition is identified as contributing toward achieving population objectives in plans such as the Partners in Flight (PIF) North American Landbird Conservation Plan and associated step-down plans.

Early successional forest habitat

Kelly Boland/USFWS

This draft LPP/EA is intended as a Service contribution to help stem the decline of an entire suite of species, help accomplish recovery plan goals for Federal-listed endangered and threatened species, and contribute to goals for numerous declining priority migratory landbirds. The proposal will also allow us to contribute to accomplishing goals for the recovery of the NEC, as identified in the Conservation Strategy for the New England Cottontail (Fuller and Tur 2012) (NEC Conservation Strategy, the strategy). In execution of their charge to initiate priority-setting under the Region 5 State Wildlife Grant (SWG) Regional Conservation Needs Program, the Northeast Fish and Wildlife Diversity Technical Committee in 2007 named the NEC as the top priority SGCN for landscape conservation, and concurrently initiated a cooperative effort to secure competitive SWG funding for a multi-state conservation effort, in the hope of averting a listing action by the Service under authority of the Endangered Species Act (ESA).

Several areas of acquisition for the proposed Great Thicket NWR represent the intersection of high priority NEC sites and populations of currently listed species, most notably the bog turtle and the northern red-bellied cooter (*Pseudemys rubriventris)(*cooter). The bog turtle recovery plan specifies acquisition of additional habitat in its Hudson/Housatonic recovery unit, which overlaps our southeastern New York/western Connecticut focus area. Management for shrubland species and the bog turtle can be targeted to benefit both. Similar benefits can be provided in southeastern Massachusetts for the cooter, where important cooter habitat has been designated and where the cooter recovery plan specifies additional acquisition of pond-shore habitats and corridors for genetic interchange (USFWS 2007a).

The proposed Great Thicket NWR is also designed to contribute to goals for numerous declining priority landbirds identified in the New England/Mid-Atlantic Bird Conservation Region Plan 30 (BCR 30). For example, we estimate that we will be able to contribute up to 5.4 percent of the BCR 30 population goal

for the blue-winged warbler and 6.8 percent for the prairie warbler, both BCR highest-priority species, on a relatively small number of acres compared to the total amount of BCR acres (PIF 2013, 2015). Map 1 shows the general vicinity of the proposed refuge acquisition areas in relation to the entire BCR 30. The BCR supports an estimated 10 percent of the blue-winged warbler total breeding population, and it has the highest breeding density of all BCRs as recorded by the Breeding Bird Survey, indicating high value of creating additional habitat in this region in terms of expected bird response (PIF 2013, 2015). Shrubland habitat within the project area also plays a crucial role in providing migratory stopover habitat for landbirds. An analysis of weather radar data has identified the southern New England coastal area as one of three areas in the Northeastern United States that supports the highest density of fall migrating birds (Buler and Dawson 2012, 2014).

Other Plans

All of the refuges within the project area have identified goals and objectives for shrubland and young forest restoration and management in their 15-year management plans, known as Comprehensive Conservation Plans (CCPs). These generally include the maintenance of maritime shrubland and forest, pitch pine-scrub oak communities, shrub-dominated wetlands, and successional shrublands and young forest stages, for the purpose of providing nesting and migratory stopover habitat for landbirds of conservation concern, to benefit the NEC, and also breeding and migratory bats. The cottontail is also the subject of a Service Northeast Region Spotlight Species Action Plan and two state Candidate Conservation Agreements with Assurances.

Status of Shrubland-Dependent Wildlife

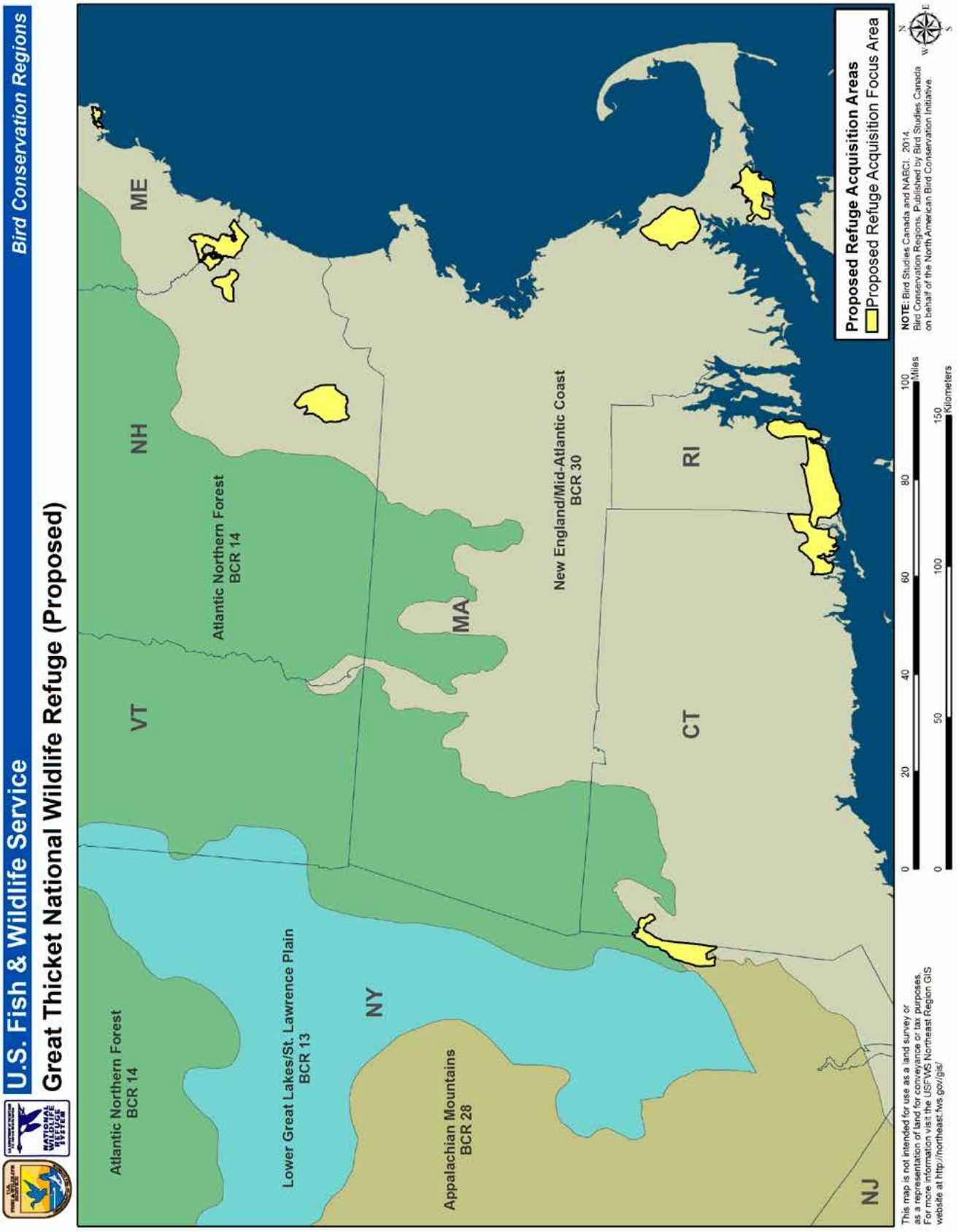
As shrubland and young forest habitats have been declining throughout the Northeastern United States for decades, the wildlife species associated with them have experienced a similar reduction in population levels. For instance, 12 of 16 shrubland birds have declining population trends in the region. Many are listed as threatened or endangered by several northeastern states. Additionally, American woodcock have declined by 40 percent over the past 30 years, and the native NEC occurs in only 20 percent of the area in which this species was historically found.

Field sparrow

James Junda 2013

Although the NEC is the most well-known shrubland-dependent species, numerous other species utilize these important early successional habitats, including 136 species of butterflies, moths, birds, reptiles, other mammals, amphibians, and beetles, all of which have been identified by states in the northeast as species that are in need of protection. Additionally, several shrub-dependent bird species, such as the American woodcock and golden-winged warbler (*Vermivora chrysoptera*) have declined significantly in the northeast from lack of habitat availability and have been identified by Atlantic Coast Joint Venture (ACJV) plans as priority species of concern. Thus, landscape-level conservation for the NEC, the most dispersal-limited surrogate species, will provide significant habitat creation and improved connectivity for an entire suite of species, many of which are also current NALCC surrogate species for shrubland habitats in the region. These include the blue-winged warbler, prairie warbler, chestnut-sided warbler, field sparrow, and eastern hognose snake (*Heterodon platirhinos*). Species such as blue-winged warbler rank high in regional concern, and the woodcock is a species of regional and global concern.

Map 1: Bird Conservation Regions



New England Cottontail

A regional inventory to evaluate the current distribution of the NEC determined that its range has declined by 86 percent since 1960, and recent studies confirm that it now only persists in highly disjunct populations that are both geographically and genetically isolated. Due to concern over its status, the rabbit was classified as a candidate for ESA protection beginning in 2006. Recognizing both the urgency and the opportunity to conserve the species, in 2008, state and Federal biologists began a coordinated conservation effort that has fueled the species' path toward recovery. That effort includes the development of a 2012 peer-reviewed NEC Conservation Strategy, as mentioned earlier in this document. Among other things, the strategy describes the process used to develop a conservation design that includes those landscapes, hereafter referred to as NEC Focus Areas, where conservation actions will be taken to achieve a series of explicit conservation goals by addressing threats to the species. These and other ongoing conservation efforts by a wide range of deeply committed partners, including state and Federal agencies, towns, land trusts, companies, and private landowners, contributed to the Service's decision in September 2015 that the NEC does not need Federal protection under the ESA (USFWS 2015a).

Great strides have been made in implementing the NEC Conservation Strategy. According to the 2014 Annual Performance Report for tracking NEC conservation progress, there are six NEC Focus Areas that currently contain an estimated 1,000 or more individual cottontails and five more NEC Focus Areas with estimated populations of 500 or more cottontails. Assessment of conservation actions planned in each NEC Focus Area indicates that an additional 17 NEC Focus Areas are expected to attain target population levels exceeding 500 individuals each by the end of the 2030 planning period (Fuller and Tur 2015).

Still, the Service and its partners recognize they must continue to implement the goals in the strategy to ensure future healthy NEC populations over the long term. The NEC is the one early successional species to date where remaining populations have declined to the point of needing critical conservation attention in many portions of its range. It requires habitat patches of extremely dense woody vegetation for escape cover, especially in winter. This stem density is only achievable in shrubland habitats. Relative to other species that require this thicket habitat, the NEC appears to be particularly vulnerable. This may be attributed to its specialized habitat needs for dense shrubs and large habitat patches, its year-round occupancy of shrublands, and its relatively limited dispersal ability.

To this end, the NEC has been identified as a SGCN by all states throughout its historic range, except Vermont. In addition, the Service, along with the state wildlife agencies, the Wildlife Management Institute (WMI), and the NRCS, formalized an agreement to develop a collaborative conservation strategy (i.e., the NEC Conservation Strategy) to promote the recovery, restoration, and conservation of the NEC and its associated habitats. The purpose was to ensure the development and implementation of a cooperative and well-coordinated conservation effort to address the population status of the NEC. The NEC Conservation Strategy was developed to describe a full complement of tasks needed to reduce threats facing the NEC, including assessing, setting, and prioritizing management actions, to generate a positive population response and status improvement. The NEC Technical Committee was formed and charged with developing, implementing, and evaluating a conservation plan that utilizes the principles of adaptive management, by establishing goals and objectives, recognizing and addressing key assumptions, identifying important conservation landscapes, and developing key partnerships. As a result, the NEC Conservation Strategy has provided agency decision leaders with an explicit description of an effective approach for conserving the species. In turn, agency leaders have guided the development of the strategy while addressing relevant issues to ensure that the strategy is well-implemented.

Migratory Birds

The suite of birds associated with naturally occurring shrublands and early successional forests in the Northeastern United States accounts for about 15 percent of the total species diversity of breeding birds for the region (Dettmers 2003). The shrubland suite of birds contributes a relatively large number of individuals but a relatively small proportion of the total bird species to the avian diversity of the region. The primary risks to persistence of this suite of birds in the northeast region include long-term declines in amounts of early successional forest and naturally occurring shrubland habitats. Many shrubland birds also have relatively high proportions of their total breeding populations occurring in the region, indicating the importance of the Northeastern United States to maintaining source populations of these species.

Partners in Flight (PIF), a cooperative bird conservation organization seeking to maintain populations of North American landbirds, has developed bird conservation plans for 12 physiographic areas in the Northeastern United States. In 10 of these 12 physiographic areas, the shrubland suite of birds is considered either a high or moderate priority for conservation action. The PIF plans indicate that the suite of shrubland birds should receive a high level of conservation attention within the Northeastern United States. Using the concept of historic range of variation, managing 10 to 15 percent of the landscape for early successional habitat might provide adequate habitat for maintaining minimal populations of shrubland birds in the region, but a greater percentage will be needed if population increases are desired (Dettmers 2003).

In addition to local remaining breeding-bird habitats, the northeast region contains numerous critical stopover sites for landbirds and shorebirds. Although the total value of these sites has not been fully assessed yet, very large numbers of birds pass through during the spring and fall migration periods. Many may face the greatest mortality risks of their lives, particularly in fall, and their need to refuel to complete long-distance migrations could be a limiting factor for their survival and population growth.

An analysis of radar data from the National Weather Service (Buler and Dawson 2012, and 2014) has indicated that the Southern New England coastal area supports high densities of migrating birds during the fall migration. The area's shrubland habitats are known to be important not just for shrubland breeding species but also for forest interior species during migration, and to post-breeding individuals and young of the year in preparation for migration.

Monarch Butterfly and Pollinator Conservation

The Service has recently begun working with partners as part of the Monarch Joint Venture (MJV), under the North American Monarch Conservation Plan (Commission on Environmental Cooperation 2008), to initiate monarch butterfly (*Danaus plexippus*) conservation programs, including on national wildlife refuges. The Plan provides a framework for monarch breeding and overwintering habitat management and restoration. The MJV is a partnership of Federal and state agencies, non-governmental agencies, and academic programs working together to protect the butterfly and its migration. On public and private lands, MJV partners are working with various land owners and managers to restore monarch breeding and overwintering habitats, including the important milkweed and nectar-producing plant resources needed in the Northeastern United States.

Through a Joint Memorandum Regarding Collaborative Efforts to Conserve the Monarch Butterfly and Other Native Pollinators, the Service and the Association of Fish and Wildlife Agencies (AFWA) have joined in a common effort to take actions on behalf of monarch butterflies and other pollinators, and consider adding these as a SGCN in SWAPs.

Restoring milkweed habitat is the most important monarch conservation and management need (Jepsen et al. 2015, Commission for Environmental Cooperation 2008, Butler 2014), and the core of any such effort would be planting

milkweed and other nectar-producing plants in places suitable for monarchs and other pollinators. Such management is compatible with early successional/ shrubland rotational management.

Threats to Resources

Early successional habitat in New England has declined in the past century as a direct consequence of land use change. The once agrarian and pastoral landscape of New England has, over time, largely yielded to woodlands. Mature forests now dominate the land cover of the Northeastern United States, while shrublands have become exceptionally rare. The amount of shrubland and young forest habitat in much of the Northeast has fluctuated widely over time, and before European settlement early successional habitats are thought to have represented less than 10 percent of land area (Litvaitis 2006, Covell 2006). Their presence was related to the frequency and distribution of natural disturbances across the landscape, with certain areas such as coastal zones and sand plains more prone to frequent or extreme storms or fires and, therefore, containing greater amounts. However, human populations and the accompanying housing, agricultural and industrial development have been most concentrated in coastal zones and river valleys, resulting in severe losses of 90 to 99 percent of these habitats in much of the region (USFWS 2009a). In eastern North America over the last 60 years, open habitats (grasslands, savanna, barrens, and shrublands) have declined by 98 percent, with shrubland communities comprising 24 percent of this decline (Tefft 2006).

Some types of shrubland habitat are generally stable and can be found in areas that experience water stress, such as scrub-shrub wetlands, salt-stressed coastal thickets, or drought-tolerant pitch pine-scrub oak barrens. In many areas of New England, shrubland habitats are comprised of young forests that represent an intermediate seral stage between old field and mature forest. These shrublands are normally created when fields or grasslands are allowed to grow into shrubland, or when openings are created in the forest canopy thus temporarily reverting the patch to an earlier seral stage. As these patches mature, the overstory closes and shrub density declines. Historically, these openings were created by natural disturbances, such as those created by fire, wind, beaver impacts, or insect outbreaks. However, reduced natural disturbances (e.g., via fire suppression) have greatly limited the creation of new shrubland habitat on the landscape. Furthermore, both stable and disturbance-generated shrubland communities have been converted to other land uses and remaining patches are highly fragmented, particularly in coastal areas of New England.

While the northeast landscape has typically been dominated by forested lands, a variety of early successional habitats have always been present on this landscape in varying amounts and geographic distributions. Despite recent timber harvests to create more of this habitat, at this point in time, the amount of shrubland and young forest habitats is still insufficient to sustain the high-priority wildlife species that depend on them. Many landscape plans call for a goal of 10 to 20 percent of the landscape to be in early successional habitats; while the actual percentage varies from location to location, these habitats currently occupy as low as two percent in some areas. Severe habitat loss and fragmentation has reduced the majority of early successional habitat to very small patches of coastal scrub or to managed areas such as utility corridors and recent timber harvests that are insufficient in supporting many shrubland-dependent species, especially the NEC. The U.S. Forest Service's Forest Inventory and Analysis Program (U.S. Department of Agriculture 2014) has continued to show a declining trend for the presence of young forest, age 0 to 20 years, across the New England states. The overall percentage of land in that forest age class over a 5-year period went from 4.53 percent in 2009 to 3.55 percent in 2014. Trends for individual states vary somewhat, but are similar for the same period of time: Maine went from 8.89 percent in 2009 to 5.58 percent in 2014; New Hampshire from 6.48 percent to 5.94 percent; Massachusetts from 2.01 percent to 1.77 percent; Rhode Island from 2.28

percent to 1.71 percent; Connecticut from 2.89 percent to 2.85 percent; and New York from 6.69 percent to 4.77 percent.

Purpose of this Proposal

We received approval in 2012 for a Preliminary Project Proposal (PPP) that would protect up to 15,000 acres in the northeast. This draft LPP/EA describes our proposal in more detail and provides the opportunity to gather input from the public and our partners.

By working closely with partners in conservation delivery and on-the-ground management, we propose to strategically acquire and improve habitat to help achieve overlapping habitat and population goals for declining shrubland wildlife species. It is envisioned that the proposed refuge would contribute towards achieving the following:

- Population goals for declining high-priority migratory bird species dependent upon shrublands.
- Habitat and population goals identified in the rangewide NEC Conservation Strategy.
- Recovery goals for several federally threatened or endangered species that have overlapping shrubland habitat needs.
- Population goals for numerous shrubland-dependent SGCN.

Based on the above proposed purposes, Great Thicket NWR could be established under the following statutory authorities:

- Endangered Species Act of 1973 (16 U.S.C. 1534), as amended
- Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742j), as amended

We are proposing limited expanded acquisition authority to allow the Refuge System to assist with conservation and management of additional shrubland in key locations. If approved by the Service's Director, this proposal would authorize the Refuge System to work with willing sellers to help conserve approximately 15,000 acres of additional land across six states to contribute to the collective partnership goals listed above.

Early successional habitat is one of the rarest habitats in this region, yet it remains a crucially important resource for numerous wildlife species. Although we are working with several public and private stakeholders, conservation by these partners alone will not be sufficient. Lack of available resources and management capability, as well as economic and public use pressures will greatly limit the protection and maintenance of shrublands on private and state lands into the future. These limitations may hinder our collective ability to implement conservation of a system of shrubland habitats sufficient to meet habitat and population goals for joint wildlife priorities. In many cases this habitat requires maintenance or rotational management, and the long-term commitment of ownership and permanent easements is key. Service acquisition will greatly facilitate achievement of these goals by ensuring long-term management authority for high value core habitats where substantial populations of shrubland wildlife can be maintained into perpetuity. Although some tracts on many of our northeast refuges are already being managed for early successional habitat, additional acreage is needed to meet recognized population and habitat goals.

One of the intended benefits of refuge acquisition is the greater long-term certainty of habitat maintenance that comes with permanent easements and fee acquisition, as compared to shorter-term private land enrollments. For

some focus areas in the NEC Conservation Strategy, the amount of secured land is not adequate to host enough management to accomplish the strategy's stated population and habitat goals. In addition to management proposed for secured lands, the strategy identified the need for an additional 15,000 acres of shrubland habitat on currently unsecured lands to meet agreed-upon habitat and population goals.

The scope of this draft LPP/EA is limited to the proposed acquisition, in fee-title and in less-than-fee-title, of lands for the establishment of Great Thicket NWR. For the purposes of this draft LPP/EA, the landscape analysis area, referred to throughout this document as the Area of Interest (AOI), is the area within which the environmental analysis is conducted. This area encompasses a large portion of the Northeastern United States (see Map 2). This draft LPP/EA is not intended to cover the development and/or implementation of detailed, specific programs for the administration and management of those lands. A conceptual management plan (Appendix A) is included to provide general outlines on how the proposed lands would be managed. The appendices are provided as general information for the public in its review of this draft LPP/EA. If the proposed refuge is established and the needed lands or interests in lands are acquired, the Service would develop a CCP and needed step-down management plans (e.g., habitat management plan, public use plan, etc.). These plans would be developed and reviewed in accordance with Department of the Interior (DOI) requirements of the National Environmental Policy Act (NEPA).

Refuge Acquisition Focus Areas

This draft LPP/EA identifies a combined target acreage of 15,000 acres, to be distributed over time across 10 Refuge Acquisition Focus Areas (RAFAs) encompassing a 298,820-acre project area. Map 2 shows the AOI containing the following 10 RAFAs: Cape Elizabeth-Scarborough, Berwick-York, Rollinsford, Oyster-Dover-Bellamy, Merrimack Valley North, Plymouth, Mashpee, Rhode Island East-West, Pachaug-Ledyard, and Northern Housatonic. Chapter 3 contains maps of each individual RAFA.

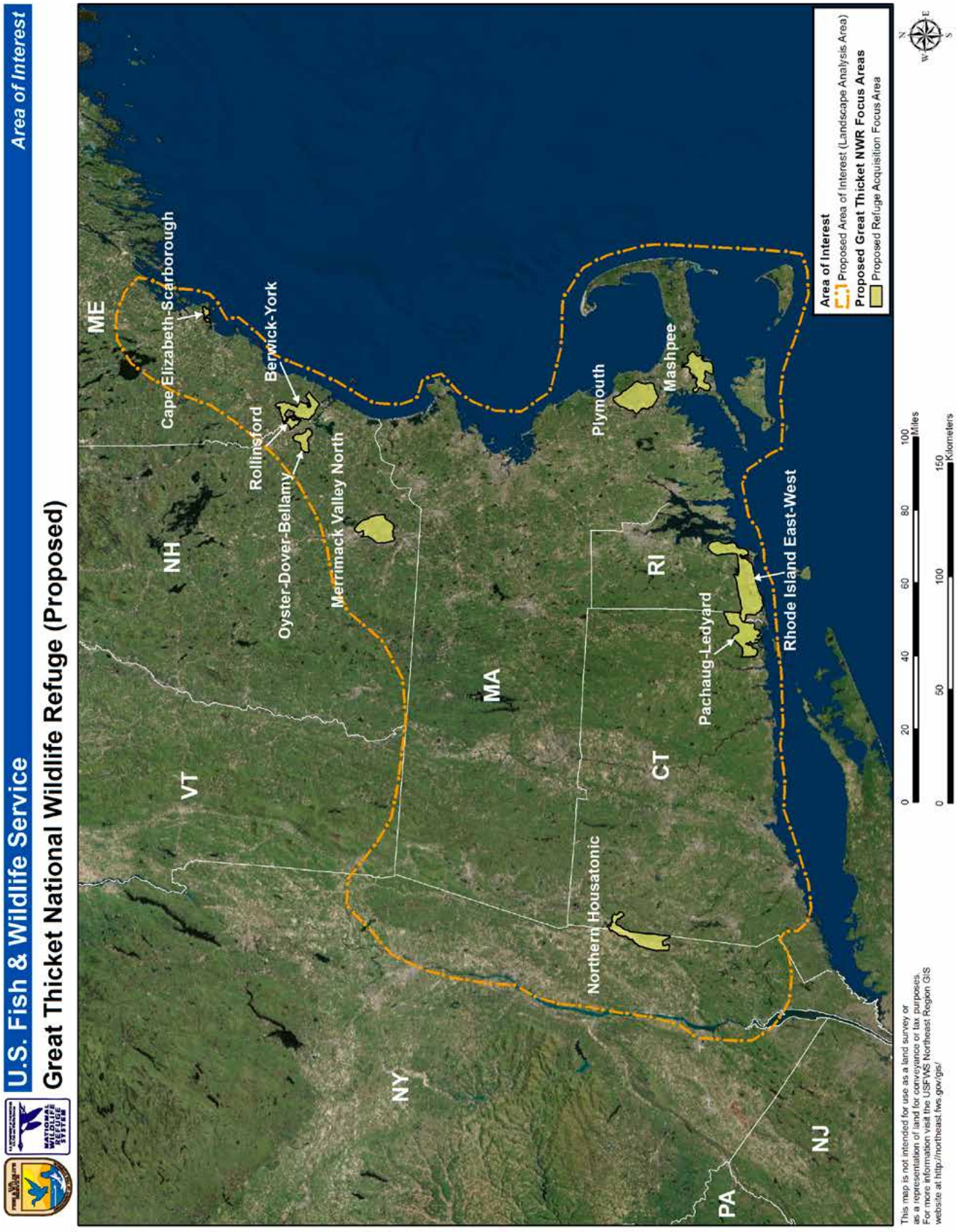
We worked with our state and other conservation partners to delineate the RAFAs in key locations within the larger partnership project area. Within each RAFA we identify a floating "target acreage" for Service acquisition, based on estimates in the NEC Conservation Strategy of the need for additional management beyond current capacity on existing agency-secured lands. Opportunities for refuge fee and easement acquisition will be evaluated and guided over time through the use of a pre-determined set of criteria. This approach will allow a Refuge System contribution with the ability to complement partnership activities, given the project's large landscape scale and the need for maximum flexibility for land protection.

Pine trees with dense shrub understory in southern Maine

Bill Zinni/USFWS

Land and easement acquisition is not intended to be the primary means of land conservation within the partnership area; rather, refuge acquisition will be an additional tool used in combination with other partners and landowner efforts. It is proposed as an additional tool to be used where it can assist the states, NRCS, the Service's Partners for Fish and Wildlife Program and Coastal Program, and other partner efforts with securement of key parcels, increasing the certainty of shrubland management over the long term. In some cases acquisition funding will not be required, such as at the Mashpee NWR area, where partners are willing to donate land or easements and enter into management agreements with the Service. In other cases, the Service may lease tracts of land to achieve habitat management and protection, as it has done at the Rhode Island NWR Complex.

Map 2: Area of Interest



Special Considerations

This draft LPP/EA closely aligns with the conservation priorities of the Service's partners. Shrubland habitat, declining shrub-dependent migratory birds, and NEC are all high priorities for the NALCC, NRCS, and the six states contributing to this initiative. The establishment of the proposed Great Thicket NWR would complement the commitments made by states and other partners to recover early successional habitats and create a network of protected shrublands, for a wide suite of species in need. This draft LPP/EA was prepared in cooperation with state shrubland teams, Refuge System staffs, the NEC Technical and Executive Committees, Service and state migratory bird biologists, endangered species biologists, and cooperating partners such as WMI.

The project demonstrates strong interagency and partner coordination and collaboration for landscape-scale conservation, and successfully implements the principles of SHC, LCD, use of surrogate species, and embraces science developed and facilitated through the NALCC. The Service is working closely with many partners, including extensive internal cross-programmatic coordination and external agency and non-governmental involvement. Service programs providing direct support and involvement include the following:

- Ecological Services-Endangered and Threatened Species
- Ecological Services-Private Lands/Partners for Fish and Wildlife
- Ecological Services-Coastal Program
- Migratory Bird Program
- Science Applications Program
- Wildlife and Sport Fish Restoration Program

Primary partners include all six state fish and wildlife agencies and additional entities:

- Maine Department of Inland Fisheries and Wildlife (MDIFW)
- New Hampshire Fish and Game Department (NHFG)
- Massachusetts Division of Fisheries and Wildlife (MDFW)
- Rhode Island Department of Environmental Management (RIDEM)
- Connecticut Department of Energy and Environmental Protection (CT DEEP)
- New York Department of Environmental Conservation (NYDEC)
- U.S. Department of Agriculture (USDA)-NRCS
- WMI
- University of Rhode Island
- University of New Hampshire
- Roger Williams Park Zoo
- Queens Zoo

In addition to our partners committing resources to managing public lands within the focus areas for early successional habitat, our Partners for Fish and Wildlife Program and several other entities are also working with numerous private landowners to manage early successional habitat, thus increasing the availability and proximity of shrubland habitat on the landscape. Securing additional refuge lands for early successional habitat is needed to help improve connectivity and management capability.

There are military installations within the project area, and the Department of Defense is also an active conservation partner. The Massachusetts Military Reservation, for example, has developed an approved Integrated Natural Resource Management Plan that identifies several tasks directed at pine barren and NEC conservation. Several Native American tribes are also located within the project area, and some, like the Narragansett Tribe in Rhode Island and the Mashpee Wampanoag Tribe of Massachusetts, are actively planning and implementing shrubland and NEC conservation actions.

Chapter 2

Bill Thompson

Brown thrasher

Alternatives

- Introduction
- Alternative A – No Action
- Alternative B – The Service-Preferred Alternative
- Alternatives or Actions Considered but Eliminated from Detailed Study

Introduction

This chapter presents:

- Our process for formulating management alternatives.
- A description of the two management alternatives we evaluated in detail, and their relationship to the Purpose and Need of our proposal.
- Alternatives and actions considered but eliminated from detailed study.

NEPA requires Federal agencies to evaluate a reasonable range of alternatives. Reasonable alternatives are those that are relevant to achieving the purpose and need of the proposal and are feasible for implementation. 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.

Indiana bat

Ann Froschauer/USFWS

The two alternatives described in detail in this chapter include a "no action" alternative required by NEPA and our proposed action. The alternatives describe complementary management approaches for achieving the missions of the Service and the Refuge System and the purposes for which Great Thicket NWR is proposed to be established, while responding to issues and opportunities identified during the planning process.

Although many ideas were discussed for the alternatives, in the end we decided there was only one reasonable alternative, as illustrated in alternative B below. Alternative B is the Service's Proposed Action because we believe it represents the best way to accomplish the stated purpose and need of this draft LPP/EA. Alternatives A and B are described in more detail below, along with maps, tables, and figures to further illustrate the alternatives.

Alternative A – No Action

NEPA requires that a "no action" alternative serve as a baseline to which all other alternatives are compared. Under alternative A, there would be no additional Service acquisition authority to augment collaborative partnership efforts. However, the Service and its partners would continue to protect and manage shrubland habitat throughout the northeast with current resources.

As noted in chapter 1, shrublands and declining shrub-dependent wildlife species have been recognized as high priorities for conservation in the northeast by numerous state-wide and national plans. In addition, the NEC was classified in 2006 by the Service as a candidate species for Federal protection under the ESA, though the Service decided in 2015 the NEC would not need Federal protection. The NEC has also been designated by the NALCC as a surrogate species, thus representing an entire suite of shrubland-dependent wildlife. As a former candidate species and now as a surrogate species, the NEC has become a focal point for collaboration between the Service and its partners to continue prioritizing shrubland conservation and management now and into the future.

As stated in chapter 1, the NEC Conservation Strategy sets forth actions to address threats to the NEC and to show how conservation partners are implementing those actions to ensure the presence of rabbits into the future as well as precluding the need to place the species on the Federal Endangered Species List. In the strategy, the NEC Technical Committee, consisting of wildlife biologists from six northeast States, the Service and the NRCS, delineated NEC Focus Areas throughout the species' range. The delineation of the NEC Focus Areas was rooted in landscape-level habitat models and an analysis of land parcels across New England and New York. This information was

then used by land management teams and local experts to ensure a connected network of habitats designed to meet NEC population goals. The methods used to delineate the NEC Focus Areas are described in greater detail in the Conservation Strategy and in Fuller et al. 2011.

The primary threat identified to NEC in the NEC Conservation Strategy is the modification of its habitat, including land-use changes (e.g., decreased logging and farming), habitat loss, and lack of natural disturbance, which has led to a dearth of suitable habitat. As a mechanism to address this key threat, each NEC Focus Area contains objectives for managing shrubland habitat on public and private lands. In order to make progress towards these objectives, each state convened a land management team, consisting of state and Federal agencies and non-governmental organizations. These land management teams identify habitat management priorities, develop habitat-creation projects, and identify resources to be used in carrying out those tasks. Such efforts help to ensure the timely creation of high-quality NEC habitat, which in turn provides high-quality habitat for a suite of early successional species.

To date, on-the-ground habitat work has been planned, initiated or completed on over 8,000 acres on both public and private land within designated NEC Focus Areas (Fuller and Tur 2015). Nearly 600 acres have been protected for NEC. Partners working on habitat projects include states, private landowners, conservation landowners, tribes, municipal lands, utility companies, and many others. According to the strategies, the partners expect to continue management on 750 to 1000 acres per year (Fuller and Tur 2015).

The states that are within the NEC's rangewide distribution have committed over $2.5 million in Federal and non-Federal funds, and are expected to deliver over 2,400 acres of habitat management, support for captive breeding, and monitoring in the near term. In addition, the states have received over $3 million in other Federal and non-Federal funds to conduct research on NEC management and genetics. Over the long term, state land managers have scheduled habitat management, including prescribed burning, on over 18,000 acres of land.

Other partners have focused on enrolling private lands into federally funded shrubland management programs. Through 2014, we estimate that WMI contributed over $1 million in technical assistance to landowners, conservation strategy development, performance database development, partnership coordination, and land management. By 2020, it is anticipated that the NRCS will manage over 10,000 acres using more than $18 million in Farm Bill funds.

Below, we provide examples of how public and private partnership efforts have contributed to shrubland management and protection in NEC Focus Areas in all six states from approximately 2010 through 2014. Under Alternative A, all of these efforts would continue.

In Maine, the Cape Elizabeth-Scarborough NEC Focus Area is an active one that includes many partners working together to achieve NEC habitat goals, and is at the northern edge of the species' range. A total of 18 active habitat projects totaling 341 acres are ongoing, including a project on land owned by the town of Cape Elizabeth, habitat and research projects on the State-owned Crescent Beach and Kettle Cove State Parks, and several Rachel Carson NWR shrubland restoration projects. Together, these public lands affect over 100 acres of habitat. In addition to the public partners, there are 12 landholdings owned by private landowners, including Scarborough Land Trust and the Sprague Corporation, that are enrolled in habitat programs funded in part by NRCS and the Service's Partners for Fish and Wildlife Program.

Also in Maine, the NEC Focus Area known as "Eliot-The Berwicks" abuts the Mount Agamenticus to the Sea Conservation Initiative Focus Area and is close to the Rachel Carson NWR. Nine projects totaling 239 acres of planned or implemented management occur here. MDIFW is planning young forest management on approximately 20 acres in this NEC Focus Area. NRCS is also active here, funding 194 acres of habitat management on private lands under easement with land trusts or on privately owned woodlots. Other partners include a habitat restoration project spearheaded by Spectra Energy Corporation, and a study of the use of artificial burrows for NEC by the University of New England along the Central Maine Power transmission line.

In New Hampshire, the Seacoast NEC Focus Areas consist of farms and woodlot owners working closely with NRCS and New Hampshire Department of Fish and Game (NHFG) towards private and public projects on over 50 parcels totaling over 1,265 acres of planned or implemented management. NRCS funds over 900 of these habitat acres and the rest include State and town lands. Partners here include several municipalities such as the towns of Rollinsford, Durham, Dover, Lee, and Madbury. Other partners include the Southeast Land Trust, Strafford County Conservation District, University of New Hampshire, Society for the Protection of New Hampshire Forests, and the National Audubon Society. NHFG Bellamy Wildlife Management Area has been used for demonstration of shrubland management techniques.

In the Merrimack Valley NEC Focus Area, located in south-central New Hampshire, the Service and its partners (e.g., NHFG, NRCS, WMI) have worked with private landowners on over 105 acres of habitat projects. Other active partners include the towns of Londonderry, Pelham, and Litchfield, as well as the Merrimack County Conservation District, Hillsborough County Conservation District, and Stonyfield Farm. In both the Merrimack Valley and Seacoast NEC Focus Areas, the utility company Eversource has altered management on over 1,500 acres of utility line to be more compatible with NEC.

In Massachusetts, the Plymouth NEC Focus Area contains a State-managed project totaling 100 acres. The MDFW has long-standing, successful partnerships with local landowners to conserve land and will continue these partnerships into the future.

Also in Massachusetts, the Mashpee-Falmouth NEC Focus Area has one of the largest and most diverse partnerships including State, Federal, and Tribal landowners as well as town and private land projects. In the heart of this focus area's pitch pine-scrub oak area there are over 200 acres of habitat being managed for shrubland-dependent wildlife. Partners include the town of Mashpee, Mashpee NWR, the Mashpee Wampanoag Tribe, the Orenda Wildlife Land Trust, The Trustees of Reservations, and Camp Edwards. The NRCS has contributed important funding for projects in this area.

The Southwest NEC Focus Area in Rhode Island is located along the south coast of Rhode Island and Narragansett Bay. Partners have planned and manage 464 acres of habitat. The RIDEM actively manages 244 acres of State-owned land within this focus area. The South Kingston, Narrow River, and Westerly land trusts, along with Rhode Island Audubon and The Nature Conservancy, as well as many private landowners, are working with the NRCS, WMI, and Partners for Fish and Wildlife to implement shrubland and young forest habitat projects. Shrubland management also occurs at John H. Chafee NWR, Ninigret NWR, and Trustom Pond NWR, all part of the Rhode Island NWR Complex.

Within two eastern Connecticut NEC Focus Areas-Pachaug and Ledyard Coast-there is a very active landscape of young forest habitat management.

Partners including NRCS, CT DEEP, the WMI, the National Fish and Wildlife Foundation, and the Service have planned or implemented projects on 683 acres. Approximately half of these projects are on private lands, funded by NRCS, and the remainder are on State lands. In addition to managing their land, the Avalonia Land Trust and Stonington Land Trust educate the public about shrubland habitat projects. The Groton Sportsman's Club and Groton Open Space Association manage and conserve land focused on shrubland and young forest wildlife. Landowners in these NEC Focus Areas have also allowed CT DEEP wildlife biologists to radio-track NEC on their land to gain insight into eastern cottontail (*Sylvilagus floridanus*) interactions and NEC response to hunting.

Kelly Boland/USFWS

New England cottontail on Great Bay National Wildlife Refuge

In the western part of Connecticut around the Housatonic NEC Focus Areas, The Nature Conservancy has been working on its own land and with private landowners to both enhance and protect land for bog turtles, which also may benefit NEC. There is a similar focus on bog turtles within the Harlem-Housatonic NEC Focus Areas in eastern New York, where the Mid-Atlantic Center for Herpetology and Conservation has assisted with NEC survey efforts. Also in these NEC Focus Areas, partners including the CT DEEP and NRCS have approached landowners and are working towards viable shrubland projects. To date, a total of 230 acres are being planned and managed to create shrubland habitat.

In addition to partnering with many of the organizations mentioned above, Service programs are making additional contributions to shrubland management in the northeast. The Service's Division of Wildlife and Sport Fish Restoration (WSFR) has distributed millions of dollars to our state partners for shrubland protection, restoration and management. WSFR has also distributed funds to federally recognized Native American Tribes for their contribution to shrublands. For example, the Narragansett Tribe in Rhode Island received $160,479 to monitor NEC populations and conduct shrubland management on tribal lands.

The Service's Partners for Fish and Wildlife Program funds shrubland management projects on lands not eligible for funding through Farm Bill programs, including corporate lands and privately owned tracts where active habitat projects have reached Farm Bill funding limits. Along with programs administered by the WMI and other partners, this program has managed approximately 1,043 acres for shrubland habitat from 2010 through 2014, thus benefiting NEC and other shrub-dependent species.

Several national wildlife refuges located adjacent to or near NEC Focus Areas have been protecting and maintaining shrublands as part of their regular

management activities. These refuges include Rachel Carson, Parker River, Wallkill, and Great Bay NWRs; Eastern Massachusetts and Rhode Island NWR Complexes; and the Silvio O. Conte National Fish and Wildlife Refuge. For example, Rachel Carson NWR has included in its Habitat Management Plan objectives for managing over 1,400 acres of early-successional and maritime shrubland habitat. In 2014, Mashpee NWR took several management actions, including thinning and burning, to improve 110 acres of forest/shrubland habitat. Refuge staff plans to do the same for another 80 acres in 2015. After Hurricane Sandy, DOI committed over $285,000 to the rehabilitation of 190 acres of shrublands near coastal wetlands at Rachel Carson and Parker River NWRs and at Eastern Massachusetts and Rhode Island NWRCs. Existing partnerships between refuges and other land-protection partners (state agencies, non-governmental organization, land trusts, etc.) present high-value opportunities to protect and manage valuable shrubland habitat.

Staff from the Service's Migratory Bird Program and Science Applications Program has also participated in efforts to conserve more shrubland in the northeast. Biologists from these programs have participated in designing shrubland-dependent migratory bird models and surveys to help determine the locations of the highest-quality shrubland habitat in the northeast. The Migratory Bird Program also works with public and private entities both in the United States and in other countries to set habitat and population goals for high-priority shrubland-dependent birds whose populations are in decline.

Alternative B – The Service-Preferred Alternative

Under alternative B, all the Service and partnership efforts described in alternative A would continue. In addition, the Service would seek approval to establish the proposed Great Thicket NWR and to acquire in fee or easement 15,000 acres of shrublands and/or lands that would be managed primarily as early successional habitat. The authority to acquire new lands for the proposed refuge would be in addition to any acquisition authorities the Service currently has for existing national wildlife refuges in the Northeast Region. We believe that the establishment of a new refuge to address the issue of early successional habitat and shrubland loss would build upon and strengthen the Service's work in the northeast, and would enable the Service to implement a landscape-level conservation program centered on the shrubland ecosystem.

As previously mentioned, the NEC Conservation Strategy was intended to design a landscape that would conserve the NEC. Since that species is a surrogate for an entire suite of shrubland-dependent species, we used that conservation design as a starting point for our proposal. As mentioned earlier in alternative A, state NEC land management teams set target acres of shrubland management on public and private lands. However, in order to meet the NEC Technical Committee's rangewide habitat and population goals for the rabbit, up to 15,000 additional acres of shrubland habitat would be needed, beyond existing efforts on secured lands within designated NEC Focus Areas (Fuller and Tur 2012). This estimated additional need provides the context for the scope of our proposal. Using the upper end of this range, we propose in alternative B to seek fee or easement acquisition authority for approximately 15,000 acres.

Landscape Conservation Design

After gaining PPP approval in 2012, we worked with the NEC Technical and Executive Committees, state land management teams, WMI, and other partners to determine where and how the Refuge System could make the highest and best contribution towards protecting shrublands, with an added emphasis on shrubland-dependent birds and federally listed species. We started at the landscape level with the 40-plus NEC Focus Areas delineated throughout the six northeast states by the NEC Technical Committee. Some of these NEC Focus Areas are quite large, and with only 15,000 acres to work with, we narrowed

our scope to key areas that would contribute to the Strategic Growth priorities mentioned in chapter 1. In the end, we determined there were 10 NEC Focus Areas that could benefit from the additional tool of Federal land protection to secure habitat for the full suite of shrubland dependent wildlife.

Piping plover

Gene Niemien/USFWS

The 10 NEC Focus Areas were still too large for a 15,000-acre proposal, so we turned our attention to the NEC model output which identified highly ranked parcels for NECs and associated shrubland species. Specifically, we focused our attention around clusters of the highest ranked parcels where the best opportunities exist for creating and maintaining quality shrubland habitat over the long-term to benefit declining priority shrubland species. We then employed the Strategic Growth Policy criteria which, as stated in chapter 1, direct the Service to acquire interests in lands that support the recovery of federally listed species, contribute towards achieving waterfowl population objectives, and conserve migratory birds of conservation concern. In doing so, we consulted numerous data layers such as bird migration radar mapping, bird conservation plan focus areas, representative species modeling (e.g., prairie warbler), and threatened and endangered species occurrences (bog turtle, northern red-bellied cooter). We looked for the greatest overlap of all these data layers and drew preliminary lines around potential areas for Service acquisition. In many areas we were able to encompass at least two of the Strategic Growth priorities. For example, the Pachaug-Ledyard Focus Area in Connecticut includes areas that are important to the federally listed piping plover (*Charadrius melodus*). This area is also a top priority for migratory birds in four major national bird prioritization plans. In other areas we were able to encompass all three Strategic Growth priorities. For example, the Plymouth Focus Area includes critical habitat for the federally listed northern red-bellied cooter, a landbird focus area encompassing the southeastern Massachusetts pine barrens, and highly ranked NEC parcels.

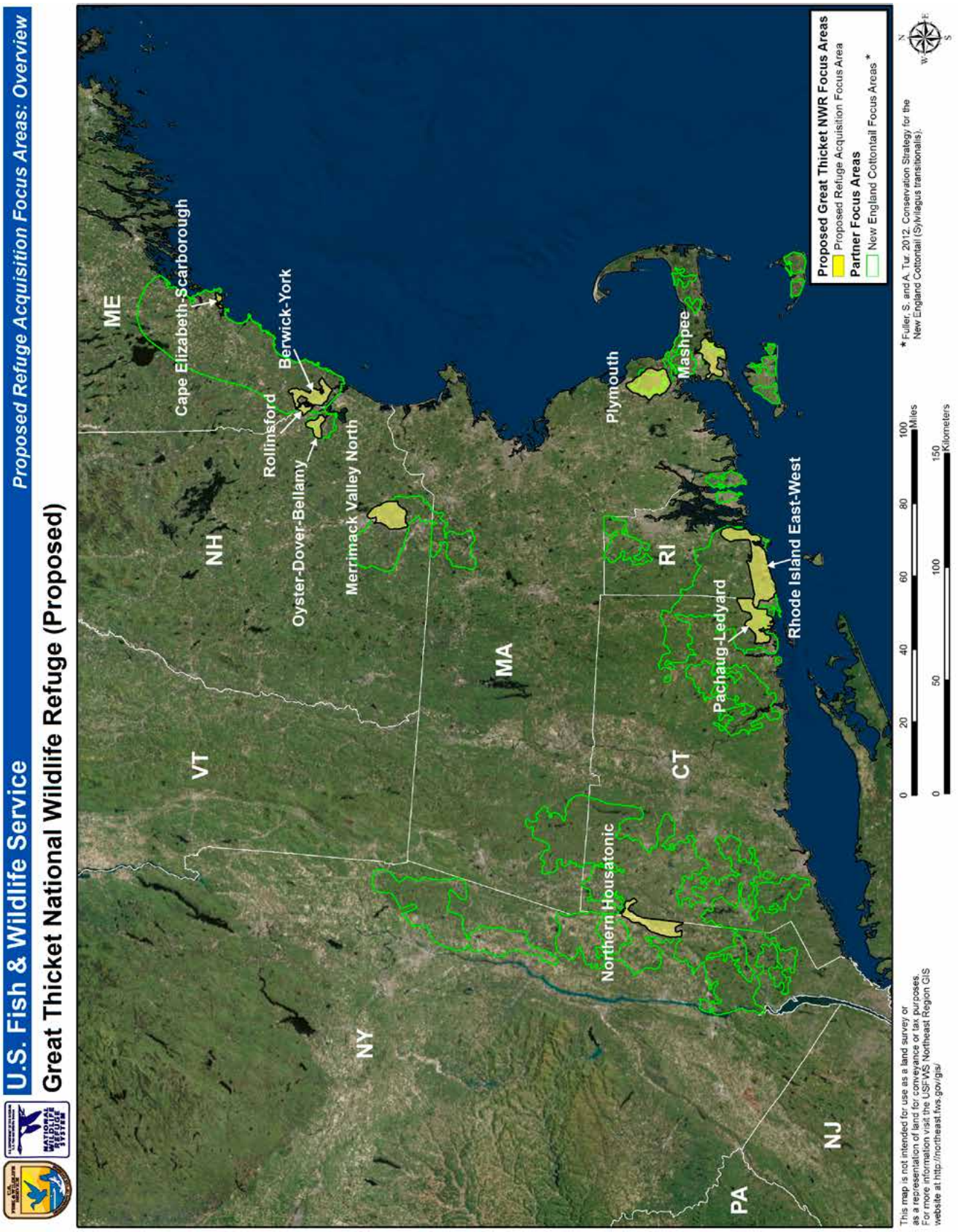
We presented preliminary land acquisition focus areas to a wide range of representative groups including our state partners and Service colleagues. Through thoughtful discussion and deliberation we refined the line work and settled on 10 draft RAFAs. Map 3 shows the general area of the RAFAs in relation to the NEC Focus Areas.

Refuge Acquisition Focus Areas

The 10 proposed RAFAs are distributed throughout six northeast states. As noted in chapter 1, we embraced a unique approach in which we identified target acres within each RAFA. The broad, conceptual RAFAs encompass about 298,820 acres while the target acquisition acres add up to the PPP-approved 15,000 acres (see Table 1 below). We turned to the NEC Conservation Strategy to derive the specific target acres for each RAFA. For each NEC Focus Area, State Land Management Teams and the NEC Technical Committee estimated acres of shrubland habitat the partners could be expected to contribute on currently secured conservation lands. They also estimated the "need for voluntary participation" to provide additional shrubland beyond secured lands that would be needed to meet NEC habitat and population goals. We developed our target acres using the "estimated need for voluntary participation" in each area.

This approach of target acres embedded in larger RAFAs differs from the traditional refuge approach in which we draw definitive lines on the landscape, identify every parcel within those lines, and propose to acquire a fee or easement interest in each parcel. We believe our proposal is more suited for landscape-level conservation because it provides maximum flexibility for land protection opportunities. It will allow us to help state land management teams react to willing seller opportunities and secure key parcels with respect to important core/source NEC populations.

Map 3: Proposed Refuge Acquisition Focus Areas: Overview



We will seek to acquire tracts in close proximity to partners to allow the Service and partners to pool management resources, and provide greater certainty that shrublands would continue to be managed over the long term. The high degree of certainty of long-term management provided by Service acquisition was identified as an important contribution to the successful implementation of the NEC Conservation Strategy and was considered during the Federal listing evaluation process for the NEC.

Table 1: Refuge Acquisition Focus Areas

Focus Area	Total Acres in Focus Area	Target Acreage for Service Acquisition
Cape Elizabeth-Scarborough (ME)	3,254	~800
Berwick-York (ME)	26,410	~2,000
Rollinsford (NH)	4,705	~500
Oyster-Dover-Bellamy (NH)	10,913	~500
Merrimack Valley North (NH)	36,495	~500
Pachaug-Ledyard (CT)	38,208	~3,500
Plymouth (MA)	43,035	~500
Mashpee (MA)	28,633	~1,500
RI East-West (RI Coast)	71,440	~3,200
Northern Housatonic (NY-CT)	35,727	~2,000
Totals	**298,820**	**~15,000**

We also developed criteria which will be used to evaluate and guide acquisition decisions on a parcel-by-parcel basis as willing seller opportunities present themselves. Our criteria are listed below, in order of importance:

1. Strategic Growth Priorities
The Service's Strategic Growth Policy lists three priorities for conservation: threatened and endangered species, migratory birds in decline, and waterfowl. We will acquire lands that contain or are in close proximity to the greatest overlap of these three priorities.

2. New England Cottontail
The NEC has been designated as a surrogate species for a variety of associated, high-priority shrubland-dependent species. We will prioritize tracts that contain, are adjacent to, or are in close proximity to known populations of NEC.

3. Landscape Connectivity
We will give priority to parcels that can potentially provide critical connectivity between two extensive patches of habitat containing target wildlife species or shrubland-related habitat types.

4. Site Suitability
Prioritizing tracts that naturally lend themselves to sustaining shrubland habitat will allow us to use our resources more wisely and efficiently.

5. Proximity to partners
Acquiring tracts in close proximity to our partners will allow the Service and its partners to pool management resources and provide greater certainty that shrublands will continue to be managed over the long-term.

USFWS

American black duck

The **Maine and New Hampshire RAFAs** were located to provide Service acquisition assistance in areas that contain core or source populations of NEC and that are proximate to the existing Rachel Carson and Great Bay NWRs. Both refuges have identified goals and objectives for the restoration and management of shrublands and young forest in support of the NEC and declining shrubland birds in their approved CCPs. The NEC is a state-listed species in both states. Maine is the only State where the NEC is not facing competition from the non-native eastern cottontail.

The **Cape Elizabeth–Scarborough RAFA** contains two Important Bird Areas (IBA), with a third being considered for just the Scarborough area. Coastal parcels in this RAFA offer opportunities to help protect naturally persistent maritime shrubland along with associated coastal beach and marsh habitats important to the federally threatened piping plover and waterfowl such as the American black duck (*Anas rubripes*). Cape Elizabeth contains the largest known occupied patch of NECs in the states of Maine, New Hampshire, and Rhode Island. As such, rabbits in this area are used as a source for captive rearing efforts in other states.

The **Berwick–York, Rollinsford, and Oyster–Dover–Bellamy RAFAs** were designed to help provide shrubland landscape connectivity for the NEC and shrubland birds between the states of Maine and New Hampshire. The Maine side is considered a key area within the State for surrogate species such as the blue-winged warbler due to the presence of remaining farm ownerships and old field habitat. The Berwick-York RAFA also contains numerous rivers, wetlands and ponds, and is known for supporting concentrations of SGCN such as the Blanding's turtle (*Emydoidea blandingii*). The New Hampshire seacoast area is characterized by naturally sustaining pitch pine-scrub oak communities that support shrubland bird surrogates, and strong landscape partnerships with the need for additional Federal assistance. The **Merrimack Valley North RAFA** is within the Merrimack North NEC focus area, for which the recently modified habitat and species goals reflect the commitment of conservation partners to support a viable population of NEC. The area supports the largest population of NEC in New Hampshire, hosts an IBA along the Merrimack River, and supports numerous shrubland bird surrogates.

The **Plymouth RAFA** in southeastern Massachusetts focuses on an area just south of Plymouth that contains pine barren habitat and a high concentration of kettle-hole ponds. It includes the Massasoit NWR, created to help support the cooter, whose population is centered in these ponds and for which critical habitat has been designated. That State is heavily involved in land protection in this area with the Miles Standish State Forest and MDFW's long-standing relationships with local large landowners. This area was located to allow the Service to help secure additional lands in support of cooter recovery efforts, and offer overlapping potential for Service assistance with shrubland and young forest protection for migratory bird co-management and possible NEC support. This particular area is within a designated landbird focus area for shrubland species, due to the importance of the pitch pine-scrub oak community.

Habitat preservation, enhancement, restoration and management in support of cooter recovery plan goals will be a high priority for this RAFA. The 5-year review for the cooter recommends additional protection through fee acquisition, conservation easement, purchase of development rights or other means, of the most important pond shore habitats supporting the species in Plymouth County. Approval will allow Service acquisition, easements, and cooperative agreements to contribute open-canopy management for shoreline nesting areas and help maintain long-term corridor connectivity between ponds and turtle populations. Our intent is to create and maintain openings along shorelines to facilitate nesting, and secure key parcels linking populations to maintain and enhance

viability. We will continue to coordinate with the MDFW and other conservation partners as acquisition and management opportunities arise.

The **Mashpee RAFA** was delineated to encompass a major stronghold for the NEC, the most consistent core/source population in Massachusetts, and represents opportunities for dispersal and translocation from this area. It is also an important area of overlap with a designated landbird focus area for shrubland birds, centered on the area's pine barren habitat. It is a highly suitable site for shrubland and young forest management in general, due to the extensive naturally sustaining pitch pine-scrub oak communities. There is a high degree of partnership opportunity in the area, and the centrally located Mashpee NWR was created with the intention of operating as a partnership refuge. The MDFW, Department of Defense, and many local non-profit conservation organizations are currently working with the Service in this landscape, sharing staff and equipment and cooperating in habitat management activities such as controlled burning for pine barrens and shrubland maintenance. The Mashpee NWR is already a member of a strong land protection partnership, and has established relationships with local towns and land trusts. We intend to continue partnership activities and to collaborate on management of acquired lands and easements and nearby partner lands. In this particular RAFA there are opportunities for no-cost transfers to the Service from partner organizations, and for our agency to enter into management agreements to co-manage lands.

The **RI East–West** and **Pachaug–Ledyard RAFAs** were located along the southern New England coast to allow overlapping opportunities for Service acquisition contributions to NEC partnership activities and migratory bird conservation efforts. This area has been shown to support important bird migration concentrations through recent Service-supported radar analysis of fall bird migration stopover sites (Buler and Dawson 2012, 2014). Refinement of this study is continuing with Service support. A fall banding station at Ninigret NWR, located within the RI East-West RAFA, has documented diversity and abundance of birds during fall migration over the last 4 years. Naturally persistent and successional shrubland habitats within a several miles-wide zone along the coast support both shrubland and forest-dependent birds that refuel on fruits provided by shrub communities in the fall. These RAFAs are also within NEC Focus Areas that currently host core populations of rabbits or represent State land management team intentions to restore NEC populations through habitat management and re-introduction efforts. These collaborative efforts also involve a captive breeding program at the Roger Williams Zoo in Rhode Island, refuge habitat management, hardening pens and reintroduction at the Rhode Island NWR Complex. As mentioned earlier, refuge staff has also been successful in using leases- temporary interests in land-to accomplish goals and objectives for shrubland management. Indeed, there are two known locations within this RAFA where landowners have expressed an interest in leasing their land rather than selling an easement.

The **Northern Housatonic RAFA**, along the New York-Connecticut border, focuses on the Ten-mile River/Webatuck/Mill Creek valley bottom and portions of surrounding forested slopes. This area was located to allow a Service contribution to bog turtle recovery efforts, and offer overlapping potential for Service partnership assistance with NEC goals and shrub and young forest management opportunities for migratory bird co-management. Habitat management for shrubland species and the bog turtle can be juxtaposed and timed to benefit both. One of the greatest threats to bog turtles is the continued loss, alteration, or fragmentation of the species' highly specialized wetland habitat (USFWS 2001). This valley contains numerous bog turtle sites and includes wetlands that provide existing or potential bog turtle habitat and

farmlands that offer wetland restoration opportunities for turtle habitat. We will strive to acquire and manage parcels with wet meadows and calcareous fens, with adjacent upland and wetland shrub habitats and young forest. Where possible we will also seek to restore former wetlands that were historically ditched, drained and converted to agricultural fields.

We intend to continue to coordinate with our State and other conservation partners as acquisition and management opportunities arise. The recovery plan recommends the acquisition of bog turtle sites where available over time within this area. In coordination with the Service's New York and New England Field Offices and Bog Turtle Recovery Team, we will work to set back succession and control invasive plants using such management tools as mowing or mulching, biological control agents, herbicides, girdling red maple stems, and light grazing of livestock. The conceptual management plan in appendix A describes how we intend to manage shrublands for priority species, including the bog turtle.

Land Protection Options

In developing our proposed action, we considered several land protection options. Those options are listed below in no priority order:

Option 1: Landowner retains ownership and all use of property.

Option 2: Management and/or land protection measures by others.

Option 3: Less-than-fee-title acquisition (easement, lease, management agreement) by the Service.

Option 4: Fee-title acquisition by the Service.

Our proposal includes a combination of Options 1, 2, 3, and 4. We believe this approach outlines a selection of voluntary, flexible, and cost-effective methods of implementing Service policy of seeking only the minimal level of protection needed to accomplish refuge goals and objectives, and to acquire a Service interest only from willing sellers. These options would provide a menu of alternatives to be responsive to the preferences of local landowners interested in contributing to conservation, but who may or may not want to sell an interest in their lands.

In general, lands in which the Service has a real estate interest will be managed and administered by the nearest existing national wildlife refuge, at least in the short-term.

Option 1: Landowner Retains Ownership

Landowners who do not wish to convey their lands to the Service or another conservation entity may still like to improve their lands for wildlife. We may provide technical expertise or inform the landowner of incentive programs offered by the Service or its partners to assist in habitat conservation. Landowners within a RAFA would not be subject to any additional obligation or regulation due to this designation.

Option 2: Management and/or Land Protection by Others

It is not our intent that the Service be the primary means of land protection within the larger RAFAs but rather, in combination with other partners and landowners, to ensure sufficient habitat protection to establish self-sustaining populations of NEC and other shrubland-dependent species. We recognize that many of our partners have long-standing relationships with landowners in the NEC Focus Areas, and even within the smaller RAFAs. We also recognize that for a variety of reasons, such as management capability and feasibility, it is more logical for our state or other partners, rather than the Service, to acquire

certain parcels. This proposal would enhance the availability of protection efforts by expanding the options available to the landowner, rather than compete or duplicate existing partner initiatives.

Our proposal complements the diverse menu of partner initiatives, such as the USDA voluntary landowner incentive programs included in the 2014 Farm Bill that are intended to restore wetland and wildlife habitat, and employ best management practices for land stewardship. Each of these voluntary programs, and similar state and locally based conservation alternatives, are important conservation strategies to promote an integrated and sustainable working landscape. Management and protection of land and related resources by others will continue to add to the larger goal of increasing habitat for shrubland-dependent wildlife.

Following approval of this proposal, our intent is to continue working with our partners to determine which parcels are best suited for Federal acquisition. We will continue to collaborate with the NEC Technical Committee and the six state land management teams. We will also remain a part of the NEC Land Protection Working Group which is looking to track acquisition in NEC Focus Areas and to bring partners together once or twice a year to discuss land acquisition priorities. In this way, the Service will utilize the participation of the states and other partners to identify the most appropriate parcels for Service protection and to meet our mutual wildlife conservation goals.

Option 3: Easements, Leases, and/or Management Agreements

The Service acquires lands and interests in lands, such as easements, and management rights on lands through leases or cooperative agreements for the conservation of fish and wildlife and to provide wildlife-dependent recreational and educational opportunities. This option would employ long-term, renewable easements, leases, and/or management agreements as a means of protecting and managing land by purchasing only a partial interest from willing landowners, typically in the form of a conservation easement. Short-term leases may be used to protect or manage habitat until more secure land protection can be negotiated.

Bill Thompson

Chestnut-sided warbler

Conservation easements convey a partial, but permanent, interest in land to the Service. Other less-than-fee options include cooperative management agreements or leases, which convey management rights on a temporary basis. Similar to an easement, a lease represents an interest in the real estate for a specific period of time. Service easements are typically perpetual, while leases are temporary. The Code of Federal Regulations applies when the Service acquires interests in land via leases. We could post the property and protect it as a national wildlife refuge for the duration of the lease, provided the appropriate clause was agreed to by the landowner (lessor) who is granting the lease.

Easement interests in land are acquired at market value from willing sellers to accomplish the purposes of the refuge, although easement interests can also be donated by other agencies, organizations, and individuals. The underlying fee title to the property is retained by the landowner, leaving the parcel in private ownership. The Service and landowner agree to land-use practices that enable both to meet their conservation goals, as well as provide the landowner continued stewardship and management of these lands. In some instances, early dialogue may reveal there are more suitable options offered by one of our other conservation partners.

We will negotiate, on a case-by-case basis, the extent of the rights that we will acquire. Those may vary, depending on the configuration and location of the parcel, the current extent of development, habitat management requirements,

the needs of the landowner, and other considerations. The structure of such easements will provide permanent protection of existing wildlife habitat while also allowing habitat management or improvements and access to sensitive habitats, such as for endangered species or migratory birds. A conceptual management plan in appendix A describes how we intend to manage shrubland habitat for early successional species on easement or fee lands.

Properties subject to easements generally remain on the tax rolls, although the change in market value may reduce the assessment and ultimately the amount of property tax liability for the landowner. The Service does not pay refuge revenue sharing (i.e., funds the Service pays to counties in lieu of taxes) on easement rights.

In those instances where we identify conservation easements, we will be interested primarily in purchasing the rights necessary to protect the desired wildlife and habitat values along with wildlife management and/or public access rights. Easements are best employed by the Service as a conservation measure when: (1) only minimal management of the resource is needed, but there is a desire to ensure the continuation of current undeveloped uses, wildlife habitat conditions, public access, and to prevent fragmentation over the long term; and (2) a landowner is interested in maintaining ownership of the land, does not want it to be further altered, and would like to realize the benefits of selling development rights, management rights, and/or public access rights.

Option 4: Fee Title Acquisition

When and where appropriate, the Service will acquire parcels in fee title from interested willing sellers, thereby purchasing all rights of ownership. This option provides us the greatest flexibility in managing priority lands, and ensuring the protection in perpetuity of nationally significant wildlife trust resources, and providing opportunities to engage the public with wildlife-dependent recreation and education opportunities. Generally, the lands we will buy require more than passive management and may include controlling invasive species, mowing or prescribed burning. (See appendix A for more information on potential habitat management techniques for shrubland and young forest habitats). We only propose fee-title acquisition when adequate land protection is not assured under other ownership scenarios, active land management is required, or we determine the current landowner is interested in a fee-title acquisition transaction and is unwilling to sell a partial interest such as a conservation easement. In some cases, it may become mutually advantageous to convert a previously acquired conservation easement to fee title acquisition, such as when a landowner is interested in selling the remainder interest in the land on which we have acquired an easement. We would need to conduct another appraisal to determine the market value of the residual land rights. We will evaluate this need on a case-by-case basis.

In order to determine the value of the land, either fee or easement, a real estate appraiser familiar with the local market will be contracted to appraise the property to determine its market value. The appraisal is based on comparable sales in the local real estate market and must meet stringent Federal and professional appraisal standards. Once an appraisal has been completed and approved by the DOI's Office of Valuation Services, we can present an offer to the landowner. The Service is required by Federal law to offer 100 percent of the appraised market value for fee or less-than-fee acquisitions; however, we can also accept landowner offers of less than appraised value via donation.

Finally, the Service also has the authority to exchange land in Service ownership for other land that has greater habitat and/or wildlife value. Inherent in this

concept is the requirement to get dollar-for-dollar land value with, occasionally, an equalization payment. Exchanges are attractive because they usually do not increase Federal land holdings or require purchase funds. However, they are often complicated and can take a long time to complete.

Costs

During planning for the proposed Great Thicket NWR the Service identified 298,820 acres within 10 focus areas which span portions of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, and New York. Of these 298,820 acres, the Service is seeking authority to acquire approximately 15,000 acres in fee title or conservation easements. The estimated cost to acquire the entire 15,000 acres for the proposed Great Thicket NWR is between $84 million and $129 million (see Table 2). The cost-per-acre values used in this rough estimation are based on land purchases associated with nearby national wildlife refuges for each RAFA. For this exercise, we extrapolated a low-to-high range of values. Because the method of acquisition would be determined on a case-by-case basis for each landowner, it is impossible to pre-determine how many acres would be acquired in fee title and how many acres would be acquired in a conservation easement, so we have provided a low range based on the acquisition of conservation easements on all 15,000 acres and a high range based on the fee title acquisition of all 15,000 acres. This range in value is affected by the following factors:

- The per-acre value is affected by the land use associated with lands for purchase. Developed or developable lands have a higher per-acre value than wetlands or lands that for a variety of reasons may not be susceptible to development pressures.

- Per-acre value is also affected by parcel size. Most of the focus areas contain tracts of land that are relatively small. Parcel sizes on the order of 3 to 20 acres are much more common than larger (500 acres or bigger) parcels. The per-acre cost for acquisition tends to be higher for smaller parcels.

Our total estimated cost to acquire in fee title all 15,000 acres is $129,200,000. To determine the average per-acre cost for each of the RAFAs, we reviewed land purchases that were acquired for nearby national wildlife refuges for similar habitat types that we will likely acquire for the proposed Great Thicket NWR. This is based on an average per-acre cost of all size tracts and various land uses. Costs associated with obtaining conservation easements range from 50 to 80 percent of the fee title value of the property. Using a mid-range easement estimate of 65 percent of fee title value provides a low end estimate for acquiring conservation easements on all 15,000 acres at $83,980,000. This is also based on an average per-acre cost of all size tracts and various land uses. This provides us with a high/low range of value for acquisition of the entire 15,000 acres. It is important to note that these costs are only provided as an approximation. There are many factors that will influence the costs associated with acquiring in fee or easement all 15,000 acres of the proposed refuge. These factors include donations, transfers, leases, management agreements, the ratio of fee-title to conservation easement purchases, and land value fluctuations over time. Therefore, the total cost of the land acquisition envisioned for the proposed Great Thicket NWR would fall somewhere between $84 million and $129 million at current market values.

Rusty blackbird

Bill Thompson

Table 2: Fee and Easement Costs by RAFA

Focus Area	Total Acres	Target Acres	Fee Title Cost per Acre	Fee Title Total Estimated Cost	Easement Cost per Acre	Easement Total Estimated Cost
Cape Elizabeth - Scarborough (ME)	3,254	~800	$7,000	$5,600,000	$4,550	$3,640,000
Berwick-York (ME)	26,410	~2,000	$7,000	$14,000,000	$4,550	$9,100,000
Rollinsford (NH)	4,705	~500	$7,000	$3,500,000	$4,550	$2,275,000
Oyster-Dover-Bellamy (NH)	10,913	~500	$7,000	$3,500,000	$4,550	$2,275,000
Maine/NH Coast Sub-region	45,282	3,800		$26,600,000		$17,290,000
Merrimack Valley North (NH)	36,495	~500	$7,000	$3,500,000	$4,550	$2,275,000
Merrimack Valley Sub-region	36,495	500		$3,500,000		$2,275,000
Plymouth (MA)	43,035	~500	$9,000	$4,500,000	$5,850	$2,925,000
Mashpee (MA)	28,633	~1,500	$9,000	$13,500,000	$5,850	$8,775,000
Southeastern MA Sub-region	71,668	2,000		$18,000,000		$11,700,000
Pachaug-Ledyard (CT)	38,208	~3,500	$11,000	$38,500,000	$7,150	$25,025,000
RI East -West (RI)	71,440	~3,200	$11,000	$35,200,000	$7,150	$22,880,000
Southeastern CT/Rhode Island Sub-region	109,648	6,700		$73,700,000		$47,905,000
Northern Housatonic (NY-CT)	35,727	~2,000	$3,700	$7,400,000	$2,405	$4,810,000
New York/CT Border Sub-region	35,727	2,000		$7,400,000		$4,810,000
Totals	**298,820**	**~15,000**		**$129,200,000**		**$83,980,000**

Additional costs associated with this proposal include boundary posting, interpretive signs, and other outreach materials. These costs can be estimated at approximately $3,000 per 1,000 acres, for a total of roughly $45,000 across the project area.

There may be a long-term need to hire some additional staff for the proposed Great Thicket NWR, depending on the proximity of newly acquired lands to existing national wildlife refuges. Some additional workforce requirements may only be seasonal or temporary. These needs will be evaluated on an individual-refuge basis as budgets allow.

Funding

There are many costs associated with Federal land acquisition, including direct land costs and incidental real estate expenses associated with appraisals, surveys, title work, and relocation expenses. The main source of appropriated dollars for fee title or easement acquisition is the Land and Water Conservation Fund (LWCF). The primary source of income to this fund is fees paid by companies drilling offshore for oil and gas, as well as oil and gas lease revenues from Federal lands. Additional sources of income include the sale of surplus Federal real estate and taxes on motorboat fuel. Other sources of Federal land conservation funding include the Migratory Bird Conservation Fund and North American Wetlands Conservation Fund. In many cases our land conservation goals are achieved by combining Federal funds with funding from state wildlife agencies, Federal partners, private non-profit groups and other partners. Indeed, we believe the establishment of a new national wildlife refuge would create even

more of an opportunity and justification for our partners to participate and leverage their human and financial resources within a partnership context to support of mutually beneficial programmatic and landscape agency goals.

There are also several funding sources for landowners who wish to participate in shrubland conservation by conducting habitat restoration or selling temporary easements on their land, but who are not willing to sell fee title to the Service. Some of these funding sources come from the Service in the form of Partners for Fish and Wildlife and Coastal program grants, as well as Competitive State Wildlife Grant agreements. Other funding sources come from NRCS programs such as the Environment Quality Incentives Program and the Wetland Reserve Easement Program. Further, additional resource accomplishments could be realized using U.S. Department of Transportation funding and U.S. Environmental Protection Agency (USEPA) funding. These funding sources provide opportunities to stimulate vital resource accomplishments and decrease Service costs over the long-term.

It is important to note that given the costs associated with this project and in light of our willing-seller-only approach, it could take 50 years or more to acquire fee or easements for the entire proposed 15,000- acre proposed refuge. A long-term commitment of this nature is not at all uncommon when compared to the status of other Refuge System land protection projects.

Public Use

National wildlife refuges are managed specifically for wildlife and wildlife habitat. While wildlife comes first with regard to management of these lands, public uses may be allowed when they are found to be both appropriate and compatible. An appropriate use finding is the initial decision-making process a refuge manager follows when considering whether to allow a proposed use on a refuge. If a new use is not appropriate, the refuge manager will deny the use without determining compatibility.

In the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57; 111 Stat. 1235) (Improvement Act), Congress directed the Service to give special consideration to allowing wildlife-dependent recreational activities on national wildlife refuges. The six wildlife dependent public uses that were identified in the Improvement Act are hunting, fishing, wildlife observation, wildlife photography, environmental interpretation, and environmental education. These uses do not require an appropriateness determination. However, a refuge manager must still determine if these uses are compatible with the mission of the Refuge System and the purposes of the proposed refuge before permitting them.

Hunting upland game birds

USFWS

As lands are added to the proposed Great Thicket NWR, the refuge manager will make a pre-acquisition compatibility determination. The purpose of a pre-acquisition compatibility determination is to inform the public, prior to acquisition, which pre-existing wildlife-dependent recreational public uses will be allowed to continue on newly acquired lands. Pre-acquisition compatibility determinations only apply to existing wildlife-dependent recreational public uses and are intended to be short-term in nature, bridging the gap between acquisition of refuge lands and completion of refuge CCPs or step-down plans.

Regarding lands the Service acquires that do not have pre-existing wildlife-dependent recreational public uses, these lands will be closed to the public until a CCP or a step-down management plan is

completed. At such time we will review each parcel that is acquired and we will manage public uses in accordance with our policies. At this juncture, it is difficult to state with certainty what uses may or may not be permitted on lands that may be eventually acquired as part of this proposal.

In particular, many of our state partners have asked whether we will open newly acquired lands to hunting. We generally open new lands for hunting when we have acquired manageable units and when those units can biologically, ecologically, and safely accommodate hunting within state guidelines. The following facts demonstrate the Service's commitment to providing access for hunting and other wildlife-dependent activities on refuge lands:

- Hunting is one of six priority public uses of the Refuge System, as directed by the Improvement Act.
- All six priority uses, including hunting, have been pre-determined to be appropriate uses of refuge lands, thus negating a requirement for an "appropriateness review" to which non-priority uses are subjected.
- Executive Order 13443, *Facilitation of Hunting Heritage and Wildlife Conservation*, directs the DOI and its component agencies, bureaus and offices "to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat."
- Currently, 18 national wildlife refuges within the six-state project area are open to some form of hunting.

By law, all refuge lands are closed to public use until opened. The process for opening a refuge to hunting requires the following:

- NEPA compliance, usually through preparation of an EA and a Finding of No Significant Impact;
- Compatibility Determination by the refuge manager, and concurrence from the Regional Chief of the Refuge System;
- Hunt Plan;
- Compliance with Section 7 of the ESA (Intra-agency consultation);
- Concurrence from the state fish and game agency and possibly Tribal concurrence;
- Publication of special refuge regulations;
- Outreach plan; and
- News release.

Refuge managers must consider the time commitment involved in completing the process outlined above, along with safety and other logistical issues, when considering opening a refuge to hunting or other visitor uses.

It is important to note that easement acquisition, now proposed to account for 50 percent of the 15,000-acre acquisition proposal, generally does not give the Service rights to manage hunting. Typically hunting rights and the ability to control public access are reserved by the landowner.

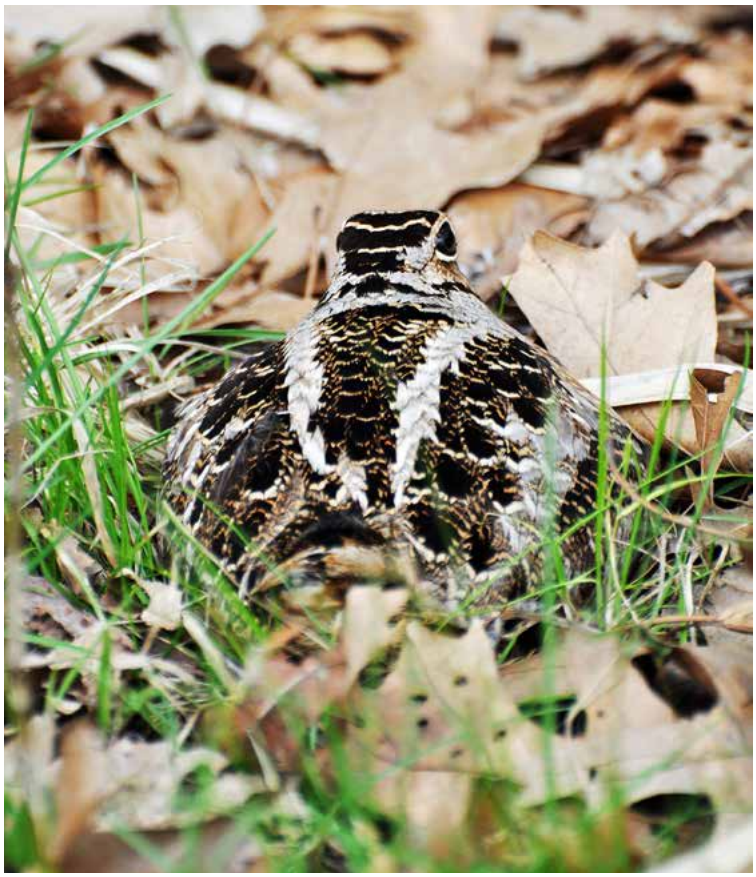
Another important consideration in this discussion is the fact that acquisition of 15,000 acres will take considerable time. The earliest year that the Service could request funding from LWCF is 2017, and more likely 2018. Based on experience and recent funding, it would likely take many years to reach the 15,000-acre goal for the proposed Great Thicket NWR.

Alternatives or Actions Considered but Eliminated from Detailed Study

There were some alternatives or actions that were suggested to us or that we discussed internally but chose not to analyze in detail. Below we discuss why we eliminated them from further analysis.

The Service would only acquire lands in RAFAs that are adjacent to existing national wildlife refuges: While this alternative would result in administrative efficiencies, it would exclude half the states we have been coordinating with, namely New Hampshire, Connecticut, and New York. It would also exclude many high priority NEC Focus Areas. All six states that we have been working with fully support increased refuge acquisition authority and have specifically asked for the Service to assist in protecting and managing shrubland in their state. All our partners, including the states, agree that the increased level of long-term certainty of management that would result from Service ownership is critical to the success of the overall shrublands conservation effort. Furthermore, we did not feel that we could make a biologically meaningful contribution towards restoring and maintaining the amount of shrubland habitat needed in the Northeast Region by focusing our efforts on only three states. Indeed, the concept of this alternative would be based largely on administrative justification and management capability rather than on SHC and LCD.

American woodcock



Matt Poole

The Service could acquire all easements and no fee: Although we thought about a specific alternative where the Service would acquire only easements and no fee lands, we realized that, as mentioned above, Service policy already addresses this issue. Our land acquisition policy allows for the purchase of only easements within this proposal, however, it is possible that some landowners would not be interested in selling an easement and would only be willing to sell their land in fee title. Proposing an alternative that only allows us to acquire easements could limit us from acquiring important shrubland habitat and would not address the purpose and need of our proposal. As such, under the alternative B, the Service would acquire whichever interest in land is needed to accomplish its management objectives, and whichever interest the landowner is willing to sell.

Chapter 3

Malin Clyde/UNH Cooperative Extension

Shrubland habitat on a University of New Hampshire property

Affected Environment

Resources of the Area of Interest

- Cultural Resources and Historic Preservation
- Physical Environment
- Socio-Economic Environment
- Biological Environment

Description of Sub-Regions Containing Refuge Acquisition Focus Areas

- Maine/New Hampshire Coast Sub-Region
- Merrimack Valley-New Hampshire Sub-Region
- Southeastern Massachusetts Sub-Region
- Southeastern Connecticut/Rhode Island Coast Sub-Region
- New York/Connecticut Border Sub-Region

Chapter 3 describes the physical, biological, and socio-economic resources that could be impacted by the alternatives described in chapter 2. In the first section of the chapter, we describe the resources that pertain to the entire AOI. Despite being spread across six states, the AOI has many features that are common across the landscape. For the second section, we group RAFAs into smaller sub-regions and describe particular resources for those smaller sub-regions and how those resources differ from the other sub-regions.

Resources of the Area of Interest

Cultural Resources and Historic Preservation

Coastal New England

Prior to European arrival, coastal southern New England likely supported a "shifting mosaic" of open land habitat within a mostly forested landscape. The open lands were a result of native heathlands, grasslands and shrublands, extensive beaver meadows, periodic fires, shifting agriculture by Native Americans, and occasional hurricanes (Cronin 1983, DeGraaf and Yamasaki 2001). DeGraaf and Yamasaki (2001) and Askins (2000) reported broad evidence for the presence of extensive grasslands along the coast and major rivers in pre-European New England.

Native Americans in southern New England depended on fishing and shellfishing for much of their food. They also hunted birds and trapped and hunted small game. When colonists landed on Massachusetts shores in the early 1600s, they saw large clearings and open woodlands. Waterfowl, deer, ruffed grouse, wild turkey, and wild pigeons were abundant (Marchand 1987, Foss 1992, DeGraaf and Yamasaki 2001). Colonists found old growth forests not far inland, including old stands of mixed hardwoods, white pine, and hemlock at low elevations, and spruce and fir in the mountains (Marchand 1987).

European contact (e.g., explorers and traders) with native people began during the 16th century in New England. Foster and Motzkin (2003) suggested that European arrival prompted such rapid and profound changes to the lifestyle and land use practices of indigenous people that by the time colonists began to settle here, the landscape was already altered. Foster and Motzkin (2003) suggested that expansive clearing for agriculture and semi-permanent (rather than mobile) villages were a new phenomenon and resulted from European influence.

European colonists brought new land use concepts such as permanent settlements and political boundaries. They shifted land use from primarily subsistence farming and gathering to harvesting and export of natural resources (Foss 1992). Just 100 years after the colonists arrived, the forests were rapidly being logged. By 1830, central New England was 80 percent cleared (Marchand 1987).

However, shortly after this, many people began leaving the rough, rocky New England landscape for other opportunities. The abandonment was due to a variety of factors, including the California Gold Rush, the Industrial Revolution, new railroads, richer midwestern soils, and the Civil War. Abandoned farm fields began reverting back to forest. White pine seeded into the fields and pastures and by 1900 was ready for harvest. An understory of hardwoods, released from the shade of white pine, emerged as the new dominant vegetation. This is a legacy that remains today (Marchand 1987, DeGraaf and Yamasaki 2001).

Housatonic River Basin

The Housatonic River Basin is located primarily in western Massachusetts and western Connecticut. However the western headwaters of the basin lie within a small portion of easternmost New York State, where the majority of our

Northern Housatonic RAFA is located. The Tenmile River, Green River, and Williams River are the primary Housatonic tributaries that make up the New York portion of the basin. While the entire Housatonic Basin covers about 1,950 square miles before emptying into Long Island Sound, within New York State the Housatonic tributaries drain only about 219 square miles in the Taconic and southern Berkshire Mountains. The basin includes small portions of Dutchess and Columbia counties. The following summary about the river's cultural and historic resources comes directly from the U.S. National Park Service's 2002 Upper Housatonic Valley National Heritage Area: Feasibility Study and Environmental Assessment.

The upper Housatonic River and its tributaries have played a prominent role in the growth and development of the valley land around them. The earliest settlers, the Native Americans, arrived in the area some 10,000 years ago. They settled along the river's banks, farmed the river's nutrient-rich floodplains, and fished the river. The Mohicans were the local tribe when the English arrived in the 1720s and 1730s. The English settlers made agriculture the major activity throughout the valley for much of the next century. It is still evident today in the wide, fertile floodplain of southwestern Massachusetts and northwestern Connecticut.

Bill Thompson

Monarch butterfly

During the 18th and 19th centuries, waterpower played an important role in the development of industry throughout the valley. Remnants of dams and mill races can still be seen. In the northwest hills of Connecticut, high quality iron ore was abundant. The ore was smelted with limestone in blast furnaces, molded into finished iron utensils, tools, and armaments, and then cooled with river water. Many forests were cleared to make the charcoal used as fuel in the furnaces. The iron industry began in Salisbury in 1734, and more than 40 blast furnaces were in operation from Lanesboro, Massachusetts, to Kent, Connecticut, during the 1800s. The last furnaces ceased operation in 1923. The 1800s also witnessed extensive quarrying of marble and limestone in the "Marble Valley" of northwest Connecticut. Sheffield quarries provided marble for the Washington Monument, New York City Hall, and the Boston Custom House. The Pittsfield region was the first area in the nation to make paper for markets other than its own. By the end of the Civil War there were at least 28 paper mills in Berkshire County alone. By 1850, most towns had small factories along the upper Housatonic's banks, using the river as both a source of water for their manufacturing or milling processes and a dumping ground for their waste products. While these industries provided economic stimulus to the region they also dumped tons of pollutants into the Housatonic River. The Federal Water Pollution Control Act Amendments (1972) and the Clean Water Act (1977) established a system for controlling river pollutants by mandating removal of chemicals from wastewater discharges.

Physical Environment

Geomorphology

The physical landscape of the AOI is the result of several concurrent and successional events: the combination of complex bedrock and surficial geology and recent glacial history; historical mountain-building and regional land uplifting forces; and the dynamic processes of erosion, sedimentation, and chemical and physical weathering acting differentially on rock types of various hardnesses. Such extraordinary physiographic diversity and geological complexity, along with climate and historical events, have contributed directly to the region's remarkable biological diversity and the current distribution patterns of its fauna and flora. One of the most interesting and significant factors to shape the modern landscape of much of North America has been the work of glaciers and the continental ice sheet during the most recent glacial period, the Pleistocene Epoch.

During the height of glaciation, portions of the region were covered by an ice sheet up to 1.6 kilometers (1.0 mile) thick, though its thickness was considerably less along its margins and eastern portions. Over the entire glaciated area, a layer of unsorted and unconsolidated glacial debris, glacial till, ranging from clay particles to huge boulders, was directly deposited on the landscape by the advancing glacier. Following the retreat of the ice sheet, the post-Pleistocene landscape, with its rock-strewn surface and polished bedrock surfaces, was devoid of higher plants and animals, leaving a clean slate for the migration and colonization of modern plant and animal communities in the region.

The weight of the Wisconsin ice sheet caused the crust of the continent to sag, depressing the land. During the maximum period and extent of glaciation during the Wisconsin stage, much of the surface water was locked up as frozen ice in the ice sheet and sea level was some 107 to 122 meters (350 to 400 feet) lower than at present, exposing hundreds of miles of the continental shelf. With the warming of the climate and the retreat of the ice sheet, the depressed land rebounded and sea level rose to its present level and continues to rise.

The New England Province is essentially a northward extension of the larger Appalachian Mountains or Highlands region. It is a plateau-like upland that rises gradually inland from the coast and is surmounted by mountain ranges or individual peaks. The topography of the New England Uplands section is that of a maturely dissected plateau with narrow valleys, and the entire area is greatly modified by glaciation. It is the most widespread of the geomorphic sections in the New England Province, extending from Canada through New England down to the Seaboard section and extending southwestward through New York and New Jersey as two narrow upland projections. Glaciation has resulted in the erosion and rounding off of the bedrock topography and numerous rock basin lakes. Glacial drift is thin, patchy, and stony, and ice-contact features such as kames, kame terraces, and eskers are abundant. The surface of the New England uplands slopes southeast from maximum inland altitudes around 670 meters (2,200 feet), excluding the other mountainous sections of the province, to about 122 to 152 meters (400 to 500 feet) along its seaward edge at the narrow coastal seaboard section, which goes down to sea level.

Most of the region is underlain by igneous and metamorphic rocks that are 136 to over 570 million years old. This bedrock is typically seen in natural exposures along the coast, where glaciers and waves have exposed the underlying rocks.

Water Quality

Both point and nonpoint source pollution affect water quality. Point source pollution originates from a single discharge point; nonpoint pollution sources can originate from numerous sources in the watershed, typically as runoff from the land. Point source pollution includes sewer overflows, sewage pipes leading directly to the water, and industrial discharges from paper mills and other manufacturers. Nonpoint source pollution includes nutrients, bacteria, sediment, oil, and heavy metals that are transported to water bodies from different sources by runoff from storms. Nonpoint source pollution is much harder to manage and control, and is exacerbated by development and increased impervious and polluted surfaces. Faster water carries more sediment and pollutants, and erodes topsoil. Sediments cover aquatic plants, block sunlight from reaching the bottom, and clog the filtering and respiratory organs of aquatic animals. Run-off from uplands carries excess nutrients that can destroy that fragile ecosystem and, eventually, deplete the oxygen in backwaters and coastal ponds. Increased run-off may also cause changes in plant communities along upland edges.

Soils

Heavily influenced by glacial history, the majority of the AOI's soil types are derived from glacial till and glaciofluvial deposits. Sandy loam is a dominant

soil type. The sandy loam soils are distributed on hills, drumlins, terraces, and outwash plains. These soils are moderately well-drained to well-drained and contain varying percentages of rock and stone that create an assortment of "very stony," "gravelly," or "extremely stony" characterizations. Silt loams are another abundant soil type, followed by complexes of soil in which two soil types are intermixed or found in close proximity. The sandy and silt loams form the basis for many of the region's farmlands. Mucks, which are very poorly drained soils commonly associated with wetlands, are primarily derived from organic material. Shrublands tend to be ephemeral, occurring in areas that have been periodically disturbed (fire, storms, or cutting). For those areas that are dominated by shrubs for longer periods of time, there is evidence that soil type has an influence. These areas tend to be on the extremes of being either very wet, organic peat or very sandy, well drained soils (Latham 2003).

Climate, including 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. There is a growing body of evidence, however, to support the theory that the recent historically unprecedented high levels of greenhouse gases being released through human activities (e.g., carbon dioxide, or CO_2, released from fossil fuel combustion and biomass decomposition via extensive global deforestation) greatly exacerbate 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 (Intergovernmental Panel on Climate Change, IPCC 2007, Mithen 2003, and USEPA 2013).

The climate of the AOI is characterized by warm, moist summers and cold, snowy winters. Annual temperatures have risen an average of 0.14 Fahrenheit degrees per decade since 1900, but have also risen by 0.5 Fahrenheit degrees per decade since 1970 (Union of Concerned Scientists, UCS 2006). Winters have been warming even faster, by 1.3 Fahrenheit degrees per decade since 1970. If we remain reliant on current sources of energy, annual temperatures are projected to increase a total of 6.5 to12.5 Fahrenheit degrees by 2100 (UCS 2006).

Because maritime air masses have year-round access to the eastern seaboard, precipitation is evenly distributed throughout the year. Average precipitation in the region is approximately 40 to 43 inches annually (Garabedian 1998). January is the coldest month of the year (mean temperature of 29 Fahrenheit degrees) and July the warmest month (mean temperature of 70 Fahrenheit degrees). This annual variation creates distinct seasons that affect or influence migratory use of the area's land and waterscapes by a variety of fish and wildlife. Precipitation is more uniform than temperature through the four seasons, with summer (June through August) slightly drier than the other three seasons. Overall, the region's weather is known for its frequent and dramatic changes, with temperatures capable of shifting 50 degrees in one week (Gibbs et al. 1995). Blizzards and hurricanes occasionally affect the area, as do tornadoes, ice storms, and flash floods.

Climate changes are expected to alter current precipitation patterns in the AOI (UCS 2006). Winter precipitation is projected to increase, with more falling 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 (UCS 2006). 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 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, (e.g., insect emergence synchronized to flower blooming may occur before spring migrating birds arrive, thereby diminishing a critical food source).

Kelly Boland/USFWS

Young forest in Durham, New Hampshire

Northeast Climate Impacts Assessment (NECIA) is a collaboration between UCS and a team of more than 50 independent experts to develop and communicate a new assessment of climate change, impacts on climate-sensitive sectors, and solutions in the Northeastern United States. According to the NECIA, "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). Some predict that in the next century, ranges of New England's northern hardwood and boreal spruce-fir forests could retreat north, and be replaced with forests that are common today in southern New England or the Mid-Atlantic states with losses of Bicknell's thrush (*Catharus bicknelli*), snowshoe hare (*Lepus americanus*), and Canada lynx (*Lynx canadensis*). Northern hardwoods (e.g., American beech, yellow birch, and sugar maple) may persist, but the optimal climate zone may shift northward 350 to 500 miles. The impacts on wildlife and fish communities, as we know them today, could be profound (Frumhoff et al. 2007). Since wildlife species are closely adapted to their environment, their 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).

Analysis of breeding bird survey data over a 26-year period shows a significant 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). Eastern brook trout (*Salvelinus fontinalis*) habitat may shrink 50 to 100 percent by the next century. Hemlock woolly adelgid (*Adelges tsugae*) will steadily move north thereby removing hemlocks and reducing shade that moderates stream temperatures, among other impacts. Lyme and hemorrhagic diseases will expand as insect vectors move north. Only a third of current national wildlife refuges in the Northeast Region will be in the same biome by 2100 (Inkley 2008, UCS 2006, Frumhoff et al. 2007).

Streamflow could be altered, as greater winter rainfall and earlier snow melt leads to earlier high flows and flooding during the spring (Inkley et al. 2004, UCS 2006). In contrast, summer low-flow periods may become more

extended, therefore impacting riparian habitats and instream fish, wildlife, and invertebrates (Koch 2009). Aquatic and riparian life forms will need to adjust rapidly or experience population declines. Replacement of some species by more southerly species is predicted.

Air Quality

Local air quality can affect our daily lives, and like the weather, it changes from day to day. Polluted air also injures wildlife and vegetation, causes acidification of water, degrades habitats, accelerates weathering of buildings and other facilities, and impairs visibility (USEPA 2012, USFWS 2013). Ground-level ozone and airborne particles are the 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 (NOx) and volatile organic compounds, components of smog. The southern portion of the AOI 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.

Socio-Economic Environment

This section presents an overview of the socio-economic characteristics of the AOI. In addition to providing a brief baseline summary of the area's socio-economic conditions, we discuss in this section and in chapter 4 how the presence of a national wildlife refuge may affect the social and economic vitality of the communities where we propose to conduct additional land acquisition.

For the purposes of reviewing the socio-economic information, we divided the AOI into the following three geographic regions: (1) Coastal New England; (2) Interior New Hampshire; and (3) Eastern New York. Within these three geographic areas, we gathered socio-economic information only on the 11 counties that are encompassed by the 10 RAFAs. Table 3 shows the relationship between the geographic regions and the affected counties. Because socio-economic data is generally collected and reported at the county level by such agencies as the U.S. Census Bureau and the Bureau of Labor Statistics, this draft LPP/EA will predominately use county profiles to characterize regions.

Table 3: Counties Associated with Geographic Regions and Refuge Acquisition Focus Areas

Geographic Regions	Refuge Acquisition Focus Areas	Counties
Coastal New England	Cape Elizabeth-Scarborough, ME	Cumberland County, ME
	Berwick-York, ME	York County, ME
	Rollinsford, NH	Strafford County, NH
	Oyster-Dover-Bellamy, NH	Strafford County, NH
	Plymouth, MA	Plymouth County, MA
	Mashpee, MA	Barnstable County, MA
	RI East-West	Washington County, RI
	Pachaug-Ledyard, CT	New London County, CT
Interior New Hampshire	Merrimack Valley North, NH	Rockingham County, NH Hillsborough County, NH
Eastern New York	Northern Housatonic	Dutchess County, NY
		Litchfield County, CT

Population

There are nearly 3 million people living in the 11 affected counties. This represents 8.7 percent of the total population of the six states (see Table 4).

The Coastal New England region contains nearly 60 percent of the affected population, with Interior New Hampshire accounting for about 25 percent and Eastern New York over 15 percent. The exact breakdown of population by region is presented in Table 5.

Table 4: Populations of Affected Counties and States (2014)

	2014 Population
All Counties (11)	2,923,753
Six states (CT, ME, MA, NH, NY, RI)	33,800,387
Percent of Total	8.7%

Source: U.S. Census Bureau, Population Division.

Table 5: Population by Geographic Region (2014)

	2014 Population	Percent of Total
Coastal New England	1,736,376	59.4%
Interior NH	705,805	24.1%
Eastern NY	481,572	16.5%
Total	2,923,753	100.0%

Source: U.S. Census Bureau, Population Division.

Between the 2000 and 2010 U.S. Census, the population of the 11 affected counties has increased at a faster overall rate than their corresponding six states. Populations are predicted to continue to grow. Collectively, the population is predicted to increase by 3.3 percent between the years 2015 and 2025. Leading this growth is the Eastern New York region, which is expected to grow by 6.4 percent, followed by Interior New Hampshire (4.6 percent). The most populous region, Coastal New England, is predicted to grow by only 2 percent between 2015 and 2025. Table 6 shows these estimates.

Table 6: Population Projections

	Population	Population	Population	Percent Change
	2015	2020	2025	2015 - 2025
Coastal New England	1,749,293	1,767,547	1,784,259	2.0%
Interior NH	704,657	721,223	736,736	4.6%
Eastern NY	500,089	517,120	531,922	6.4%
Total	2,954,039	3,005,890	3,052,917	3.3%

Sources: Various State and County Agencies.

Employment

This section provides a general overview of the labor forces in each geographic region. The largest portion of jobs across all three geographic regions is in the fields of education, health care, and social services. Approximately one-quarter of all workers in the affected counties works in these fields. Other popular employment fields include retail trade, manufacturing, and professional services. In contrast, workers in the agriculture, forestry, fishing and hunting and mining industries comprise the fewest number of workers in the region. Table 7 shows the most current estimated number of jobs by industry sector and Table 8 shows the percentage breakdown.

Table 7: Occupation by Industry, 2009 to 2013

	Coastal New England	Interior New Hampshire	Eastern New York	Total Number of Jobs
	Estimate	*Estimate*	*Estimate*	*Estimate*
Total:	860,111	373,421	241,617	1,475,149
Agriculture, forestry, fishing and hunting, and mining	6,689	2,018	2,494	11,201
Construction	56,894	24,945	17,400	99,239
Manufacturing	78,164	52,616	23,362	154,142
Wholesale trade	20,343	11,950	5,290	37,583
Retail trade	108,849	48,249	28,026	185,124
Transportation and warehousing, and utilities	34,227	16,469	9,732	60,428
Information	16,845	8,939	5,588	31,372
Finance and insurance, and real estate and rental and leasing	64,236	25,869	15,133	105,238
Professional, scientific, and management, and administrative and waste management services	87,409	43,412	25,124	155,945
Educational services, and health care and social assistance	218,923	82,088	69,282	370,293
Arts, entertainment, and recreation, and accommodation and food services	93,632	27,859	19,015	140,506
Other services, except public administration	36,483	15,919	10,227	62,629
Public administration	37,417	13,088	10,944	61,449

Source: U.S. Census Bureau 2009-2013 Five-Year American Community Survey

Table 8: Relative Occupation by Industry, 2009 to 2013

	Coastal New England	Interior New Hampshire	Eastern New York	Total
	Estimate	*Estimate*	*Estimate*	*Estimate*
Agriculture, forestry, fishing and hunting, and mining	0.8%	0.5%	1.0%	0.8%
Construction	6.6%	6.7%	7.2%	6.7%
Manufacturing	9.1%	14.1%	9.7%	10.4%
Wholesale trade	2.4%	3.2%	2.2%	2.5%
Retail trade	12.7%	12.9%	11.6%	12.5%
Transportation and warehousing, and utilities	4.0%	4.4%	4.0%	4.1%
Information	2.0%	2.4%	2.3%	2.1%
Finance and insurance, and real estate and rental and leasing	7.5%	6.9%	6.3%	7.1%
Professional, scientific, and management, and administrative and waste management services	10.2%	11.6%	10.4%	10.6%
Educational services, and health care and social assistance	25.5%	22.0%	28.7%	25.1%

	Coastal New England	Interior New Hampshire	Eastern New York	Total
Arts, entertainment, and recreation, and accommodation and food services	10.9%	7.5%	7.9%	9.5%
Other services, except public administration	4.2%	4.3%	4.2%	4.2%
Public administration	4.4%	3.5%	4.5%	4.2%

Table 9: Changes in Occupations by Industry: 2005 to 2013

	Coastal New England	Interior New Hampshire	Eastern New York	Total
Total:	-0.3%	0.3%	-0.3%	-0.2%
Agriculture, forestry, fishing and hunting, and mining	13.9%	-15.6%	-47.0%	-13.6%
Construction	-15.6%	-18.1%	-19.1%	-16.9%
Manufacturing	-6.1%	-8.4%	-16.9%	-8.7%
Wholesale trade	-29.2%	-22.9%	-26.1%	-26.9%
Retail trade	-3.4%	-5.4%	2.7%	-3.1%
Transportation and warehousing, and utilities	10.1%	7.5%	11.7%	9.6%
Information	-16.4%	-3.6%	-17.2%	-13.3%
Finance and insurance, and real estate and rental and leasing	-6.5%	6.7%	-6.2%	-3.5%
Professional, scientific, and management, and administrative and waste management services	7.4%	8.7%	7.4%	7.8%
Educational services, and health care and social assistance	10.7%	20.9%	14.6%	13.5%
Arts, entertainment, and recreation, and accommodation and food services	4.5%	4.2%	15.0%	5.8%
Other services, except public administration	-7.2%	-11.5%	9.0%	-6.1%
Public administration	0.9%	-7.5%	-9.9%	-3.0%

Source: U.S. Census Bureau, American Community Surveys 2005 and 2013, Table C24050

Construction

Since 2004, new housing permits have declined significantly for all three geographic regions. In 2004, Coastal New England counties reported nearly 8,300 new single family home construction permits, which hit a low of 2,430 in 2011 before rebounding to approximately 3,500 in 2013. A similar pattern is repeated for both Interior New Hampshire as well as Eastern New York. Overall, between the years 2004 and 2013, permits for Coastal New England counties declined by 135 percent, for Interior New Hampshire communities by 155 percent, and for Eastern New York communities by 260 percent.

Refuge Management Activities

Refuge management activities that may affect local economies include:

- Refuge purchases of goods and services within the local communities.
- Refuge personnel salary spending.

- Spending in the local communities by refuge visitors.
- Revenues generated from refuge economic management activities (such as timber harvesting or haying on the refuge).
- Refuge land purchases and changes in local tax revenue.

Additionally, it is important to note that the economic value of a refuge encompasses more than just the direct impacts to the regional economy. Refuges also provide substantial nonmarket values (i.e., values for items not exchanged in established markets) such as maintaining endangered species, preserving wetlands, educating future generations, and adding stability to the ecosystem (Caudill and Henderson 2003). The natural "services" provided by the conserved landscape can be extremely valuable to a community's well-being and to society in a more traditional economic sense. For instance, vegetated landscapes naturally filter and regulate water that drains into the public water supply. This natural process can minimize the economic burden on municipalities to treat water in accordance with national water quality standards. Such was the case with New York City, which in the 1990's notably invested between $1 billion and $1.5 billion in conserving and preserving landscapes in the Catskill watershed. This investment was calculated to produce cost savings of $6 billion to $8 billion over 10 years, when compared to the alternative of building and maintaining a new treatment facility (Chichilnisky and Heal 1998). A 2008 study done by Ingraham and Foster attempts to value the bundle of ecosystem services provided by the Refuge System in the contiguous United States. The authors determined the various habitats within the Refuge System were providing services valued at $32.3 billion (2011 dollars) per year, or an average of $2,900 per acre per year (Ingraham and Foster 2008). As the New York City example and this study indicate, these ecosystem service values can be substantial, and should be recognized when evaluating this proposal. However, quantifying individual ecosystem service values is beyond the scope of this EA.

Local economies benefit directly from public use activities offered on many refuges. At the request of state fish and wildlife agencies, the Service has been sponsoring the National Survey of Fishing, Hunting, and Wildlife-Associated Recreation every 5 years since 1955. It is viewed as one of the nation's most important wildlife-related recreation databases and the definitive source of information concerning participation and purchases associated with hunting, fishing, and other forms of wildlife-related recreation nationwide. The U.S. Census Bureau conducted the latest survey in 2011. The results of the survey show that residents and visitors spend significant amounts on wildlife-dependent recreational activities: More than 90 million U.S. residents (16 years old and older) participated in some form of wildlife-related recreation in 2011, up 3 percent from 5 years earlier (USFWS 2015b). These wildlife recreationists spent $144.7 billion in 2011 on their activities, which equated to 1 percent of the Gross Domestic Product. Of the total amount spent, $49.5 billion was trip-related, $70.4 billion was spent on equipment, and $24.8 billion was spent on other items such as licenses and land leasing and ownership.

Refuge Revenue Sharing

The Service makes revenue sharing payments to counties (or towns and cities) for the lands that we administer. When the Act of June 15, 1935 was passed (now commonly referred to as the Refuge Revenue Sharing Act, or 16 U.S.C. 715s), 25 percent of the net receipts collected from the sale of various products or privileges from refuge lands were paid to the counties in which they were located. However, if no revenue was generated from the refuge lands, the county received no payment. The Refuge Revenue Sharing (RRS) Act was amended in 1964 to provide a payment of either 25 percent of the net receipts, or three-quarters of 1 percent of the adjusted purchase price of refuge land, whichever was greater. The lands that were reserved from the public domain for national wildlife refuge

purposes continued to receive 25 percent of the net receipts. The revenue sharing payments during these early years could only be used for roads and schools, but all counties with refuge lands received a payment as a result of the 1964 amendments.

Beginning in 1976 the refuge receipts were not sufficient to make the county payments, and the payments were reduced accordingly. It was partly because of this that the RRS Act was again amended in 1978. The following changes were made as a result of the 1978 amendments:

1. Congress can appropriate funds to make up any shortfall in the revenue sharing fund.

2. All lands administered solely or primarily by the Service (not just the Refuge System) qualify for revenue sharing payments.

3. The payments to units of local government can be used for any governmental purpose.

The last year in which local units of government received 100 percent of the full amount that could be paid by law was 1981. Since 1991, the percentage of what would constitute full payments has declined each year. In 2014, the payments to localities represented approximately 24 percent of the full payment amount.

Biological Environment

Habitat Types

The following descriptions are general characteristics of the broad habitat types that exist within the area in the vicinity of the RAFAs. The habitat types are from Ecological Systems products developed by the University of Massachusetts (Designing Sustainable Landscapes project, http://www.umass.edu/landeco/research/dsl/dsl.html), based upon The Nature Conservancy's Northeastern Terrestrial Habitat Classification System. In this draft LPP/EA we focus primarily on shrubland and young forest habitats since that is the habitat type that will be most affected by our proposed actions. For a list of the scientific names of plants mentioned in this section and elsewhere in this draft LPP/EA, refer to the Glossary in the back of this document.

Woodchuck in shrubland, Rhode Island

Bill Zinni/USFWS

Grassland and Shrubland

Native grasslands dominated by little bluestem occur throughout the region in various sizes and configurations. The effects of tropical storms, salt spray, and coastal winds delay succession of some of these habitat types to shrubland, woodland and forest. A few large grasslands located on airports and military bases in the region support grassland-dependent birds, such as upland sandpiper (*Bartramia longicauda*) and grasshopper sparrow (*Ammodramus savannarum)*, and serve as important habitats for grassland-dependent insects, including monarch butterflies and other pollinators.

Shrublands are dominated by low woody vegetation (generally less than 3 meters tall) with varying amounts of herbaceous vegetation and sparse tree cover, including regenerating forests and abandoned field sites. Tree cover is less than 25 percent. Early successional shrublands and forests may be either seasonally flooded or non-flooded.

Shrublands include abandoned field sites and power line corridors that would ultimately revert to forest, absent some human or natural disturbance (e.g., mowing or burning), and abandoned beaver flowages along forested stream courses, which typically succeed from wet meadow to drier herb/shrub habitat, and eventually revert to forest in the decades following abandonment. Enduring shrubland habitats also occur, and include both pitch pine-scrub oak communities on relatively dry upland sites, as well as shrub-dominated wetland communities, such as shrub swamps. Shrub swamps are wetlands dominated by woody shrubs. They occur throughout the region and are highly variable depending on a variety of influences such as 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).

Coastal Scrub-Herb

The coastal scrub-herb habitat types encompass three sub-types that are important for shrubland wildlife species. These coastal habitats are found within the RAFAs that are located in southeastern Massachusetts and in the Rhode Island and Connecticut coastal areas. While the upland shrub habitats described above tend to be more ephemeral in nature, the influence of storms, salt, and poor quality sandy soils can allow the coastal habitats to persist.

North Atlantic Coastal Plain Heathland and Grassland

This habitat type consists of a heathland/grassland complex of acidic, nutrient-poor and very well drained soils in coastal areas of southern New England. The vegetation is maintained by extreme conditions and periodic fire or other disturbance. The system has a variable structure and may occur as heathlands, grasslands, or support a patchwork of grass and shrub vegetation. Characteristic species include huckleberry, bearberry, broom crowberry, Nantucket shadbush, golden heather, blueberry, little bluestem, and Pennsylvania sedge.

North Atlantic Coastal Plain Pitch Pine Barrens

Pitch pine barrens are a dry, fire-adapted forest with a variable canopy of pitch pine, a tall shrub layer dominated by scrub oak, and a low shrub layer characterized by blueberry and other heaths. Other oaks (scarlet, black, chestnut, and white) are also sometimes present. Composition and structure vary with fire frequency. In general, oaks are more prevalent in those stands having a longer fire-return interval, while fire frequencies of 8 to 10 years foster the growth of dwarf pine stands, also known as pine plains. The field layer of these pine plains are typified by dwarf-shrubs such as lowbush blueberry, bearberry, and golden heather. Scrub oak stands may occur without pine cover, particularly in low-lying areas where cold air drainage inhibits pine growth.

North Atlantic Coastal Plain Maritime Forest

This forest-shrubland type is a mosaic encompassing a range of woody vegetation on barrier islands, near-coastal strands, and bluffs at the outer edge of the coastal plain. Defined by its proximity to maritime environments, and usually species-poor, the vegetation includes narrow bands of forests or woodlands, often featuring stunted trees with contorted branches and dense vine layers. A range of trees may be present depending on location and degrees of protection from most extreme influences. They may include some combination of pines (e.g., pitch and Virginia) and oaks (e.g. scarlet, black, scrub, post) as well as eastern red cedar, black cherry, American holly, sassafras, and red maple. The shrub layer may be dense and the herb layer is often sparse.

Peatland
Peatlands found in the region containing the RAFAs consist mainly of northern bogs and interior acidic peatlands. In general, these habitats refer to nutrient poor, acidic areas in which peat mosses, shrubs, and sedges play a prominent role. 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 S.C. 2008, Thompson and Sorenson 2000). Conifers such as black spruce and white pine are often present. These bogs are often associated with former kettlehole ponds and lakes that have filled and now contain early forest or shrubland habitat with moss carpeting.

Northeastern Upland Forest
Upland forests are dominated by tree cover where soils are not saturated by water for extensive portions of the growing season. They are characterized by deciduous trees, evergreen trees, or mixed evergreen-deciduous trees with overlapping crowns forming between 60 and 100 percent canopy cover. We consider early successional forest (less than 25 years old) to be important ephemeral shrub habitat as the tree species are of a size and density that fulfills habitat niche requirements for shrubland wildlife species.

Deciduous Forest
Deciduous forests consist of large stands of deciduous trees with overlapping crowns forming between 60 to 100 percent canopy cover. Some combination of sugar maple, American beech, and yellow birch characterize most hardwood forests. Generally, these forests contain five layers: a tree stratum, 60 to 100 feet high, dominated regionally by various combinations of the genera listed above; a small tree or sapling layer with younger specimens of the tall trees and other shorter height species such as shadbush, dogwood, and redbud; a shrub layer often with members of the heath family such as rhododendron, azaleas, and mountain laurel; an herb layer of perennial forbs that bloom primarily in early spring; and a ground layer of lichens, clubmosses, and true mosses. Lichens and mosses also grow on the trunks of trees. Lianas such as wild grape, poison ivy, and Virginia creeper climb the trees to flower and fruit high in the forest canopy.

Evergreen Forest
Evergreen forest stands contain a diverse assemblage of coniferous trees. Found throughout the area on a variety of soil types, either as pure or mixed stands. Eastern hemlock is most prevalent, but has recently declined especially in the southern portion of the region due to hemlock wooly adelgid infestation. Evergreen forests include species such as white and red pine, and spruce and fir trees.

Mixed Forest
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. A mixed forest is closely related to a northern or central hardwood forest, but typically sustains a composition that can be evenly distributed. These forests mainly consist of red maple, red oak, eastern hemlock, and white pine.

Northeastern Wetland Forest
Northeastern wetland forests, or forested swamps, are wetlands where trees dominate the vegetation and there is generally little buildup of peat. Soils are saturated for much of the growing season, often with standing water in

Forested swamp habitat

USFWS

the spring. Forested swamps are the most abundant types of all wetlands in the Northeastern United States. They usually occur as patches within the surrounding upland matrix forest. They follow patterns of differences similar to the upland forests. For example, in evergreen forest areas, forested swamps are cold and often conifer-dominated. In the warmer southern and eastern parts of the region and in deciduous forested areas, forested swamps are dominated by red maple or Atlantic white cedar. They occur in stream headwaters, behind floodplain forests, and in poorly drained basins. Forested swamps develop in poorly drained areas throughout the region. Depending on the physical setting, forested swamps receive water through surface runoff, groundwater inputs, or stream and lake overflow.

Agriculture

For the purposes of this section, lands classified as agriculture include managed grasslands, herbaceous areas, or pastures. These lands can also consist of actively cultivated croplands. When not actively tilled, these areas generally consist of herbaceous plants such as grasses, herbs and ferns that form 25 percent or more of the ground cover. This includes grasslands managed on public lands for wildlife and other managed grasslands consisting primarily of naturalized European species, such as timothy, red clover, and red fescue, as well as other herbaceous or broad-leaved plants and flowers. If this land type is actively managed for wildlife, these habitats are routinely mowed or burned prior to or after the conclusion of the avian breeding season. These areas include wet meadows and a variety of temporarily flooded grasslands. The flooding may be controlled as part of a management plan for the habitat. Vegetation typically includes a variety of herbaceous plants, including forbs, grasses, flowers, sedges, and rushes (e.g., reed canarygrass, common reed, big bluestem, bluebell bellflower, bluejoint, tussock sedge).

Active pastures have usually been planted with non-native, cool-season forage grasses and are maintained by grazing livestock or mowing. Abandoned pastures are extremely ephemeral and show a rapid increase in woody vegetation. These

serve as habitat for a succession of animal communities that parallels the stage of the vegetation communities.

Freshwater marsh
Also known as emergent herbaceous wetlands, these areas are typically adjacent to rivers and streams, and periodically flooded and influenced by run-off from adjacent upland areas. Basin freshwater marshes also are found in glacial kettles. Typical plants include cattail, buttonbush, highbush blueberry, water willow, and swamp loosestrife. This habitat type includes deep and shallow emergent marshes, wet meadows, kettlehole wet meadows, coastal interdunal marshes/swales, calcareous sloping fens, calcareous seepage marshes, calcareous basin fens, and acidic graminoid fens. Shallow emergent marshes occur in broad, flat areas bordering low-energy rivers and streams, often in backwater sloughs, or along pond and lake margins. Shallow marshes also commonly occur in abandoned beaver flowages, and in some states this type of natural community is named "abandoned beaver meadows" or "beaver flowage communities." The soils are a mixture of organic and mineral components. There is typically a layer of well-decomposed organic muck at the surface overlying mineral soil. There is standing or running water during the growing season and throughout much of the year, but water depth averages less than 6 inches.

Marshes are dominated by emergent herbaceous vegetation and have a water table that is generally at or above the surface throughout the year, but can fluctuate seasonally. Examples of marsh natural communities include cattail marshes and deep-emergent marsh-aquatic beds.

Emergent wetlands are characterized by erect, rooted, herbaceous hydrophytes occurring in all water regimes except sub-tidal and irregularly exposed. This vegetation is present for most of the growing season (Cowardin et al. 1979). Most communities are dominated by perennial plants. Freshwater emergent wetlands are dominated by non-persistent and persistent grasses, sedges, rushes, forbs, and other grass-like plants, with minimal representation by woody trees or shrubs. These communities are primarily non-tidal, freshwater habitats known as marshes, wet meadows, and pond shores.

Estuarine Intertidal
This habitat type is similar to freshwater marshes in that it is dominated by emergent herbaceous vegetation and has a water table that is generally at or above the surface throughout the year, but can fluctuate seasonally. However, these lands are influenced by tidal fluctuations and some level of saltwater intrusion. Higher levels of salinity change the vegetation composition. These estuarine wetland ecosystems are characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens that are present for most growing season in most years. These plants may be temporarily to permanently flooded at the base but do not tolerate prolonged inundation of the entire plant. A salt marsh profile features a low regularly flooded marsh dominated by salt marsh cordgrass; a higher irregularly flooded marsh dominated by saltmeadow cordgrass and saltgrass; low hypersaline pannes characterized by saltwort; and a salt scrub ecotone characterized by marsh elder, groundsel-tree, and switchgrass. Brackish areas support salt marsh cordgrass, giant cordgrass, narrowleaf cattail, and bulrush. Freshwater tidal areas include wild rice marshes and forbs such as water hemp and rosemallow.

Wildlife

The variety of habitats described above provides some of the lifecycle needs for a large number of animal and plant species. Since our actions are focused on shrub-scrub and early successional forest habitat maintenance and restoration, this section describes those species that are adapted to and use those habitat types. Early successional habitats are vitally important to a number of animal species. Table 10 provides information about species of national conservation priority, including Federal-listed species such as the bog turtle.

Table 10: Regional Conservation Plans and Priority Species for Shrublands and Young Forest Habitats

Species common name (Federal T&E status)	Scientific name	Associated step-down plans	Comments
American Burying Beetle (E)	*Nicrophorus americanus*	NALCC*	State-endangered in MA and RI; species of special concern in CT
American Woodcock	*Scolopax minor*	NALCC*#, BCR14‡, BCR28‡, BCR30‡, BCR13†, PIF27§, PIF09§, American Woodcock Conservation Plan	
Blue-winged Warbler	*Vermivora pinus*	NALCC*#, BCR30‡, BCR13†, BCR14†, BCR28†, PIF09§	
Bog Turtle (T)	*Clemmys muhlenbergii*	NALCC*#	State-endangered in MA, CT, NY
Indiana Bat (E)	*Myotis sodalis*	NALCC*	State-endangered in MA, CT, NY
Northern Long-Eared Bat (E)	*Myotis septentrionalis*		State-endangered MA, CT; State-threatened NY, NH
Karner Blue Butterfly (E)	*Lycaeides melissa samuelis*	NALCC*	State-endangered in NH, NY
New England Cottontail	*Sylvilagus transitionalis*	NALCC*#	State-endangered in ME, NH; species of special concern in NY
Northeastern Bulrush (E)	*Scirpus ancistrochaetus*	NALCC*	
Northern Red-Bellied Cooter (E)	*Pseudemys rubriventris*	NALCC*	State-endangered in MA
Prairie Warbler	*Dendroica discolor*	NALCC*#, BCR30‡, BCR28†, PIF09§	
Brown Thrasher	*Toxostoma rufum*	NALCC#, BCR13†, BCR28†, BCR30†	Species of special concern in CT
Eastern Towhee	*Pipilo erythrophthalmus*	NALCC#, BCR28‡, BCR30†	
Field Sparrow	*Spizella pusilla*	NALCC#, BCR28‡, BCR13†, BCR30†	
Northern Bobwhite	*Colinus virginianus*	BCR30†	
Whip-poor-will	*Caprimulgus vociferus*	BCR30†	Species of special concern in CT, NY
Willow Flycatcher	*Empidonax traillii*	BCR28†, BCR30†	
Chestnut-sided Warbler	*Setophaga pensylvanica*	NALCC#, BCR14†, PIF27§	
Olive-sided Flycatcher	*Contopus cooperi*	BCR14†	
Rusty Blackbird	*Euphagus carolinus*	BCR14†	
Golden-winged Warbler	*Vermivora chrysoptera*	BCR13‡, BCR28‡, PIF09§	State-endangered in MA, CT; species of special concern in NY
Canada Warbler	*Cardellina canadensis*	BCR14‡	
Black Racer	*Coluber constrictor*		State-endangered in ME, State-threatened in NH
Eastern Hognose Snake	*Heterodon platirhinos*	NALCC#	State-endangered in NH; species of special concern in CT, NY

* *NALCC–Highest priority species for North Atlantic Landscape Conservation Cooperative Development and Operations Plan*

† *High and ‡highest priority species for Bird Conservation Region Plans (BCR30 = New England/Mid-Atlantic Coast Bird Conservation Region; BCR14 = Atlantic Northern Forest; BCR13 = Lower Great Lakes/St. Lawrence; BCR28 = Appalachian Mountains)*

§ *Priority species for Partners in Flight Landbird Conservation Plans (PIF27 = Northern New England; PIF09 = Southern New England)*

#NALCC-designated surrogate species

Birds

Shrublands and thickets provide vital breeding and foraging habitat for numerous avian species which are considered priorities by bird conservation initiatives. Several species have been identified as priorities for the bird component for assessing land acquisition priorities for the Refuge System. The priority species for the Refuge System's recently adopted Targeted Resource Acquisition Comparison Tool (TRACT) are the birds that are identified on the National Birds of Conservation Concern (BCC) list. The shrubland species that are included on this list are American woodcock, blue-winged warbler, golden-winged warbler, chestnut-sided warbler, prairie warbler, field sparrow, olive-sided flycatcher (*Contopus cooperi*), and loggerhead shrike (*Lanius ludovicianus*). Birds dependent on early successional shrublands and pine barrens have shown steep population declines in the northeast over the last few decades (Dettmers and Rosenberg 2000). Ten percent of the breeding population of blue-winged warblers is estimated to breed in the last remaining remnant patches of early successional habitats in bird conservation region BCR 30.

Whip-poor-will

William Majoros

Within BCR 30, there are a total of eight "highest" and "high" priority species dependent on scrub-shrub and early successional habitats for breeding. The highest priority species for these habitats include American woodcock, prairie warbler, and blue-winged warbler. The high priority species are brown thrasher, eastern towhee, field sparrow, whip-poor-will (*Caprimulgus vociferous)*, and willow flycatcher (*Empidonax traillii)*. Gray catbird (*Dumetella carolinensis*), another shrubland-dependent species, is a moderate priority species. In addition to their priority status in BCR 30, blue-winged warbler, prairie warbler, and willow flycatcher have been identified by the NALCC as representative species for shrubland/early successional habitats in the southern New England region, as well as chestnut-sided warbler. In addition, early successional habitats provide important landbird migration habitat for species such as the Bicknell's thrush, which uses coastal shrubland communities during fall migration.

Priority species that have been identified under the PIF 9 Southern New England physiographic area for shrubland/young forest habitat are as follows, with focal species in boldface: **blue-winged warbler,** prairie warbler, **American woodcock, eastern towhee,** and whip-poor-will. Many species of shrubland birds have been experiencing steep population declines in the northeast over the last several decades. In addition to the significant decreases in the high priority species listed under this habitat type, brown thrasher, eastern towhee, and indigo bunting (*Passerina cyanea*) have also undergone significant long-term population declines, as monitored through the Breeding Bird Survey (Dettmers and Rosenberg 2000, Sauer et al. 1999).

For selected shrubland-dependent birds identified as priorities in BCR 30 or as representative species for shrubland habitats within the southern New England region, we have estimated the current combined total amount of potentially suitable habitat within all RAFAs for this project and the associated number of breeding birds currently supported by that habitat (see Table 11). We also compare these habitat and population estimates with the habitat and population objectives that have been identified for each species in BCR 30, as reported in the BCR 30 Bird Conservation Plan (ACJV 2014), the PIF North American Landbird Conservation Plan (Rich et al. 2004) in conjunction with the PIF Population Estimates Database (PIF 2013), or the American Woodcock Conservation Plan (WMI 2008).

Table 11: Current Breeding Bird and Habitat Estimates for all RAFAs combined

Context:

Current suitable habitat for shrubland-dependent birds in all RAFAs combined = 24,500 acres.

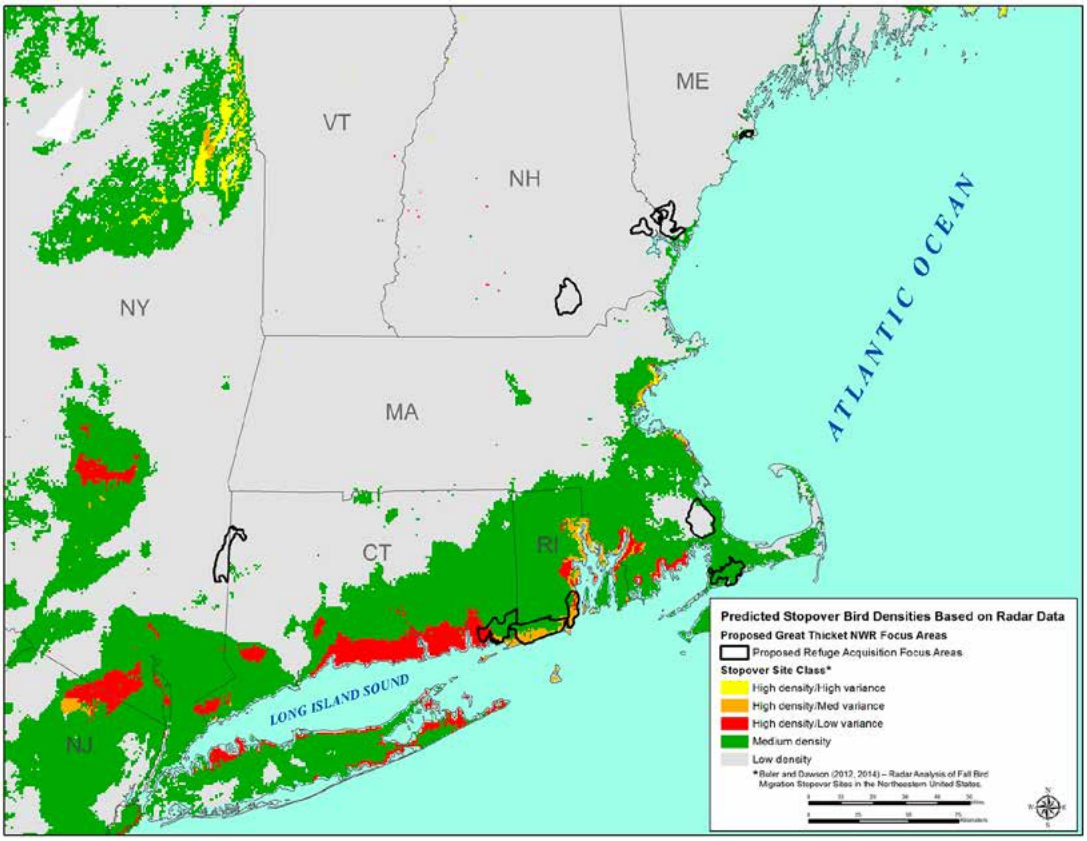
Species	% of BCR 30 habitat objective based on 24,500 acres	# of breeding birds (% of BCR 30 population objective)
Blue-winged warbler	8.2%	6,620 (11%)
Prairie warbler	10.5%	12,940 (13.9%)
Brown thrasher	17.8%	4,090 (7.4%)
Eastern towhee	2.1%	15,260 (3.3%)
Chestnut-sided warbler	15.5%	17,100 (17.1%)
Field sparrow	15.5%	5,715 (3.4%)
Willow flycatcher	55.5%	14,445 (72.2%)
Gray catbird	1.6%	13,945 (1.7%)
American woodcock	0.01%	895 (0.01%)

The amount of existing suitable shrubland habitat within focus areas was estimated from appropriate shrubland and forest classes, as described above, within the modified ecological systems model developed for the Designing Sustainable Landscapes project (NALCC 2015). Acres of upland and wetland shrub habitats were estimated directly from the amount of those habitat classes within RAFAs. Acres of early successional forest were estimated by calculating the county-level proportion of young forest based on Forest Inventory Analysis data (USDA 2014) and then multiplying that proportion by the total acres of upland and wetland forest within the RAFAs. Bird population estimates were derived by applying published breeding density estimates for each species (see Emlen 1977, Inman et al. 2002, Chandler et al. 2009, King et al. 2009a, King et al. 2009b, Schlossberg et al. 2010) to the acres of upland and wetland shrub habitat types occurring within the RAFAs. We typically used numbers at the lower end of the range of published density estimates because high densities usually reflect the most suitable habitat but we are trying to estimate populations across the landscape, which will include a range of habitat quality. We also acknowledge that the published bird population objectives typically reflect relatively low densities at landscape scales, and we wanted our estimates to be as comparable with those objectives as possible.

In addition to contributions to breeding bird populations, the shrubland habitat within the RAFAs provides critical habitat during post-breeding and migratory periods for landbirds, and is also important for many forest-interior breeding birds (Marshall et al. 2003, Vitz and Rodewald 2006). Shrublands are considered to be some of the most important stopover habitat for migrant landbirds because they provide quality food resources in the form of fruits and berries that are not as abundant in other habitats during the fall migration. The dense vegetation of shrublands also provides high quality cover for resting and recovery by birds that have completed migratory flights. An analysis of radar data from the National Weather Service (Buler and Dawson 2012, 2014) has indicated that the Southern New England coastal area is among a small number of areas in the northeast that supports the highest density of migrating birds during the fall migration.

Figure 1, adapted and modified from that analysis, shows that both the Rhode Island East-West and the Pachaug-Ledyard RAFAs overlap with areas of high bird density of migrating birds. Several of the other RAFAs overlap with areas of at least moderate migrant bird density. Thus, current conditions within the RAFAs support not only significant populations of breeding shrubland birds, but they also provide critical migratory stopover habitat in areas that support moderate to high densities of migrating birds. Observations along the southern Rhode Island coast confirm the presence of high priority forest interior birds in addition to the shrubland species, and often a disproportionate number of young of the year making their first migration such that availability of this habitat may contribute to increasing survival and recruitment of young into the breeding populations of these species.

Figure 1: Predicted Stopover Bird Densities Based on Radar Data



Mammals

The majority of the 60 native terrestrial mammal species that occur in the Northeastern United States utilize resources from several habitats on a seasonal basis. As many as 20 of these mammals demonstrate some preference for young forests, shrublands, or old-field habitats (Fuller and DeStefano 2003, DeGraff and Yamasaki 2001). Three mammal species are considered obligate users, including the NEC, the non-native eastern cottontail (*Sylvilagus floridanus*) and the bobcat (*Lynx rufus*), which preys upon both rabbit species as well as on other species (Litvaitis 2001). Examples of part-time or opportunistic users of these types of habitats in this area include the black bear (*Ursus americanus*), the little brown bat (*Myotic lucifugus*), and the white-tailed deer (*Odocoileus virginianus*). Additional examples include white-footed and deer

mice (*Peromyscus leucopus, P. maniculatus*), red and grey fox (*Vulpes vulpes, Urocyon cinereoargenteus*), raccoon *(Procyon lotor*), Opossum (*Didelphis virginiana*), striped skunk (*Mephitis mephitis*), and semi-aquatic mammals like the beaver (*Castor canadensis*) and mink (*Mustela vison*).

Although the Service decided in 2015 that the NEC does not need Federal protection, much work still needs to be done to stabilize NEC populations throughout its historic range. Shrubland habitat and NEC population goals have been established within a SHC framework to help guide our efforts. The NEC has been described as a barometer for the health of other shrubland-dependent wildlife species that occur throughout the northeast because the NEC is: (1) an extreme habitat specialist; (2) is highly sensitive to habitat area size; (3) is dispersal limited; and (4) lives in these habitats through all seasons. NEC live in dense areas of shrubs and young forests where trees are growing back following disturbances caused by factors such as logging, fire, flooding, mortality from disease or insects, and high winds. NECs are "habitat specialists," which means they depend on a specific kind of habitat. In this case, it is early successional or "thicket" habitat (Litvaitis 2001).

Eastern hognosed snake

Ohio DNR

Additionally, research has indicated the importance of early successional habitat to many other mammals, including hoary (*Lasiurus cinereus*), red (*L. borealis*), and big brown bats (*Eptesicus fuscus*).

Reptiles and Amphibians

Several state-listed endangered reptile species, such as the eastern hognose snake, northern black racer (*Coluber constrictor*) and Blanding's turtle, are found along forest edges and other shrubland habitats that are the focus of this land protection plan.

Invertebrates

Shrublands are some of the most important natural communities for rare and endangered Lepidoptera across much of the Northeastern United States, and considered most important in both Connecticut and Massachusetts. This is especially evident in Massachusetts, where 41 percent of State-listed moths and butterflies are associated with shrublands. In Connecticut, species of shrub-dominated habitats account for 23 percent of that State's listed Lepidoptera. In both states, pitch pine-scrub oak barrens, ridgetop pitch pine-scrub oak barrens, and heathlands are the most important shrubland habitats for rare moths and butterflies. Shrubland species also account for high percentages of Lepidoptera ranked as rare in other northeastern states (Wagner et al. 2003). Many species of pollinators, including butterflies and bees, have experienced severe declines in the past two decades.

Monarch butterflies use early successional habitats that contain milkweed during the spring and summer breeding period. Natural and managed early successional and shrub-dominated lands generally support a mix of native flowers with different bloom times, which ensure a stable food source for butterflies and milkweed to feed monarch caterpillars. The monarch population has recently declined to a fraction of its previous size. NatureServe and the Xerces Society recently report that estimates of up to 1 billion monarchs made the flight each fall from portions of the United States and Canada to sites in Mexico in the 1990s, and more than 1 million overwintered along the California coast. In the winter of 2013/2014, estimates from overwintering sites in Mexico suggest only about 33 million monarchs overwintered, representing a 90 percent drop from

the 20-year average (Jepsen et al. 2015). These declines are so severe that the Service has been petitioned to consider listing the North American monarch as threatened under the ESA.

The subspecies occurring in North America and the two North American populations are considered in jeopardy, and the rapid decline and widespread threats to the eastern population qualify it as critically imperiled. While the report explains that the species as a whole is apparently secure, these two major populations at the heart of its range and the associated subspecies now face potential extinction. North American monarchs are said to probably represent the majority of the total global population. One of several major factors appearing to be most important in the decline of the eastern monarch is the loss of early successional milkweed breeding habitat due to herbicides, land conversion, and reforestation.

Federally Threatened and Endangered Species

The federally listed cooter is found in early successional habitats, especially in the Plymouth RAFA. The cooter is a large, freshwater basking turtle with a carapace (i.e., shell) length of 10 to 12 inches when mature. The cooter subsists primarily on submergent vegetation, and requires good water quality and suitable basking, nesting, and overwintering sites free from disturbance. The population of this species is restricted to approximately 22 sites in Plymouth County, centered within the Plymouth RAFA. The cooters spend most of their lives in these freshwater coastal ponds in Plymouth and Carver counties, coming on land to bask in the sun and breed in sandy soils. The cooter, like other turtles, are active only during the warmer months (March to October) and hibernate through the winter months buried in the mud on the bottom of these coastal ponds (USFWS 1994).

In addition, federally listed bog turtles occur in the Northern Housatonic RAFA. The northern population of the bog turtle is a federally threatened species and listed as endangered in the states of Connecticut and New York. Among the contributing factors to the decline of bog turtles is habitat destruction due to development; illegal collection; wetland ditching, flooding and filling; water quality degradation; and forest succession or invasive species encroachment (Beans and Niles 2003). Bog turtles require open wetlands, generally with a scrub-shrub component, with perennial groundwater seepage and typically at least several inches of mucky substrate.

Parcels in the Cape Elizabeth-Scarborough and Pachaug-Ledyard RAFAs are associated with coastal beach and marsh habitats that are important to the federally threatened piping plover. Finally, the federally endangered Karner blue butterfly (*Lycaeides melissa samuelis*) uses early successional pine and oak barren habitat that is an important component of this land protection proposal.

Invasive species

Invasive species have been introduced, purposefully or accidentally, into the AOI from other countries or other regions of this country. Often these exotic species establish in natural ecosystems, becoming naturalized, but without noticeably affecting natives animals 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, parasitism) in their new location. In many cases, species have been introduced specifically because they were easy to establish, hardy, and resistant to disease. In addition to the initial introductions, human activities that result in disturbed soils, excessive nutrients, and native plant removal can favor the spread of exotics. In general,

introduced species that multiply in large numbers, displace native species, and cause ecological damage (e.g., 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 (*Dreissena polymorpha*)], or impact human health (e.g., giant hogweed) are called invasive species.

Some invasive species that occur within the AOI and specifically win the RAFAs include Asiatic bittersweet, common reed, autumn olive, Japanese knotweed, glossy buckthorn, garlic mustard, Japanese barberry, and tree-of-heaven. Control of these species would be integrated into the management regime for maintaining shrubland habitats within RAFAs.

Description of Sub-Regions Containing Refuge Acquisition Focus Areas

For the second section of this chapter, we grouped the RAFAs into the following five sub-regions:

- Maine/New Hampshire Coast
- Merrimack Valley-New Hampshire
- Southeastern Massachusetts
- Southeastern Connecticut/Rhode Island Coast
- Northern Housatonic

Below, we list the RAFAs that fall under each sub-region and we describe the particular resources that can be found in each sub-region. We also provide maps illustrating the specific locations of each RAFA and the habitat types that can be found within each RAFA.

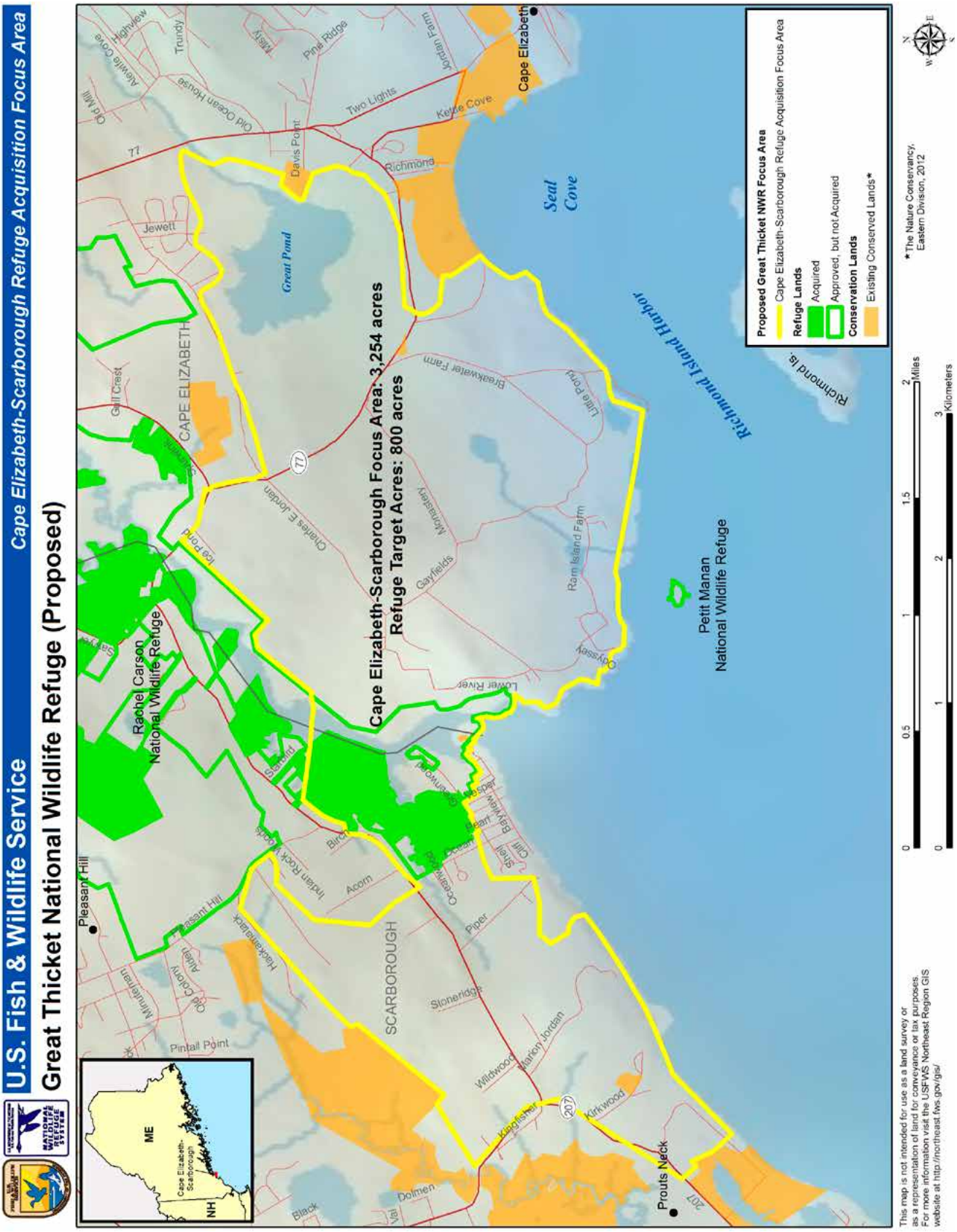
Maine/New Hampshire Coast Sub-Region

The Maine/New Hampshire Coast sub-region includes the following four RAFAs: Cape Elizabeth-Scarborough, Berwick-York, Rollinsford, and Oyster-Dover-Bellamy. In general, these areas are within 20 miles of the coast and contain a mix of forest, marsh, and shrubland habitats, with northern upland forest habitats making up nearly half of the area. Approximately 16.5 percent of the area is in some stage of development and 14.5 percent of the total acreage of this sub-region is currently classified as agriculture. This area also contains over 3,000 acres of land that is currently protected. This includes more than 1,100 acres of private land that is protected by conservation easements and 938 acres of local conservation land. Lands identified for protection within these sub-regions under the proposed Great Thicket NWR often link already existing conservation areas and add to the overall wildlife and water quality benefits.

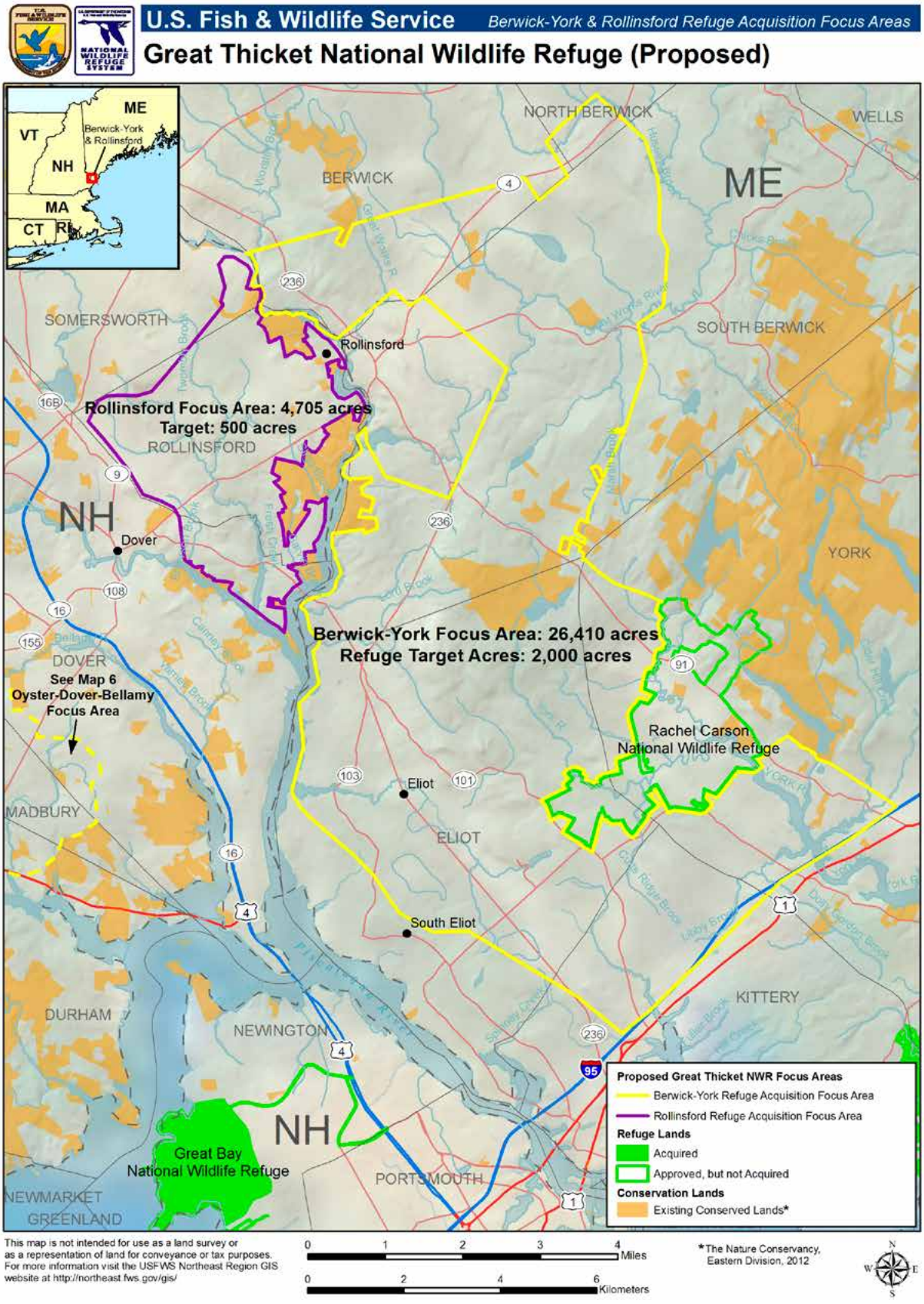
Table 12: Maine/New Hampshire Coast Sub-Region Conserved Lands

	Cape Elizabeth-Scarborough RAFA Acres	Berwick -York RAFA Acres	Rollinsford RAFA Acres	Oyster-Dover-Bellamy RAFA Acres	Total
Federal	127	0	0	42	169
State	7	384	0	363	754
Local	0	272	72	594	938
Non-government conservation organization	0	140	0	2	142
Private landowner conservation easement	0	108	16	1037	1153
Total	**134**	**904**	**88**	**2038**	**3164**

Map 4: Cape Elizabeth-Scarborough Refuge Acquisition Focus Area



Map 5: Berwick-York and Rollinsford Refuge Acquisition Focus Areas



Map 6: Oyster-Dover-Bellamy Refuge Acquisition Focus Area

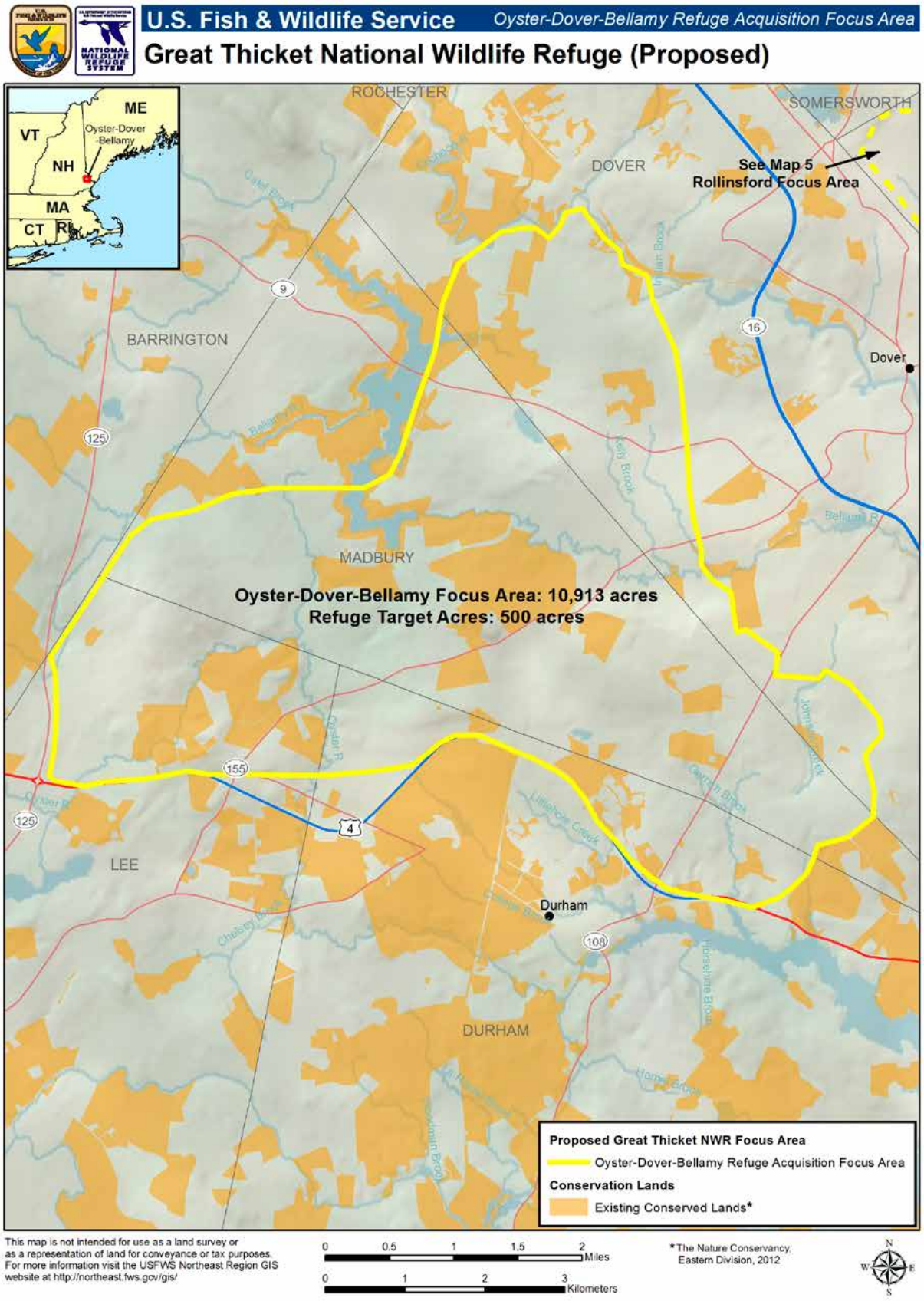


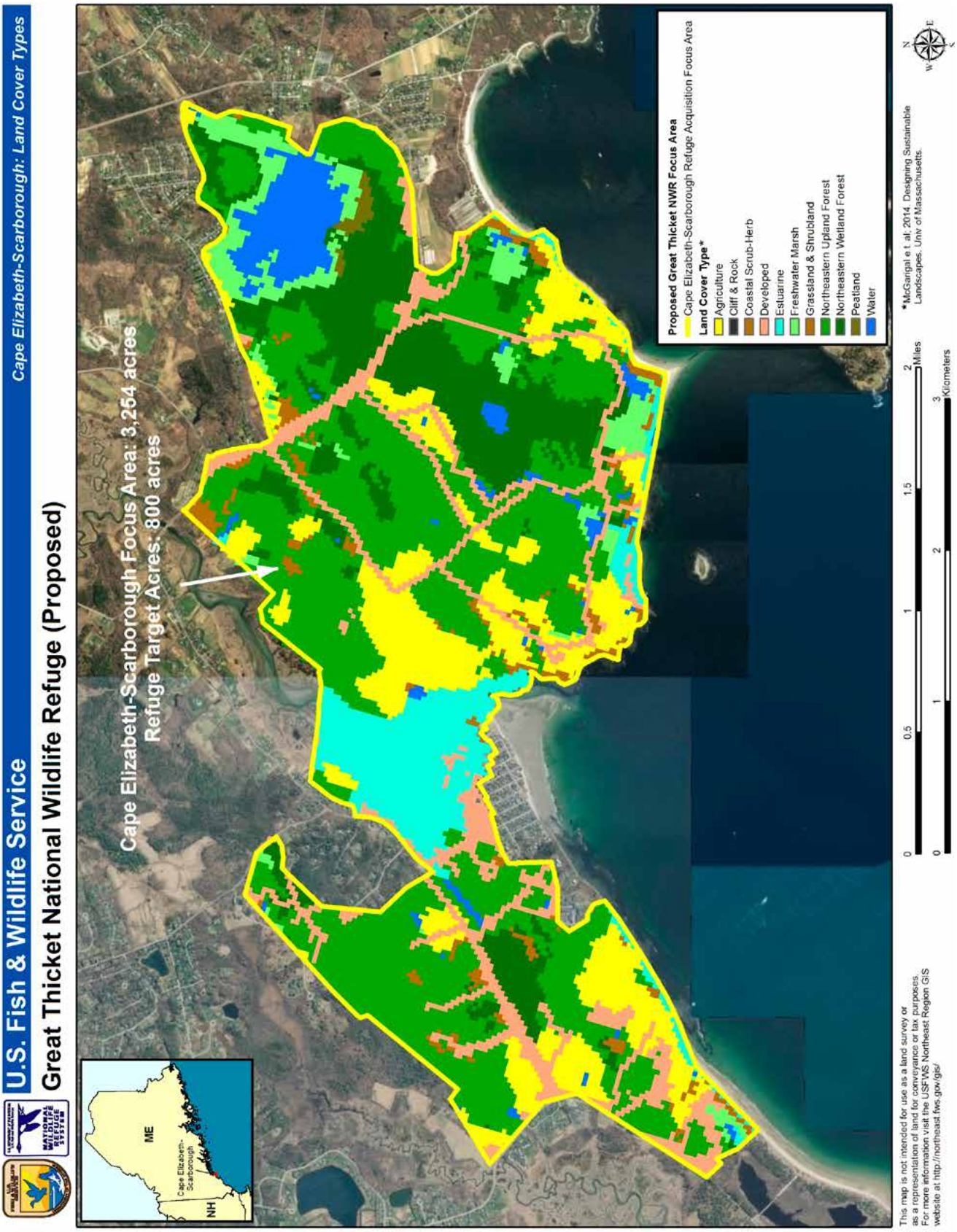
Table 13: Maine/New Hampshire Coast Sub-Region Land Cover Types

	Cape Elizabeth-Scarborough RAFA Acres	Berwick-York RAFA Acres	Rollinsford RAFA Acres	Oyster-Dover-Bellamy RAFA Acres	Total
Grassland and Shrubland	57	956	18	235	1,266
Coastal Shrub-herb	42	0	0	0	42
Peatland	12	53	0	14	79
Northeastern Upland Forest	1,244	12,775	1,653	5,643	21,315
Northeastern Wetland Forest	493	2,990	191	740	4,414
Agriculture	484	3,607	1,039	1,444	6,574
Freshwater Marsh	153	1,435	194	241	2,023
Estuarine Intertidal	185	379	20	20	604
Open water	147	684	139	388	1,358
Developed	361	3,434	1,415	2,189	7,399
Total	**3,178**	**26,313**	**4,669**	**10,914**	**45,074**

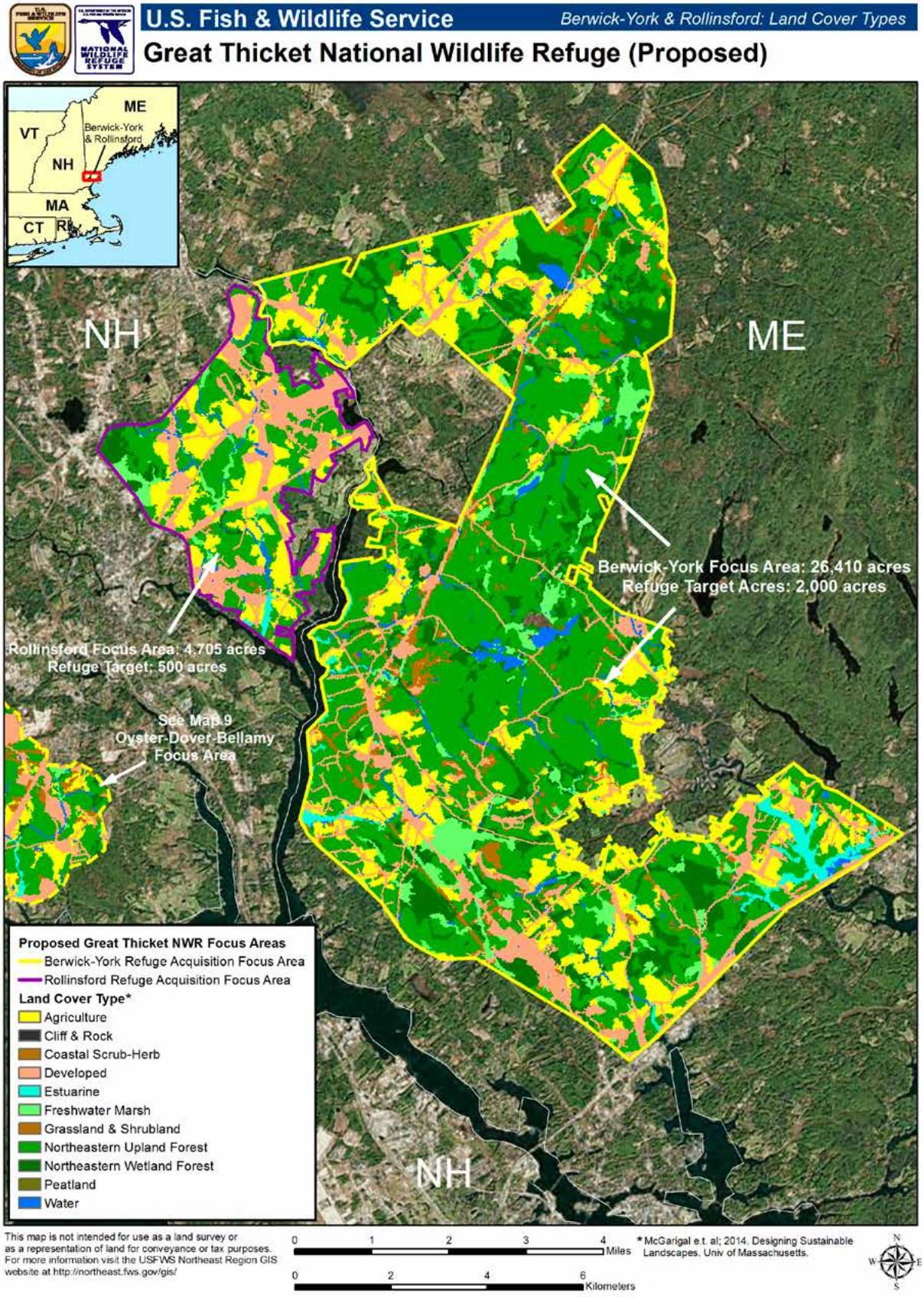
Habitat restoration in the Lee Five Corner Preserve in New Hampshire

Ted Kendziora/USFWS

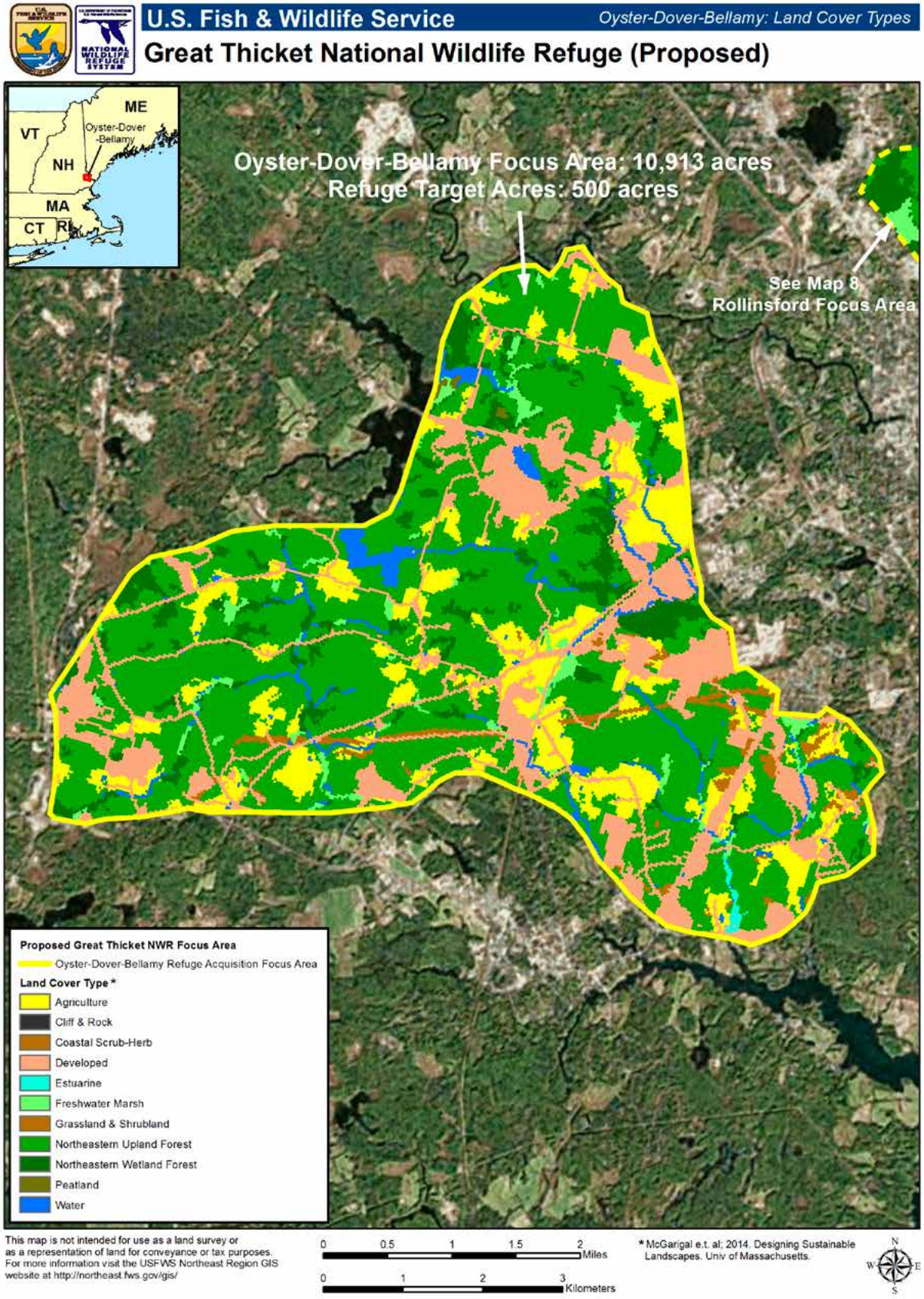
Map 7: Cape Elizabeth-Scarborough Refuge Acquisition Focus Area: Land Cover Types



Map 8: Berwick-York and Rollinsford Refuge Acquisition Focus Areas: Land Cover Types



Map 9: Oyster-Dover-Bellamy Refuge Acquisition Focus Area: Land Cover Types



Aspen stand regeneration

Ted Kendziora/USFWS

The Maine/New Hampshire Coast sub-region has an archaeological record that offers evidence of thousands of years of Native American occupation. Euro-American settlement has shaped the ecology of the sub-region as well.

The four RAFAs in this sub-region feature ponds, streams, and wetlands in proximity to the Atlantic coastline. Native American settlement was oriented around these freshwater resource areas during the pre-European contact period. Consequently, undeveloped areas in settings such as wetland margins and riparian zones have high sensitivity for Native American archaeological sites, including seasonal camps and large and small settlements. At the time of European contact, Native American communities in this sub-region apparently occupied large villages surrounded by palisades and planting fields, with smaller villages or hamlets distributed along the shoreline. Some groups may have dispersed upriver or inland periodically for hunting, fishing, and access to other seasonal resources.

Historical Euro-American settlement in the vicinity of this sub-region began in the early 17th century, resulting in the founding of the communities of York and Scarborough in Maine (settled in 1624 and 1635, respectively), and Dover and Rollinsford in New Hampshire (settled in 1623 and 1630). Euro-American land use featured the establishment of villages, farms, and early industries such as grist mills, sawmills, and shipyards. Today, undeveloped locations that feature favorable agricultural soils in the four RAFAs, and are found near water sources, thoroughfares, or centers of early colonial occupation, are likely to contain archaeological evidence of agrarian land use and settlement over the last three and a half centuries.

Lands within the Maine/New Hampshire Coast sub-region that may be considered for acquisition are likely to include undeveloped, open spaces and current, or former agricultural areas. Depending on the proximity of such properties to freshwater resources (e.g., wetlands, streams, rivers) and/or to locations that witnessed historic land use (e.g., settlement, agriculture, early industries), expected historic properties in the acquired lands may include Native American and Euro-American archaeological sites, and historic agricultural structures.

Merrimack Valley-New Hampshire Sub-Region

This sub-region contains just one RAFA, Merrimack Valley North. This RAFA stands alone in the interior area of New Hampshire. This area is more than 50 percent forested and contains a high concentration (34 percent) of developed land. Within this RAFA, there are nearly 5,000 acres of conservation land. Of that land, nearly all of it is either protected by the local government or by conservation easements on private lands (2,066 acres and 2,036 acres, respectively).

Table 14: Merrimack Valley North Conserved Lands

Ownership	Merrimack Valley North RAFA Acres
Federal	0
State	677
Local	2,066
Non-government conservation organization	0
Private landowner conservation easement	2,036
Total	**4,779**

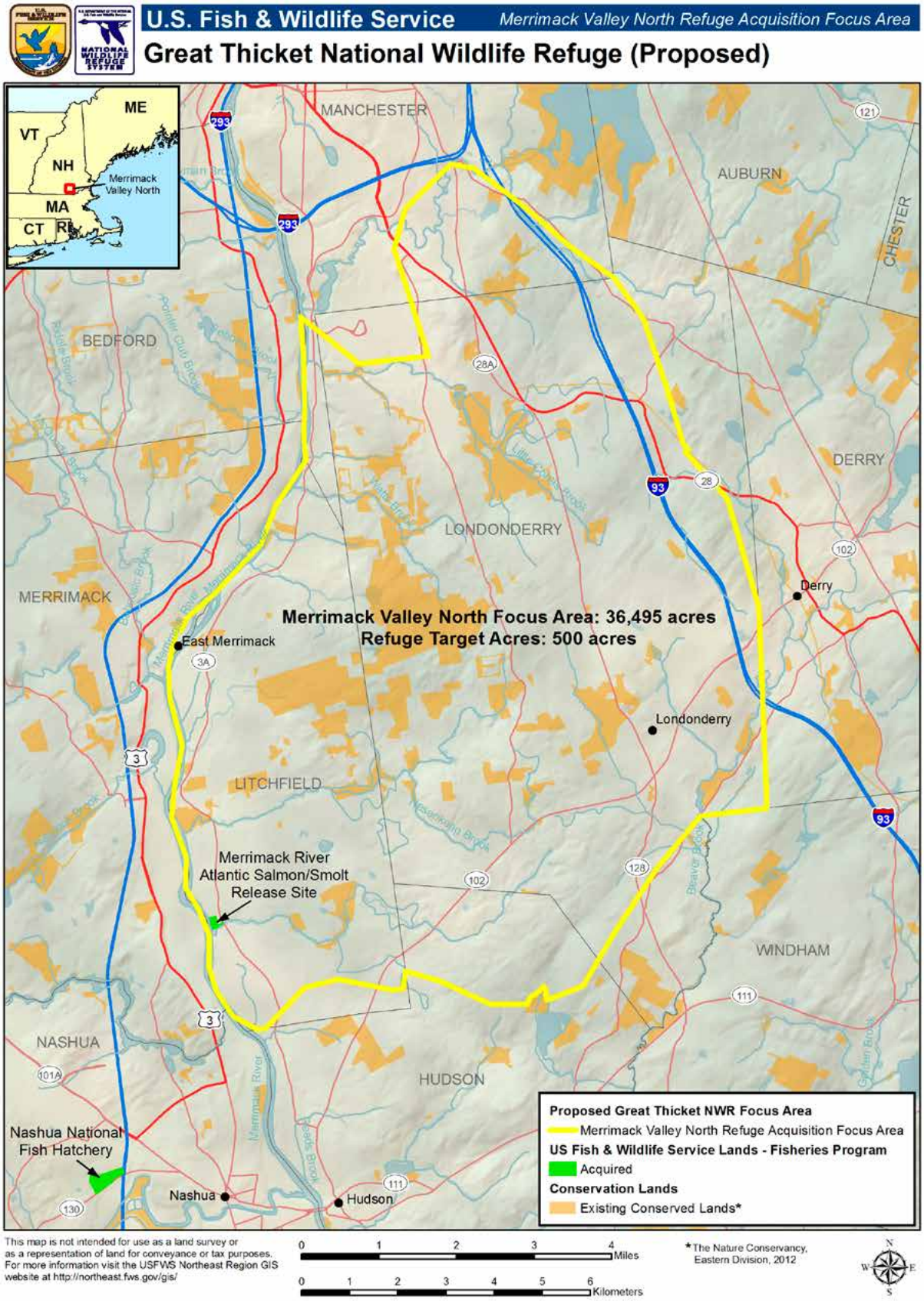
Table 15: Merrimack Valley North Land Cover Types

Land Cover Types	Merrimack Valley North RAFA Acres
Peatland	24
Northeastern Upland Forest	14,407
Northeastern Wetland Forest	3,395
Agriculture	3,220
Freshwater Marsh	848
Developed	11,195
Total	**33,089**

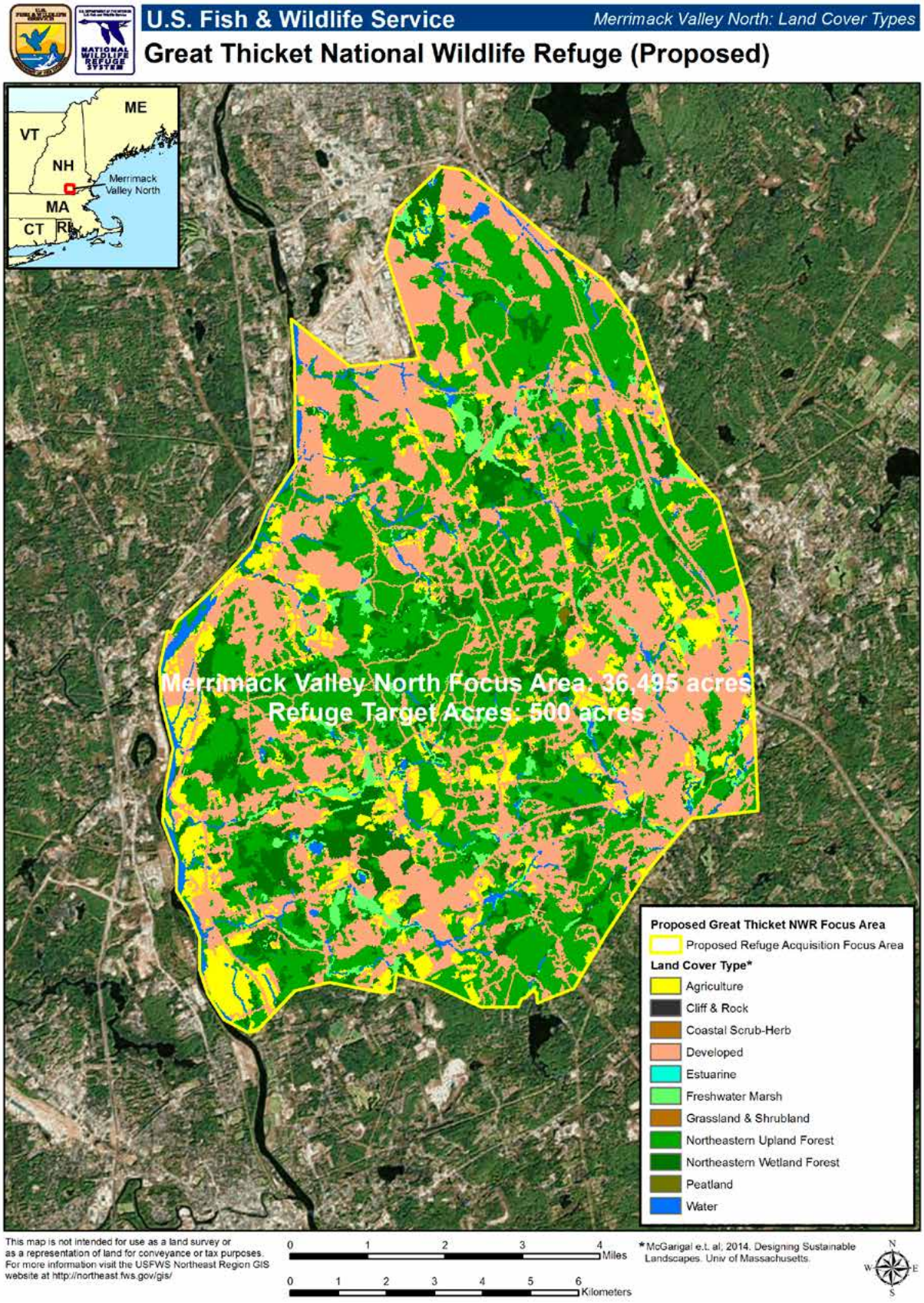
Emma Carcagno/UNH Cooperative Extension

Regenerating young forest (aspen and birch) at Bellamy River Wildlife Management Area in Dover, New Hampshire

Map 10: Merrimack Valley North Refuge Acquisition Focus Area



Map 11: Merimack Valley North Refuge Acquisition Focus Area: Land Cover Types



The archaeological record within this sub-region is complex and diverse. It has provided evidence of Native American settlement that began more than 11,000 years ago. The sub-region also witnessed early Euro-American exploration and colonization, which affected land use and local ecology.

The Merrimack Valley North RAFA is characterized by glaciated landscapes, with streams and wetlands. Although environmental transitions affected the types of plant and animal species that were available to Native Americans for their subsistence, their settlement systems appear to have been oriented around these freshwater resource areas throughout the ancient past. Consequently, undeveloped areas in settings such as wetland margins and zones near the Merrimack River have high sensitivity for Native American archaeological sites, including large and small settlements, and seasonal camps.

Habitat restoration area in Lee Five Corner Preserve in New Hampshire

Ted Kendziora/USFWS

Euro-American settlement began in the mid-17th century, resulting in the initial occupation of Nashua (1655), Derry (1719), and Manchester (1722) near the focus area. Euro-American land use featured the establishment of villages and farms, and early industries such as grist mills, sawmills, lumber camps, and tanneries. Today, undeveloped locations that feature favorable agricultural soils in this RAFA, and are found near water sources, thoroughfares, or centers of colonial-period occupation, are likely to contain archaeological evidence of agrarian land use and settlement over the last three and a half centuries.

Lands within this sub-region that may be considered for acquisition are likely to include undeveloped, open spaces and current, or former agricultural areas. Depending on the proximity of such properties to freshwater resources (e.g., wetlands, streams, rivers) or to locations that witnessed historic land use (e.g., settlement, agriculture, early industries), expected historic properties in the acquired lands may include Native American and Euro-American archaeological sites, and historic agricultural structures.

Southeastern Massachusetts Sub-Region

This sub-region includes the Plymouth and Mashpee RAFAs. These RAFAs are located in the low elevation area near and on Cape Cod respectively. Shrubland habitats in these areas include pine barrens and scrub-oak shrublands that can be more permanent in nature. Approximately half of the land within the two RAFAs is forested and just over one-quarter is developed. Within these two RAFAs, a total of 26,595 acres is currently protected. Over 60 percent of that protected land is State conservation land (16,626 acres) and 6,703 acres is protected by local governments.

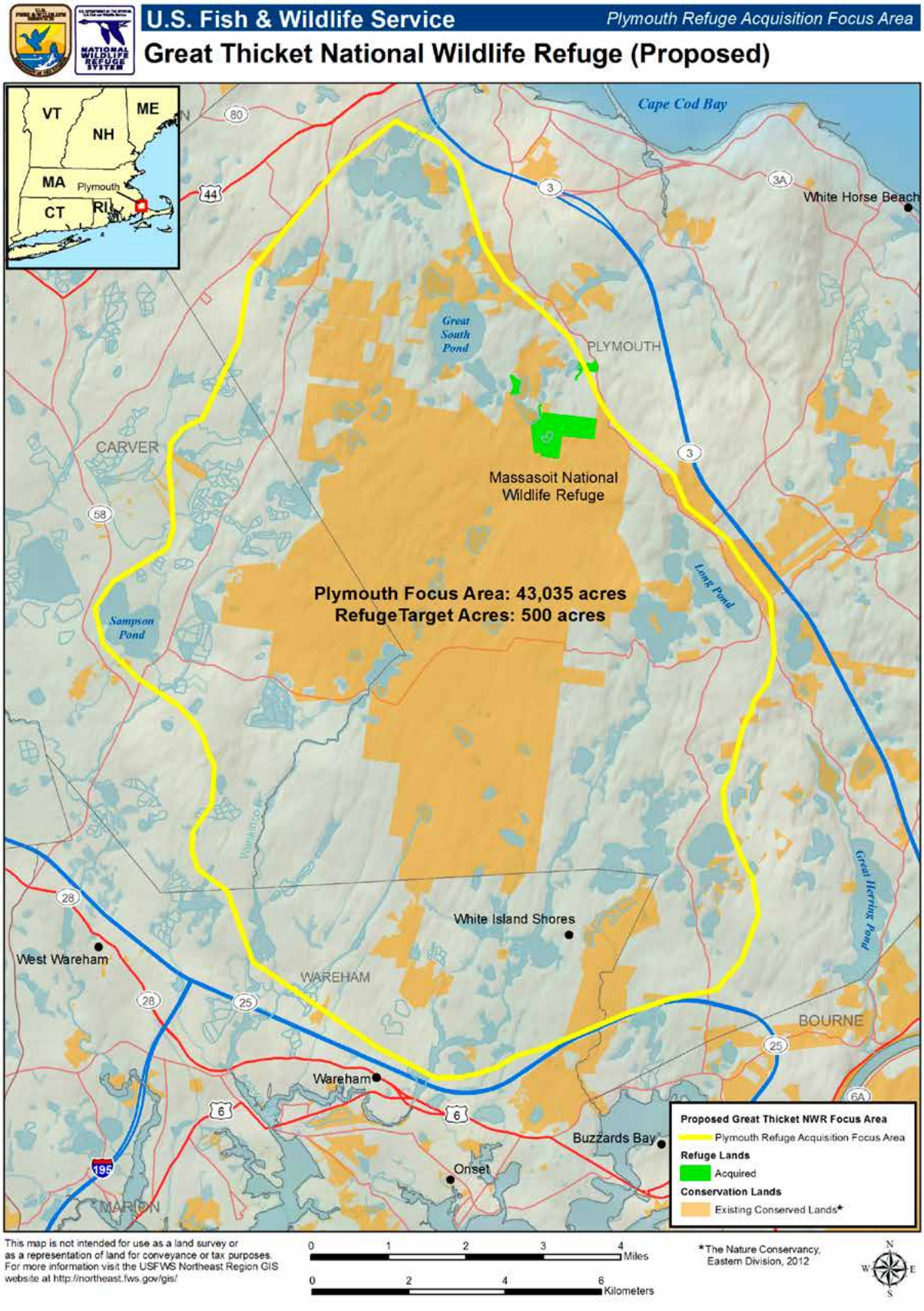
Table 16: Southeastern Massachusetts Sub-Region Conserved Lands

	Plymouth RAFA Acres	Mashpee RAFA Acres	Total
Federal	192	281	473
State	13,571	3,055	16,626
Local	1,048	5,655	6,703
Non-government conservation organization	1,439	790	2,229
Private landowner conservation easement	165	399	564
Total	**16,415**	**10,180**	**26,595**

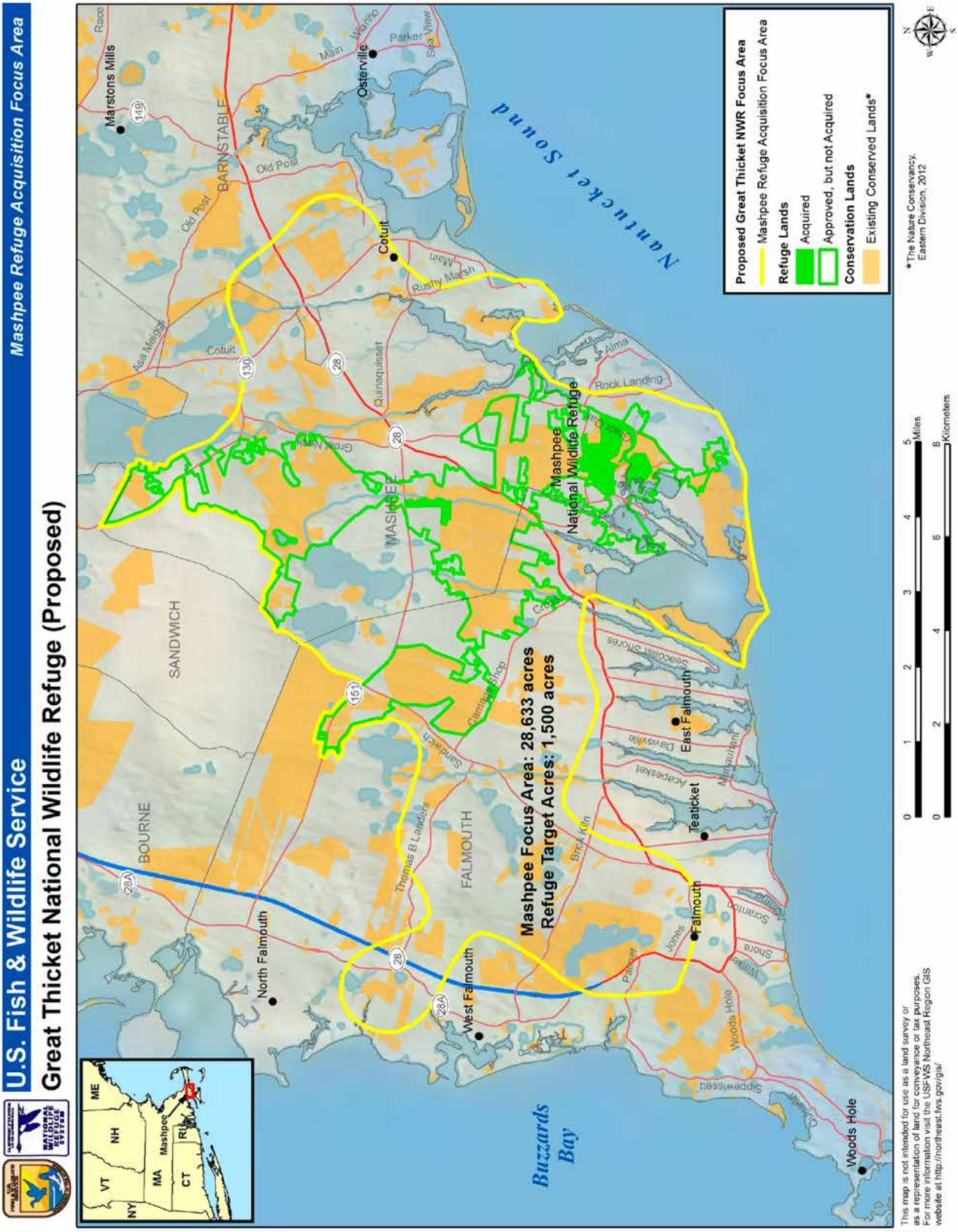
Table 17: Southeastern Massachusetts Sub-Region Land Cover Types

	Plymouth RAFA Acres	Mashpee RAFA Acres	Total
Grassland and Shrubland	1,495	220	1,715
Peatland	95	34	129
Northeastern Upland Forest	23,649	11,234	34,883
Northeastern Wetland Forest	873	688	1,561
Agriculture	4,605	382	4,987
Freshwater Marsh	412	292	704
Estuarine Intertidal	0	42	42
Open water	5,422	1,669	7,091
Developed	6,471	11,173	17,644
Total	**43,022**	**25,734**	**68,756**

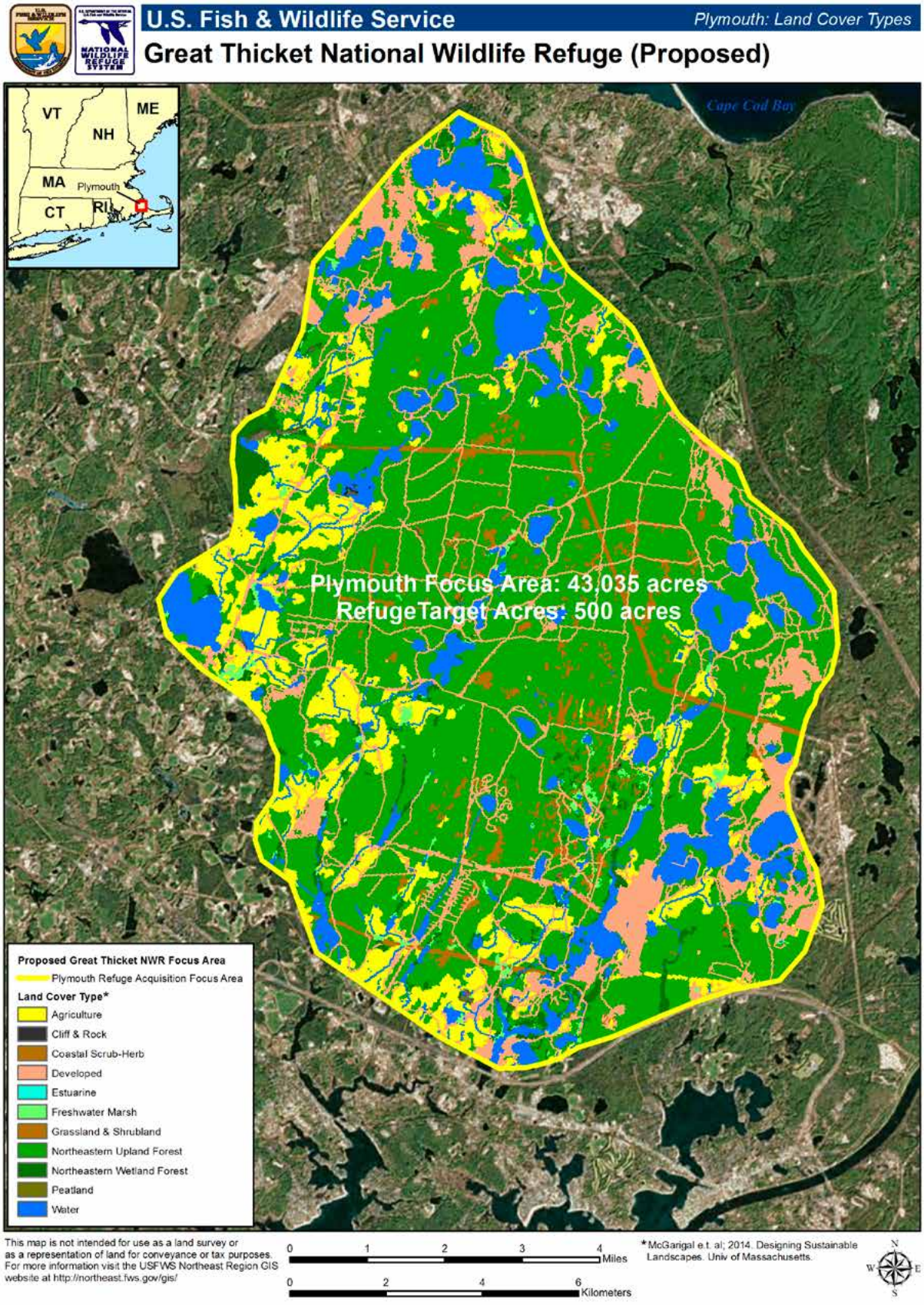
Map 12: Plymouth Refuge Acquisition Focus Area



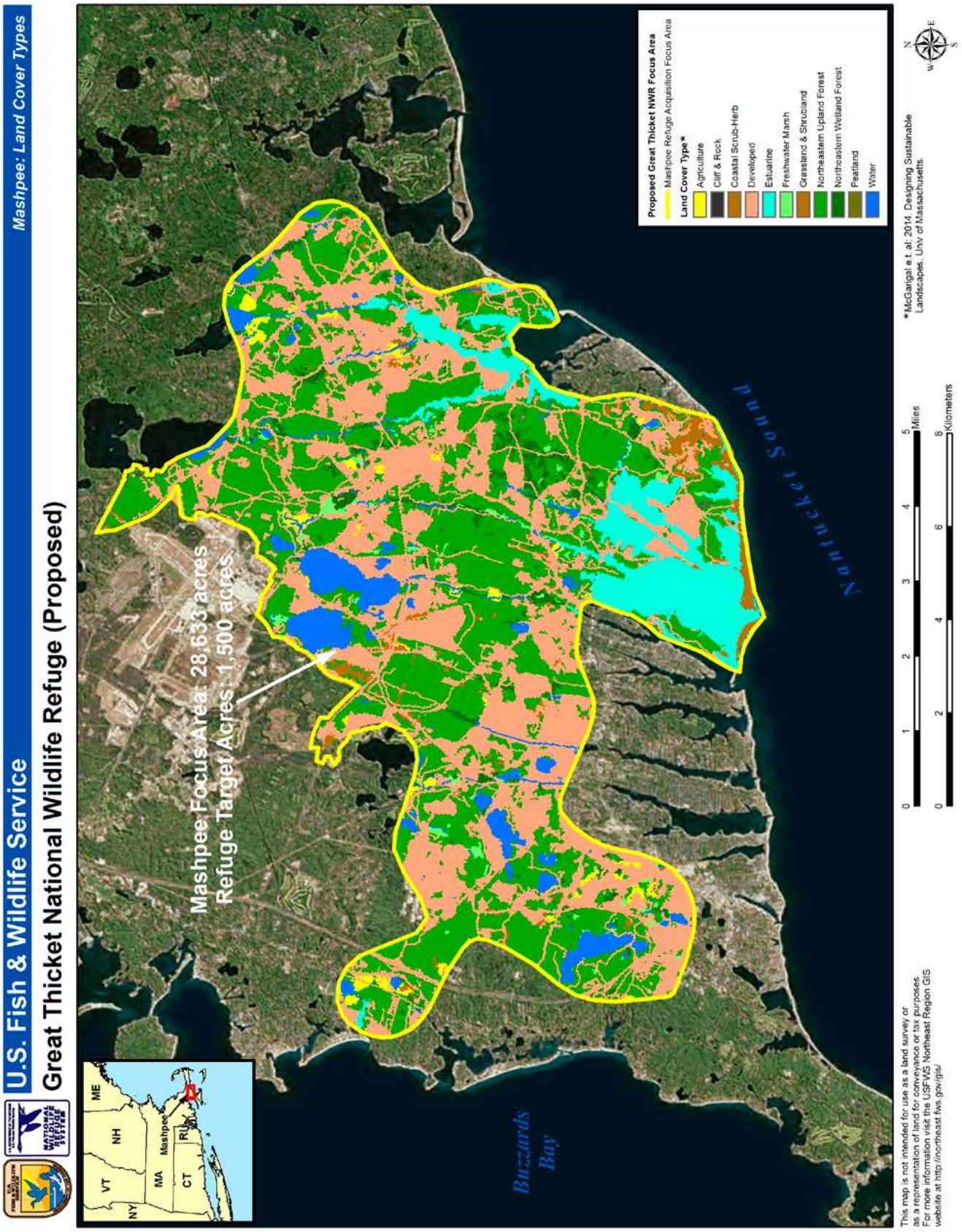
Map 13: Mashpee Refuge Acquisition Focus Area



Map 14: Plymouth Refuge Acquisition Focus Area: Land Cover Types



Map 15: Mashpee Refuge Acquisition Focus Area: Land Cover Types



The archaeological record within this sub-region is complex and diverse. It has provided evidence of Native American settlement that began more than 11,000 years ago. The area was continuously populated by indigenous people, even as profound changes in environmental conditions occurred, and the estuary systems, rivers, and coastline recognized today came into form. The sub-region also witnessed some of the earliest Euro-American exploration and colonization in North America, with consequences for land use and local ecology.

The Plymouth and Mashpee RAFAs are both characterized by glaciated landscapes, with numerous ponds, streams, and wetlands in proximity to the Atlantic coastline. Although environmental transitions affected the types of plant and animal species that were available to Native Americans for their subsistence, their settlement systems appear to have been oriented around these freshwater resource areas throughout the ancient past. Consequently, undeveloped areas in settings such as wetland margins have high sensitivity for Native American archaeological sites, including large and small settlements, seasonal camps, and burial grounds. Native American communities in this sub-region followed a seasonal round, favoring coastal settlements during the summer months and inland settlements during the winter. Today, the descendants of these Native American groups include the members of the two federally recognized Tribes in this sub-region: the Mashpee Wampanoag Tribe, and the Wampanoag Tribe of Gay Head (Aquinnah).

Historical Euro-American settlement began in the early 17th century, resulting in the founding of Plymouth and Mashpee near the two RAFAs. Euro-American land use featured the establishment of villages, farms, fishing and seafaring points, and early industries such as grist mills, sawmills, and tanneries. Today, undeveloped locations that feature favorable agricultural soils in the RAFAs, and are found near water sources, thoroughfares, or centers of early colonial occupation, are likely to contain archaeological evidence of agrarian land use and settlement over the last four centuries.

Management for shrubland wildlife in Connecticut

Bill Zinni/USFWS

Lands within this sub-region that may be considered for acquisition are likely to include undeveloped, open spaces and current, or former, agricultural areas. Depending on the proximity of such properties to freshwater resources (e.g., wetlands, streams, rivers) and to locations that witnessed historic land use (e.g., settlement, agriculture, early industries), expected historic properties in the acquired lands may include Native American and Euro-American archaeological sites, and historic agricultural structures.

Southeastern Connecticut/Rhode Island Coast Sub-Region

This sub-region includes the RI East-West and the Pachaug-Ledyard RAFAs. Similar to the Southeastern Massachusetts sub-region, these areas are relatively heavily developed with over 20 percent of the land within the two RAFAs considered developed. Only 8 percent of the land is in agricultural use and almost 60 percent is forested. Within these focus areas, there is nearly 9,000 acres of State conservation land and just over 6,000 acres of non-governmental conservation organization land.

Table 18: Southeastern Connecticut/Rhode Island Coast Sub-Region Conserved Lands

	RI East-West RAFA Acres	Pachaug-Ledyard RAFA Acres	Total
Federal	1,762	0	1,762
State	8,848	11	8,859
Local	3,423	880	4,303
Non-government conservation organization	5,270	732	6,002
Private landowner conservation easement	4,293	194	4,487
Total	**23,596**	**1,817**	**25,413**

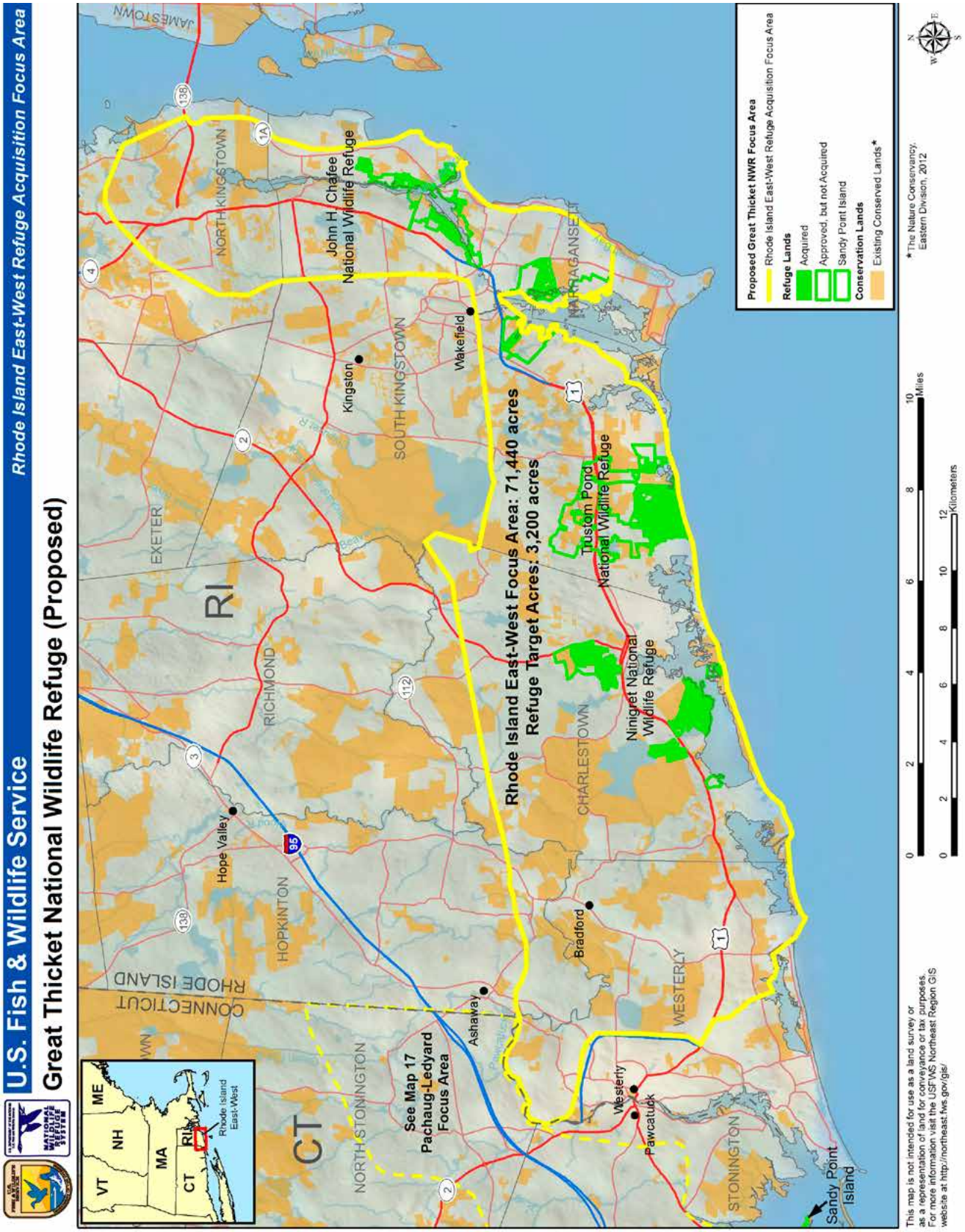
Table 19: Southeastern Connecticut/Rhode Island Coast Sub-Region Land Cover Types

	RI East-West RAFA Acres	Pachaug-Ledyard RAFA Acres	Total
Grassland and Shrubland	1,221	290	1,511
Coastal Shrub-herb	1,292	342	1,634
Peatland	56	6	62
Northeastern Upland Forest	25,964	18,960	44,924
Northeastern Wetland Forest	14,078	4,520	18,598
Agriculture	3,732	5,195	8,927
Freshwater Marsh	1,123	233	1,356
Open water	3,538	1,068	4,606
Developed	15,817	7,195	23,012
Total	**66,821**	**37,809**	**104,630**

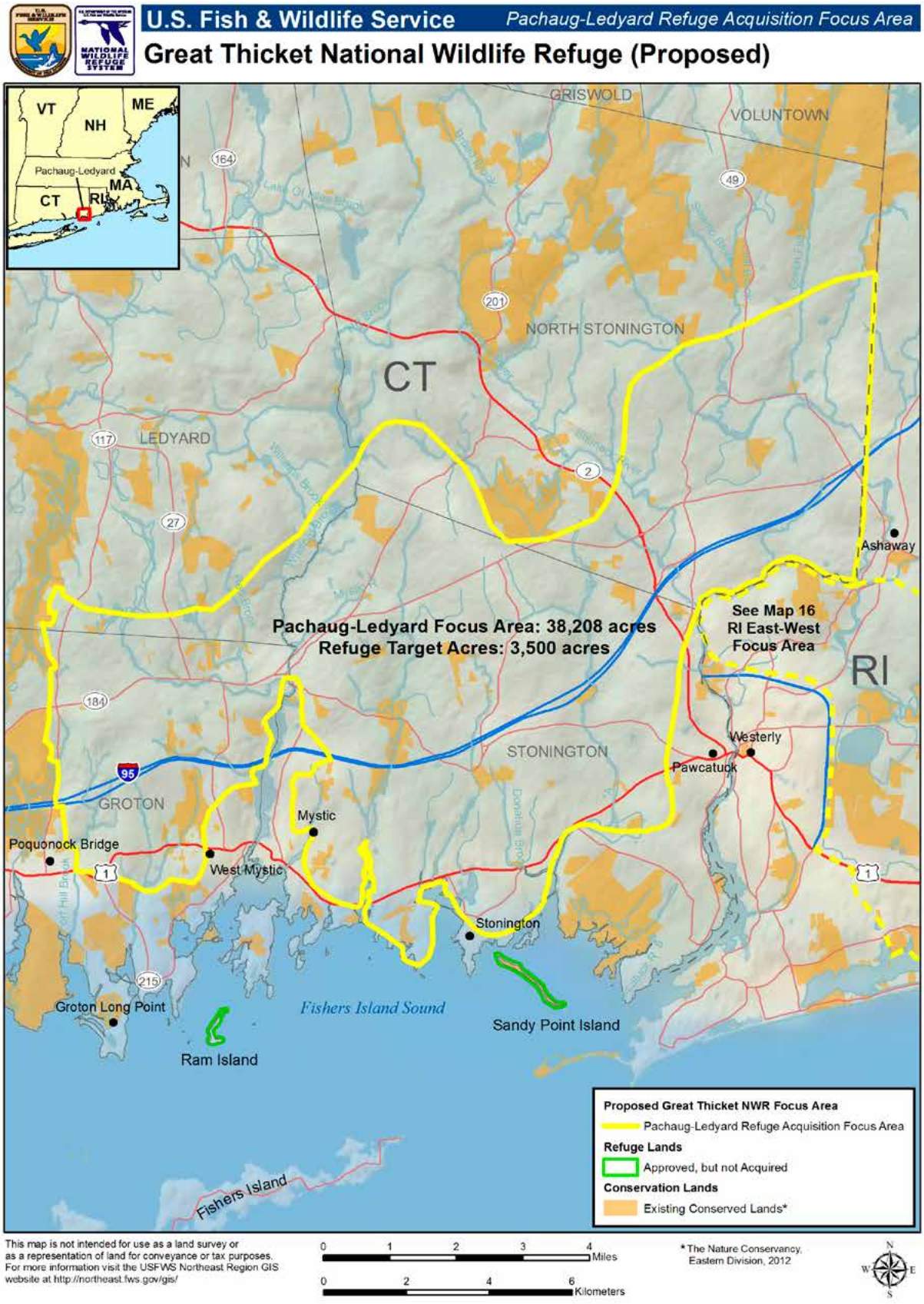
The archaeological record within this sub-region has provided evidence of Native American settlement that began more than 11,000 years ago. Indigenous people adapted to profound changes in environmental conditions, as the estuary systems, rivers, and coastline recognized today came into form. This sub-region also witnessed early Euro-American exploration and colonization, which affected land use and local ecology.

The Rhode Island East-West and Pachaug-Ledyard RAFAs are both characterized by glaciated landscapes, with numerous ponds, streams, rivers, and wetlands, many of which are close to the Atlantic coastline. Although environmental transitions affected the types of plant and animal species that were available to Native Americans for their subsistence, their settlement systems appear to have been oriented around these freshwater resource areas throughout the ancient past. Consequently, undeveloped areas in settings such as wetland margins have high sensitivity for Native American archaeological sites, including large and small settlements, and seasonal camps. Today, the descendants of these Native American groups include the members of the federally recognized Tribes in this sub-region: the Narragansett Indian Tribe, the Mashantucket Pequot Tribal Nation, and the Mohegan Tribe of Indians of Connecticut.

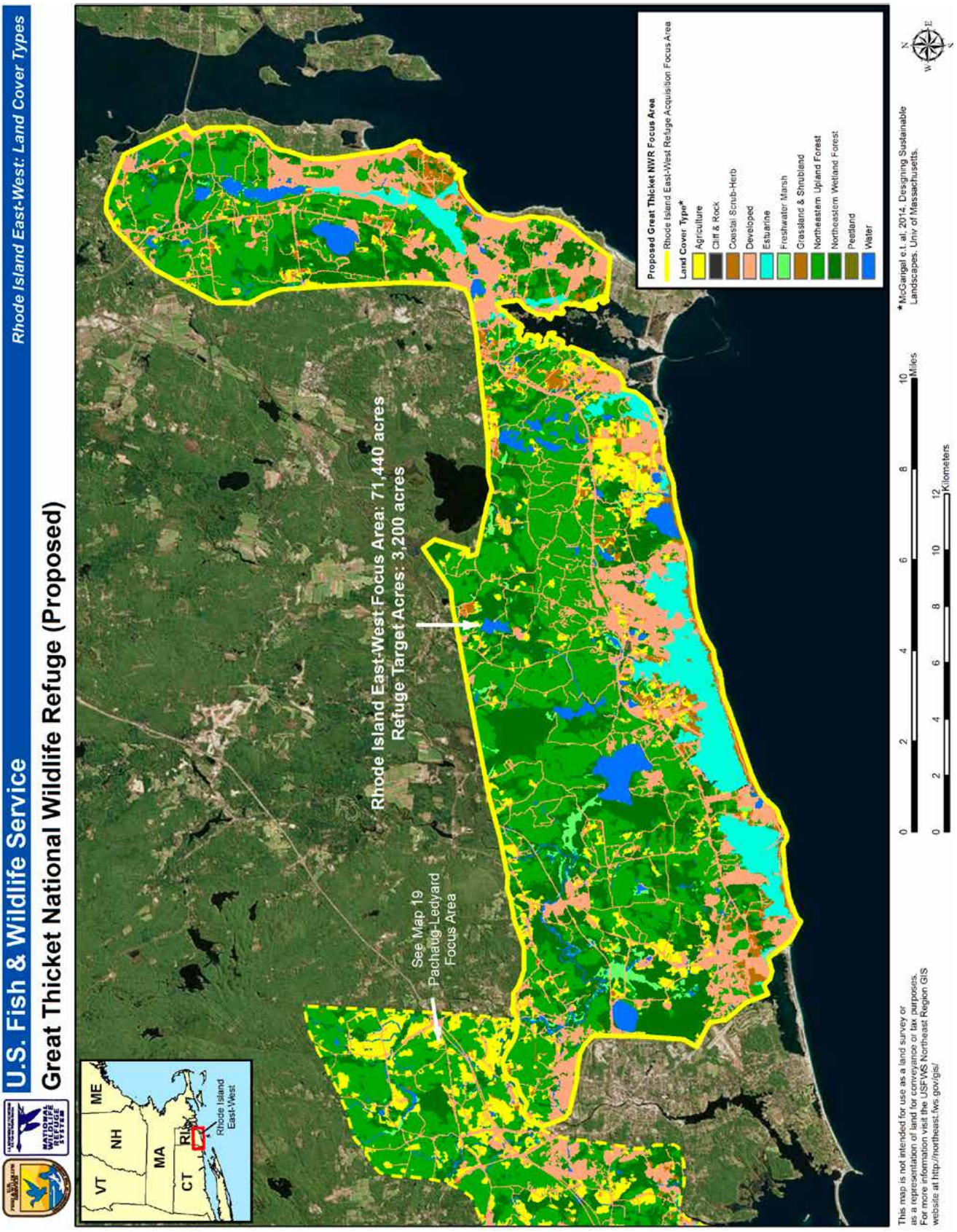
Map 16: Rhode Island East-West Refuge Acquisition Focus Area



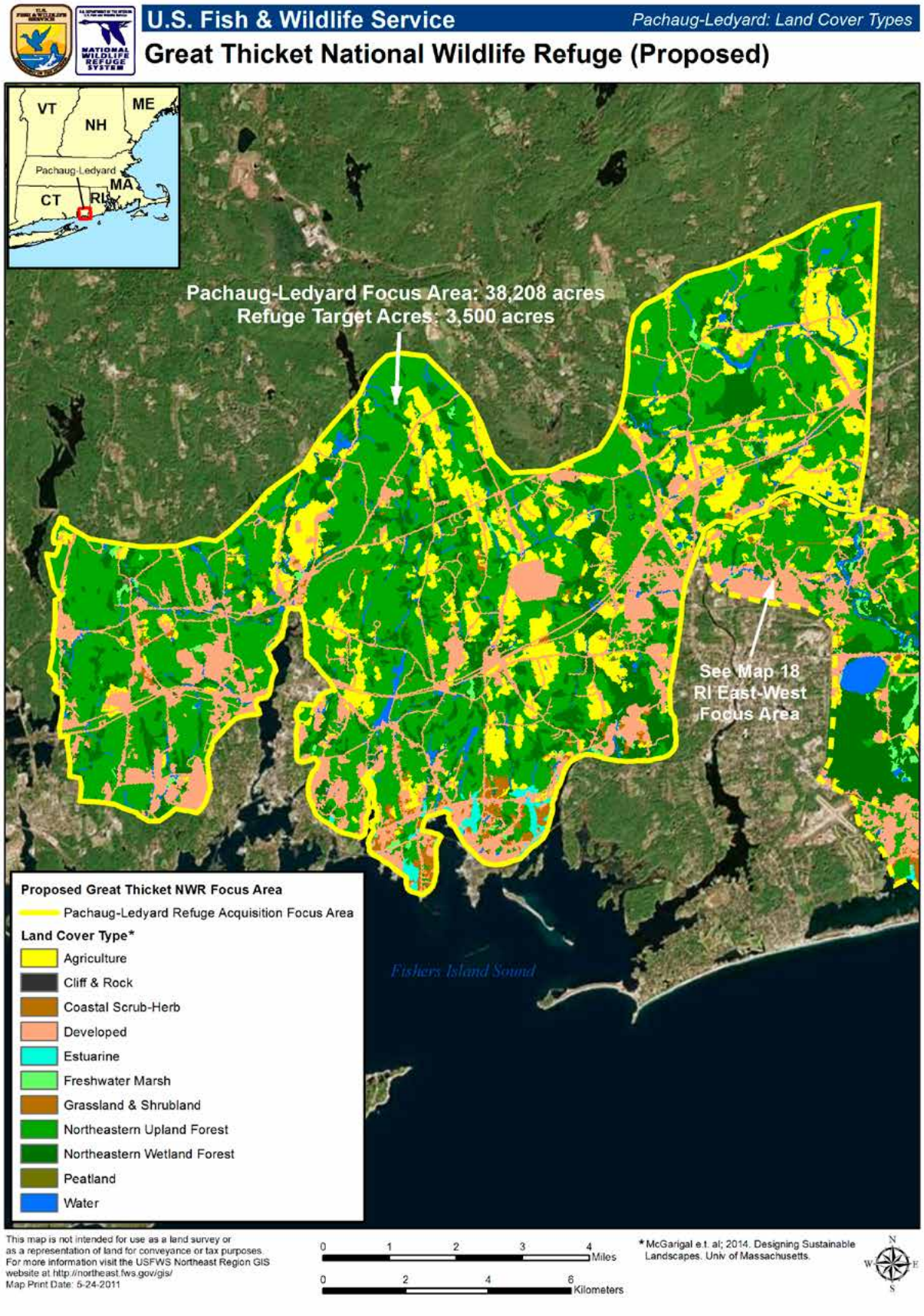
Map 17: Pachaug-Ledyard Refuge Acquisition Focus Area



Map 18: Rhode Island East-West Refuge Acquisition Focus Area: Land Cover Types



Map 19: Pachaug-Ledyard Refuge Acquisition Focus Area: Land Cover Types



Euro-American settlement within the RAFAs began in the early 17th century, resulting in the founding of numerous colonial towns. Euro-American land use featured the establishment of villages, farms, fishing and seafaring points, and early industries such as grist mills, sawmills, and tanneries. Today, undeveloped locations that feature favorable agricultural soils in the RAFAs and are found near water sources, thoroughfares, or centers of early colonial occupation, are likely to contain archaeological evidence of agrarian land use and settlement over the last four centuries.

Lands within this sub-region that may be considered for acquisition are likely to include undeveloped, open spaces and current, or former, agricultural areas. Depending on the proximity of such properties to freshwater resources (e.g., wetlands, streams, rivers) and to locations that witnessed historic land use (e.g., settlement, agriculture, early industries), expected historic properties in the acquired lands may include Native American and Euro-American archaeological sites, and historic agricultural structures.

New York/Connecticut Border Sub-Region

The Northern Housatonic RAFA is the only focus area in this sub-region. This area is less than 10 percent developed and is nearly 60 percent forested. It has the highest percentage of its land classified as agriculture (32 percent) of the five sub-regions. Within the Northern Housatonic RAFA, 1,353 acres of land are protected. Of that total, nearly half (623 acres) is owned by conservation organizations and approximately one-quarter (380 acres) is protected as Federal land.

Table 20: New York/Connecticut Border Sub-Region Conserved Lands

Ownership	Northern Housatonic RAFA Acres
Federal	380
State	108
Local	1
Non-government conservation organization	623
Private landowner conservation easement	241
Total	**1,353**

Table 21: New York/Connecticut Border Sub-Region Land Cover Types

Land Cover Types	Northern Housatonic RAFA Acres
Grassland and Shrubland	85
Northeastern Upland Forest	19,320
Northeastern Wetland Forest	1,768
Agriculture	8,063
Freshwater Marsh	923
Open water	1,893
Developed	3,243
Cliff and Rock	382
Total	**35,677**

New England cottontails use thick shrubs and young trees to hide from predators.

Emily Reuber/SUNY-ESF

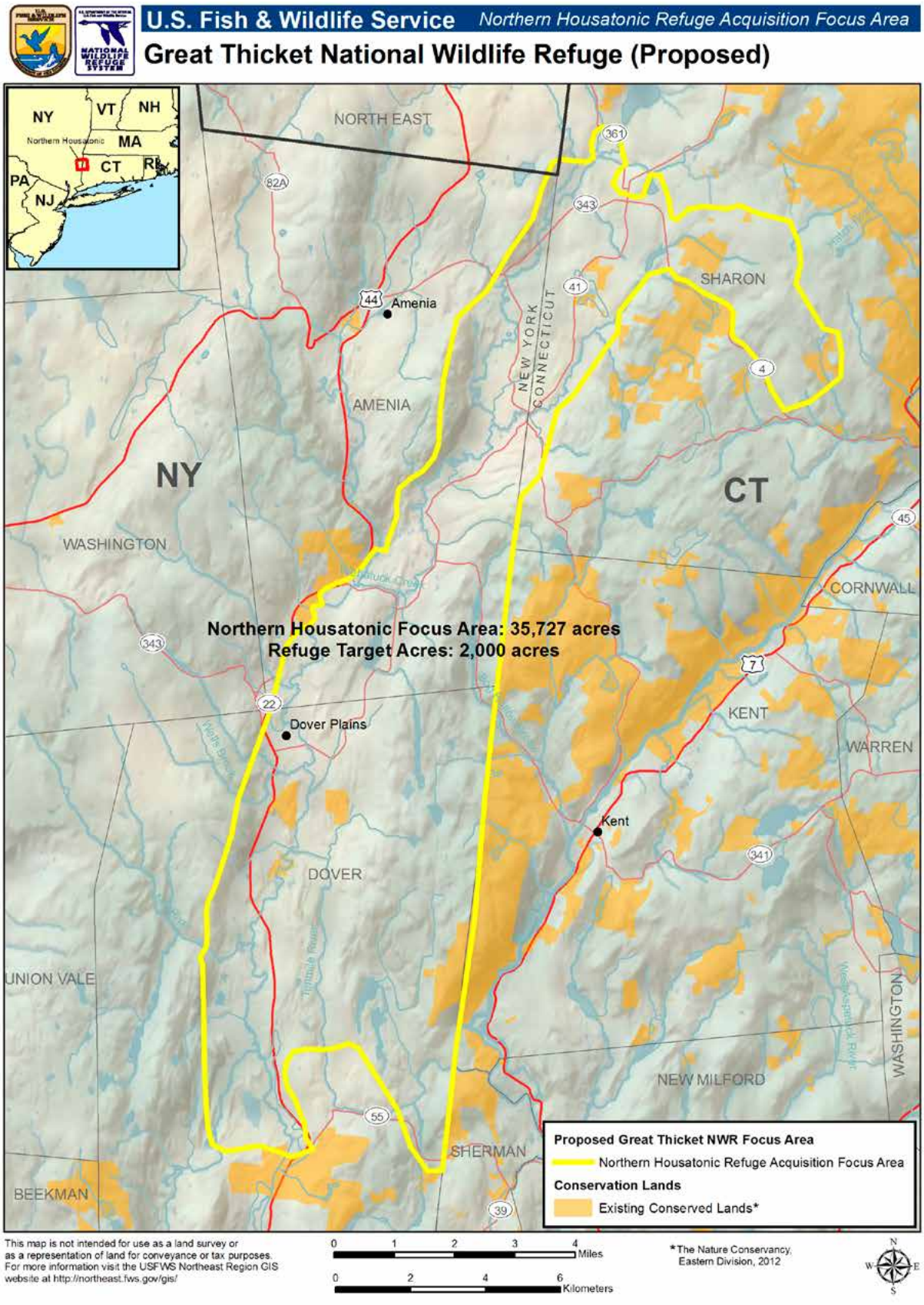
The archaeological record within this sub-region has provided evidence of Native American settlement that began more than 11,000 years ago. There is archaeological evidence of settlement occurring in subsequent periods, up until the time of European contact, although this area was somewhat isolated from more focal areas of Native American settlement within the Hudson River Valley, the lower Housatonic River drainage, and in coastal Connecticut. Even until the early 18th century, the lands within the Northern Housatonic RAFA were not well-known to the colonial authorities of New York and Connecticut.

The Northern Housatonic RAFA is characterized by a glaciated landscape, with multiple ponds, streams, and wetlands distributed among rugged, forested ridges and gently rolling valley floors. Although changing environmental conditions affected the types of plant and animal species that were available to Native Americans for their subsistence, their settlement systems appear to have been oriented around these freshwater resource areas throughout the ancient past. Consequently, undeveloped areas in settings such as wetland margins have high sensitivity for Native American archaeological sites, including long-term settlements and seasonal camps. Today, the descendants of the Native American people of this RAFA include members of the federally recognized Stockbridge-Munsee Band of the Mohican Nation.

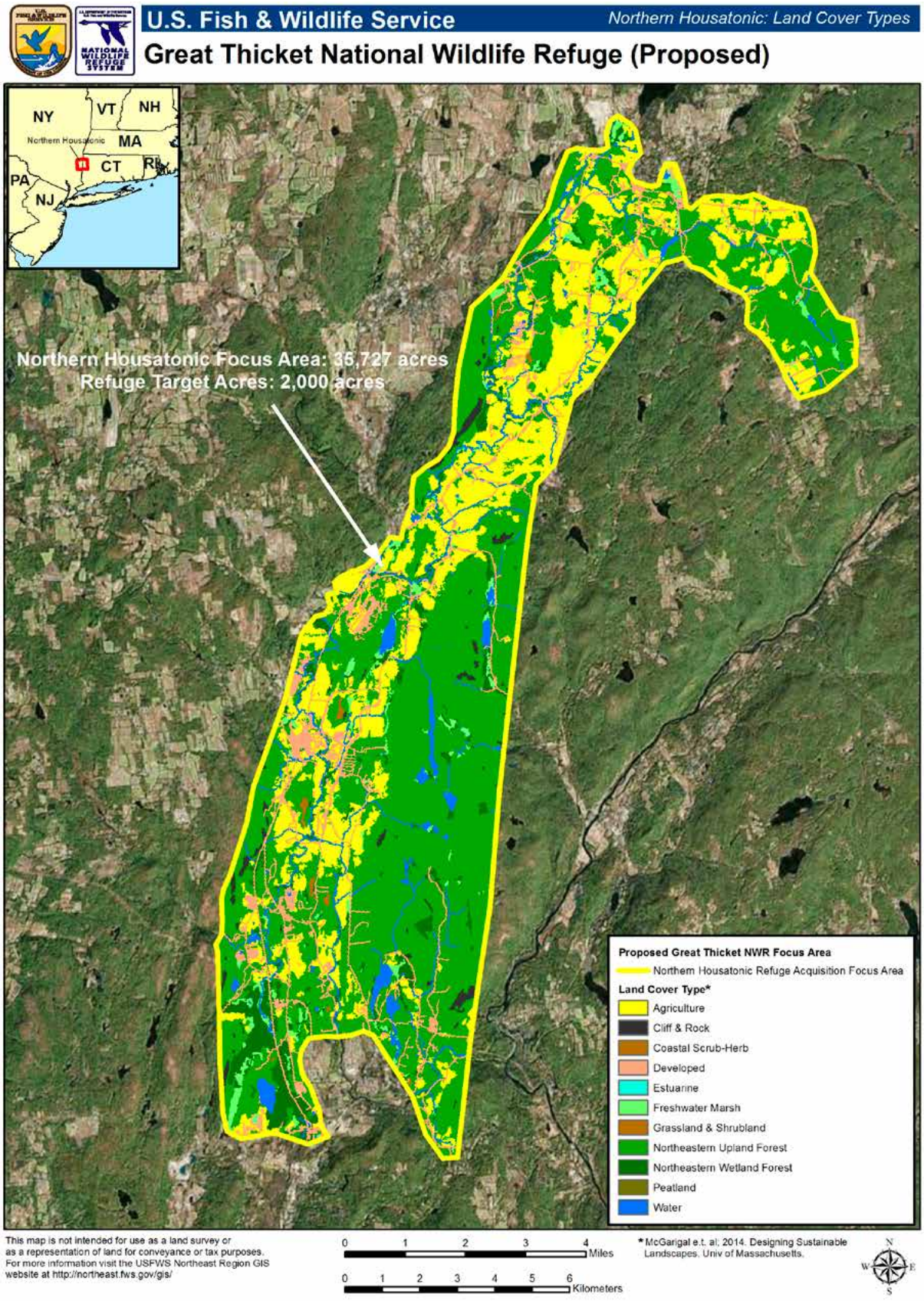
Historical Euro-American settlement began in the late 17th and early 18th centuries, resulting in the founding of multiple townships near the Northern Housatonic RAFA. Euro-American land use featured the establishment of villages, farms, and early industries such as grist mills, sawmills, and iron works. Today, undeveloped locations that feature favorable agricultural soils in this sub-region, and are found near water sources, thoroughfares, or centers of colonial occupation, are likely to contain archaeological evidence of agrarian land use and settlement over the last three centuries.

Lands within this sub-region that may be considered for acquisition are likely to include undeveloped, open spaces and current, or former, agricultural areas. Depending on the proximity of such properties to freshwater resources (e.g., wetlands, streams, rivers) and to locations that witnessed historic land use (e.g., settlement, agriculture, early industries), expected historic properties in the acquired lands may include Native American and Euro-American archaeological sites, and historic agricultural structures.

Map 20: Northern Housatonic Refuge Acquisition Focus Area



Map 21: Northern Housatonic Refuge Acquisition Focus Area: Land Cover Types



Chapter 4

Bill Thompson

Gray catbird

Environmental Consequences

- Introduction
- Impact Analysis and Relationship to Scale
- Effects on Cultural Resources and Historic Preservation
- Effects on the Physical Environment
- Effects on the Socio-Economic Environment
- Effects on the Biological Environment
- Cumulative Impacts

Introduction

This chapter analyzes and discusses the potential environmental effects on the resources outlined in Chapter 3—Affected Environment. Environmental effects include those that are direct, indirect, and cumulative. Direct effects are caused by the action and occur at the same time and place. Indirect effects are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable.

Alternative B, if approved, is generally believed to have indirect effects since the majority of lands are not expected to be protected immediately. Cumulative impacts are effects on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative effects are discussed in a separate section following the analysis of alternatives A and B.

Potential effects or impacts, either positive (beneficial) or negative (adverse), to resources resulting from the implementation of the two alternatives were identified and placed into one of the following listed categories, when possible:

- None—no effects expected.
- Minimal—impacts are not expected to be measurable, or are too small to cause any discernible degradation to the environment.
- Minor—impacts would be measurable, but not substantial, because the impacted system is capable of absorbing the change.
- Moderate—effects would be measureable, but could be reduced through appropriate conservation measures.
- Major—impacts would be measurable and individually or cumulatively significant; an Environmental Impact Statement would be required to analyze these impacts.

Impact significance is defined in terms of intensity, the type, quality, and sensitivity of the resource involved, the location of a proposed projects, the duration of its effect (short-term or long-term), and other consideration of context. It is not a value judgment, as some actions can be beneficial for one species and adverse for another, or have a positive impact on visitor use but a negative impact on migratory birds.

We recognize that we cannot fully address all the potential impacts involved with the alternatives through this planning process. Inevitably, some future management decisions may require more detailed analysis before an action can be implemented. For specific projects evaluated in the future, NEPA documents will be prepared that address and fully analyze the potential adverse and beneficial impacts. Most likely, these NEPA documents will be prepared by Service staff at the national wildlife refuge nearest to the acquisition parcel. Our goal is to develop and implement all future plans to minimize adverse impacts while maximizing the long-term benefits to each resource. Each additional NEPA analysis will include compliance with Federal laws and mandates including the ESA, the National Historic Preservation Act, and the Coastal Zone Management Act, as appropriate. Although not a comprehensive list, we recognize that further analysis would be required for the following projects associated with Refuge System lands:

- Habitat Management Plans (HMPs)
- Hunt Plans by respective state

- Fishing Management Plans
- Fire Management Plan (following HMP completion).
- Visitor Services Plan
- Integrated Pest Management Plan

Impact Analysis and Relationship to Scale

We have organized this section by major resource heading. Under each heading we discuss the impacts of each alternative. We generally discuss the impacts to the physical and socioeconomic environment on the AOI scale and the impacts to the biological environment on the RAFA scale (see Table 22 below). This aligns with how we discuss the same resources in Chapter 2—Affected Environment.

Each section addresses the projected types of impacts, both adverse and beneficial, potentially resulting from proposed actions in the different alternatives. We also describe, when possible, how impacts differ across alternatives. In doing so, impacts can more clearly be compared and evaluated. Lastly, concluding summary statements about impacts are provided for each section analyzed.

Table 22: Context for Impact Analysis

Resource Impacted	Resource Aspect	Area of Interest	Refuge Acquisition Focus Areas
Physical	Geomorphology	✔	
	Hydrology and water quality	✔	
	Soils	✔	
	Climate	✔	
	Air quality	✔	
Socioeconomic	Local tax revenues	✔	
	Local property values	✔	
	Refuge personnel salary spending	✔	
	Refuge visitor spending	✔	
	Cultural Resources and Historic Preservation	✔	✔
Biological	Vegetation and habitat types		✔
	Birds		✔
	Mammals		✔
	Federal-listed species and other species of concern		✔

Effects on Cultural Resources and Historic Preservation

New England cottontail released on Patience Island in Rhode Island

Tom Barnes/USFWS

Impacts that would not vary by Alternative

Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and Section 14 of the Archaeological Resources Protection Act require the Service to evaluate the effects of any of its actions on cultural resources (e.g. historic, architectural and archaeological) that are listed or eligible for listing in the National Register of Historic Places (NRHP). In accordance with these regulations, the Service has coordinated the review of this proposal with all six states that are affected by this proposal. The body of Federal historic preservation laws has grown dramatically since the enactment of the Antiquities Act of 1906. Several themes recur in these laws, their promulgating regulations, and more recent executive orders. They include: (1) Each agency is to systematically inventory the historic properties on its holdings and to scientifically assess each property's eligibility for the NRHP; (2) Federal agencies are to consider the impacts to cultural resources during the agencies' management activities and seek to avoid or mitigate adverse impacts; (3) the protection of cultural resources from looting and vandalism are to be accomplished through a mix of informed management, law enforcement efforts, and public education; and (4) the increasing role of consultation with groups, such as Native American Tribes, in addressing how a project or management activity may impact specific archaeological sites and landscapes deemed important to those groups. The Service, like other Federal agencies, is legally mandated to inventory, assess, and protect cultural resources located on those lands that the agency owns, manages, or controls. The Service's cultural resource policy is delineated in 614 FW 1-5 and 126 FW 1-3.

Activities outlined in each alternative have some potential to adversely impact cultural resources, either by direct disturbance during a variety of habitat management projects (e.g., mowing), minor construction (e.g., interpretative sign installation), public use activities (e.g., hiking), and administration and operations activities (e.g., parking lot and road construction). These actions may directly or indirectly expose cultural and historic artifacts. The presence of cultural resources including historic properties would not prevent a Federal undertaking or project, but any undertaking would be subject to the above-mentioned laws and regulations.

Refuge staff would provide the Regional Office archaeologist a formal description and location of all projects, activities, routine maintenance, and operations that could disturb the ground or structures, details on requests for appropriate and compatible uses, and the options being considered. The archaeologist would analyze these undertakings for their potential to affect historic properties and enter into consultation with the State Historic Preservation Officer (SHPO) and other parties as appropriate. As necessary, Service staff would notify the public and local government officials. The Service would protect all known gravesites. Any collection of materials for tribal ceremonial purposes would be conducted under a special use permit.

Impacts of Alternative A

Alternative A would have an adverse impact on the protection of historical and archaeological resources in the AOI. Without additional protection, cultural resources, whether listed or not, tend to be vulnerable to development, disturbance, take, and vandalism. Absent the establishment of Great Thicket NWR, fewer lands would be managed by the Service and its partners, which

have a clear responsibility for protection of cultural resources. Landowners and developers have no similar legal responsibilities, unless one of their activities requires a Federal permit (e.g., U.S. Army Corps of Engineers 404 Permit, or a Service Incidental Take Permit) or state permit. If permits are required, landowners or developers would have to comply with either Section 106 of the NHPA or state regulations regarding cultural resources prior to the issuance of any permit. In these cases, archaeological and historical investigations, if deemed necessary by the Federal agency, the state agencies, and the tribes, would be limited to the project area in question. The activity could proceed provided that the landowner or developer has taken steps to avoid, minimize, or mitigate adverse impacts to historic properties identified within the specific project area. Because of population growth, increased urbanization, and changing land use patterns projected for the region, a number of historical properties would likely be adversely impacted under the no action alternative. These impacts are expected to be moderate.

Impacts of Alternative B
Moderate beneficial impacts to cultural resources would be anticipated from the implementation of alternative B. Federal acquisition in any of the RAFAs would help increase the preservation of any archaeological and historic sites on otherwise unprotected lands. The Service, like other Federal agencies, has several legally mandated responsibilities that include development of a cultural resource management plan, compliance with Section 106 of the NHPA prior to any undertaking that possesses the potential to impact historic properties, archaeological inventory of its lands and subsequent National Register eligibility testing, research-directed testing or excavation, site protection, and interpretation. Critical to these efforts are the SHPOs, Federally recognized Native American Tribes, and a number of interested parties, such as nearby universities, adjacent landowners, and state resource agencies. Protection of historic properties would be enhanced by incorporating concepts of site stewardship and ownership, where appropriate, into public use materials and interpretive panels. This effort would be further enhanced by providing advanced archaeological resource protection training to refuge law enforcement personnel.

Minimal adverse impacts to cultural resources could be anticipated under alternative B. There could be some risk that where refuge lands are open to the public, visitors may inadvertently or intentionally damage or disturb cultural resource sites; however, we would employ all means available to protect archaeological sites, historic structures, cemeteries, and historic landscapes through scientific investigations, public education, partnerships with tribal, state, and local governments, and law enforcement efforts.

Effects on the Physical Environment

Effects on Geomorphology

Impacts of Alternatives A and B
Alternatives A and B would have no impacts on geomorphology.

Effects on Hydrology and Water Quality

Impacts of Alternative A
Under alternative A, it is reasonable to assume that some of the 15,000 acres proposed for Federal acquisition in alternative B would be developed in the absence of additional land protection by the Service. Studies have shown that adverse impacts to streams can occur with as little as 10 percent impervious cover (Schueler 1994). Impervious land cover is defined as the sum of roads, parking lots, sidewalks, rooftops, and other impermeable surfaces. Adverse impacts of impervious surfaces can include shaping stream beds, decreased water quality, increased stream warming, and a decrease in stream biodiversity.

Impervious land cover can result in decreased infiltration of stormwater and increased runoff. This in turn can lead to more frequent flooding, causing widening and undercutting of stream banks. Channel instability leads to the loss of habitat structures, such as pool and riffle features, and overhead cover. These adverse impacts can be seen with approximately 10 to 15 percent impervious cover (Booth and Reinelt 1993).

Pollutants accumulate on impervious surfaces from atmospheric depositions, vehicles, and other sources. Storms can quickly wash these pollutants into the nearest stream. These adverse impacts can be reduced by installation of retention ponds or other infiltration systems.

As noted by Schueler (1994), "Impervious surfaces both absorb and reflect heat. During the summer months, impervious areas can have local air and ground temperatures that are 10 to 12 degrees warmer than the fields and forests that they replace. In addition, the trees that could have provided shade to offset the effects of solar radiation are absent."

Stream channel instability, increased pollutants, and stream warming lead to a general decrease in aquatic system biodiversity. Aquatic diversity and health is a strong environmental indicator of overall watershed quality (Schueler 1994). Decreases in the diversity of fish, aquatic insects, wetland plants, and amphibians are all manifestations of increases in impervious surfaces of 10 percent or greater.

Overall, the adverse impacts on hydrology and water quality in the AOI are expected to constitute a moderate impact under the no action alternative.

Impacts of Alternative B
This alternative is expected to result in beneficial impacts to the hydrology and water quantity of the area. Approximately 15,000 acres of proposed refuge lands would eventually be protected from the construction of extensive drainage ditches, roads, and large areas of impervious surfaces associated with development that would otherwise alter the hydrology. Furthermore, the Service would restore the hydrology where needed, which would be beneficial to refuge lands and areas outside of the refuge.

Under alternative B, there could be some adverse impacts to hydrology and water quantity resulting from some potential construction projects on the proposed refuge. Infrastructure such as visitor and office facilities, paved areas, and landscaped areas would alter, to some degree, the local hydrology and amount of water available to downstream areas. Specific site plans for public use building(s) and refuge offices have not yet been developed (where possible, existing structure would be evaluated to determine if they could serve refuge needs), so the amounts of impervious surfaces are unknown at this time. However, impervious surfaces, such as roads, sidewalks, and buildings, reduce the area available for rainwater to percolate into the soil. This generally has two direct consequences when it rains: there is less water available for recharging the local surficial aquifer, while at the same time the amount of runoff that flows into low-lying area increases. Low impact development methods and best management practices would be used to minimize these effects. Storm-water wetlands and retention ponds, rain gardens, and rooftop rainwater harvesting, for example, would help mitigate many of the water quantity impacts associated with impervious surfaces. Best Management Practices would be employed to minimize impacts from refuge-associated development. Although additional environmental studies would likely be conducted in association with any future construction, it is not believed that there would be significant impacts to the hydrology or water quantity resulting

from the proposed refuge. Overall, the negative effects on hydrology and water quantity are believed to be minimal under this alternative.

Effects on Soils

Impacts of Alternative A
In unprotected areas, soils would continue to be lost and degraded, leading to adverse impacts such as erosion and sedimentation as a result of various land use practices including road-building and the construction of buildings, parking lots, and other infrastructure needed to support expanding human settlements. Natural soil formation processes would no longer occur in areas covered by impervious surfaces (e.g., roads, parking lots, buildings). Soil compaction is also expected at sites where construction occurs. Some soil compaction could result from managing shrublands (e.g., mowing) but these impacts would be temporary in nature and, therefore, would have short-term adverse impacts compared with the long-term adverse impacts of converting lands to developed areas.

In alternative A, soils would continue to be degraded by various contaminants resulting from the application of agricultural chemicals and run-off from roads and urban areas. Additionally, there would be no opportunity for the Service to protect or restore roads, trails, or other existing sites within RAFAs, thus soil impacts from development or unmanaged use of those lands would continue and likely would increase over the long term. However, adverse impacts to soils in the absence of a refuge would be minor, because the total area that could theoretically be protected under this proposal is relatively small compared to the entire AOI.

Impacts of Alternative B
Under this alternative, there would be a minor benefit to soils on the proposed refuge. Within the refuge, this resource would largely be protected from disturbance and degradation associated with development, agriculture, mining, etc., as discussed above in alternative A.

There is a potential for adverse impacts to soils from the shrubland management tools we intend to use to help maintain, enhance or create shrubland and young forest habitat. These tools are described in detail in appendix A: Conceptual Management Plan and include replanting with native species, prescribed burning, haying/mowing, mechanical cutting, and applying herbicides and biological control agents. In general, we will use best management practices in all activities that might affect soils to ensure that we maintain soil productivity. Site conditions, including soil composition, condition and hydrology, will be the ultimate determinant of the management technique for any particular site. We will make every attempt to manage specific sites consistent with their recognized potential.

Prescribed fire can elevate surface temperatures; mineralize detritus, litter and standing dead material; volatilize some nutrients and organic matter; alter the water-holding capacity of soil; and alter its populations of micro- and macro-fauna (Barbour et al. 1999). Fire usually elevates soil pH because of cation release; that effect is particularly evident in acidic soils. Fire may enhance soil microbial nitrogen fixation, due to the mineralization of nutrients and elevated pH levels in soils (Barbour et al. 1999). Fire usually reduces fungi, but increase soil bacteria. It may remove soil and litter pathogens. Fire often destroys nitrifying bacteria. Legumes and other nitrogen-fixing plants often must recover nitrogen losses due to volatilization, as the recovery of nitrifying bacteria is slow (Barbour et al. 1999). To minimize impacts, we would conduct all prescribed burns under a strict prescription and in optimal weather conditions to minimize concerns about smoke and the risk of wildfire. We would maintain all fires within their prescriptions to minimize the degradation of resources, although impacts could occur in small areas.

Suzanne Paton/USFWS

Habitat restoration at Avalonia Land Conservancy in Connecticut

Haying, mowing, and other mechanical methods affect soils by rutting and compaction and, depending on the soil conditions and vegetation ground cover, by removing soil-protective vegetation. To minimize these impacts we would avoid using tracked equipment when possible we would not conduct these operations when the soil is saturated.

We would follow an approved Pesticide Use Plan when utilizing herbicides and other biological control agents so as to minimize adverse impacts to the soil and other microbial and biotic organisms.

Within the proposed refuge, some soils would be disturbed due to the construction of one or more potential buildings, parking lots, and other infrastructure needed to support refuge visitors and operations. Natural soil-formation processes would no longer occur in areas covered by impervious surfaces (e.g., roads, parking lots, buildings). Soil compaction is also expected at sites where construction occurs. Best management practices would be used to minimize these impacts. Additional environmental analyses would be conducted in association with any substantial (e.g., roads, parking lots, buildings) construction projects, per Service policy.

Although the exact acreage needed for any new refuge infrastructure is unknown at this point, it is believed it would be a small percentage of the total refuge area. The impacts to soils resulting from alternative B are expected to be minimal.

Effects on Climate, including Effects related to Climate Change

Impacts of Alternative A

Under this alternative, fewer areas in the AOI are expected to remain or become carbon sinks (i.e., areas that absorb carbon instead of releasing it), so positive impacts with regard to climate change are not anticipated.

There may, however, be some minimal adverse impacts associated with climate change under this alternative. Vegetation, alive or dead, is an important carbon stock, and ecosystems in the United States contain approximately 66,600 million tons of carbon (Heath and Smith 2004). The carbon density (the amount of carbon stored per unit of land area) of any given tract of land is highly variable, as it is

directly correlated to the amount of biomass in an ecosystem or plant community. Besides vegetation, the total carbon in an ecosystem also includes the organic component of soil, which can be substantial, depending on the vegetation cover type and other factors (Bruce et al. 1999).

When land is permanently cleared of vegetation, carbon dioxide that was stored in plant material and soil is released relatively quickly into the atmosphere through such processes as decomposition, burning, and soil oxidation. Additionally, without vegetation, the ability of the land to sequester or store carbon is reduced to minimal levels. The exact extent of unprotected natural lands that would eventually be converted to agricultural or urban use in alternative A is unknown. However, even in the unlikely event that an area equaling the proposed refuge (15,000 acres) were cleared of all vegetation, it would represent only a fraction of the over 9 billion tons of global carbon entering the atmosphere annually.

Impacts of Alternative B
Under Alternative B, there would be some assurances that the approximately 15,000 acres of proposed refuge lands would remain vegetated and therefore would continue to act as carbon sinks, resulting in a positive impact with regard to climate change. Therefore, it is believed that these proposed refuge lands would provide a net reduction in greenhouse gases, even with potential anthropogenic sources (see discussion below) of these gases taken into account. Still, due to the comparatively small size of the proposed refuge, beneficial impacts to climate change would likely be minimal compared to the volume of Earth's atmosphere.

Under alternative B, refuge operations and facilities, public visitation, and habitat management would contribute greenhouse gases to the atmosphere, thus resulting in some adverse impacts. The amount of carbon that would potentially be released through refuge operations (e.g., combustion engines, electrical equipment use) was not estimated for this draft LPP/EA. However, the proposed refuge would aim to minimize its carbon emissions. As the Refuge System works to implement many of the strategies for achieving Service wide carbon neutrality by 2020 (USFWS 2010), refuge energy use is expected to decline. These actions would include use of hybrid vehicles, building energy efficient facilities, video-conferencing (to reduce travel-related energy use), and green purchasing. These strategies, combined with those of other Service offices and the Federal Government in general, would likely result in a beneficial reduction in the rate of greenhouse gas emissions nationally.

Refuge visitation would be associated with a number of vehicles on the refuge. The low rate of speed necessitated would minimize emissions. In addition, the number of vehicles on the refuge at any given time would not be expected to create a significant impact to greenhouse gas emissions.

Prescribed burning would be a valuable habitat management tool within several habitats of the proposed refuge. The primary gases released during prescribed fire include CO_2, carbon monoxide (CO), and water vapor, with other gases present in trace amounts (EPA 2012). Most of these are greenhouse gases. However, it has been shown that prescribed fires can decrease the risk of wildfires, which typically release greater amounts of greenhouse gases (National Science Foundation 2010).

Overall, the amount of greenhouse gases contributed to the atmosphere as a result of refuge-related administrative, public use, and management activities is expected to be minimal.

Effects on Air Quality

Impacts of Alternative A
Under alternative A, potential impacts to air quality would depend on the fate of lands that otherwise may have been protected by the Service. If these lands

remain vegetated and undeveloped, they may continue to contribute positive air quality benefits by absorbing carbon dioxide and emitting oxygen. If lands are developed, the degree of adverse impact on air quality would depend on the type and density of development. Industrial or dense residential development using traditional energy sources may increase carbon and other contaminants in the atmosphere above current levels, which would be detrimental to air quality. Use of solar or other non-emitting energy would reduce these potential adverse impacts. Overall, impacts to air quality under this alternative are likely to be minimal.

Impacts of Alternative B
With the establishment of the proposed refuge, potential sources of air pollution resulting from urbanization, agricultural operations, industry, etc., would be eliminated on 15,000 acres. This benefit is expected to be minimal, given that the proposed refuge would cover a relatively small percentage of the total AOI.

Under alternative B, refuge operations and facilities, public visitation, and habitat management would contribute some pollutants to the atmosphere, thus adversely affecting air quality. Some air pollutants would be released through refuge operations (e.g., combustion engines, electrical

equipment use). However, the proposed refuge would aim to minimize its emissions from vehicles as well as the indirect emissions associated with electrical energy use. As mentioned above, the Refuge System is working to implement strategies for achieving Service wide carbon neutrality by 2020. These strategies, combined with those of other Service offices and the Federal Government in general, would likely result in a beneficial reduction of air pollutants.

Refuge visitation would be associated with a number of vehicles on the refuge. The low rate of speed necessitated would minimize emissions of air pollutants. In addition, the number of vehicles on the refuge at any given time would not be expected to create a significant impact to air quality.

Prescribed burning would be a valuable habitat management tool within several habitats of the proposed refuge. As mentioned above, prescribed burning releases several air pollutants, including CO and particulate matter. The proposed refuge would work with its partners to reduce smoke-related issues in adjacent areas resulting from prescription fires. The risk of wildfires would be minimized through a fire management program. One positive consequence of prescribed fire is the reduction in the frequency and intensity of wildfires, which tend to release larger amounts of air pollutants (National Science Foundation 2010). Overall, the adverse impacts to air quality associated with this alternative are expected to be minimal.

Effects on the Socio-Economic Environment

Impacts of Alternative A
Under alternative A (no new refuge), it is difficult to determine what the overall effects would be on local tax revenues. Generally, the area is experiencing population growth, but there are more localized areas where this is not the case. These trends could change over time. Similarly, with no new refuge, there would be no impacts to property values.

Since there would be no new refuge lands, there would also be no economic impacts associated with wildlife-dependent recreation such as hunting, fishing, and wildlife observation/photography.

Impacts of Alternative B
Much of the information presented in this section was taken from an economic analysis completed by the USGS for the Silvio O. Conte National Fish and Wildlife Refuge CCP. In general, the consequences of refuge land acquisition in this proposal are similar to those predicted within the Connecticut River Watershed.

Local tax revenues
In alternative B, the Service is considering expanding the Refuge System's total acreage under ownership through additional fee and easement acquisitions. As noted by USGS:

These transactions are typically in the form of a one-time payment. A transaction of this type and shift in private to public land ownership can have an assortment of economic impacts. Some examples include effects to the local tax base and adjoining revenues, the amount of municipal services required, spillover property value impacts, and various dynamics with development in the region. The effect of fee acquisitions on local government revenue is complex and speculative. Many variables are at play, often requiring time to unfold. While there may be some upfront reductions in local tax revenues, reduced dependence on municipal services could more than counter these losses. Other unknowns, such as relocation and spending decisions, and property enhancement effects, will ultimately determine the extent of the economic and fiscal impacts within the region. While these relationships are identified and discussed, estimating these impacts quantitatively requires a large degree of speculation and is beyond the scope of this analysis.

Bobcat

Gary Kramer/USFWS

The sale of interest in land (fee and easement) will provide the original landowner with additional revenue following the sale. The landowner might go on to spend some percentage of the funds from their equity in the property in the regional economy, including new real estate investment in the local area. This spending activity can directly impact local industries such as construction and various service sectors, with additional indirect impacts to follow suit. Contrarily, these types of economic impacts could be relinquished if former landowners emigrate outside the region. There is also the possibility of removing a production practice on the land parcel, such as farming or forestry, which could have negative economic consequences. These, too, could be negated by the expenditures required for habitat restoration and stewardship fronted by the Service once acquired. As indicated, there are many dynamic relationships at play that ultimately determine net economic impacts to the local and regional economies.

There are also many dynamic variables at play when considering effects to local tax revenues. Property taxes constitute the largest source of local governments' own revenue (Urban Institute and Brookings Institution 2008). Lands acquired by the Service would be exempt from local property taxation. However, under provisions of the RRS Act, local townships and/or counties receive an annual payment for lands that have been purchased by full fee simple acquisition by the Service. Payments are based on the greatest of 25 percent of net receipts[1], 75 cents per acre, or 0.75 percent of the market value[2] of lands acquired by the

[1] Revenues are derived from the sale or disposition of products (e.g., timber and gravel), privileges (e.g., right-of-way and haying/grazing permits), and/or leases for public accommodations or facilities (e.g., oil and gas exploration and development) providing economic activities incidental to, and not in conflict with, refuge purposes.

[2] Updated appraisals of refuges are to be completed every 5 years to determine the market value.

Service. The exact amount of the annual payment depends on congressional appropriations, which has tended to be less than the amount to fully fund the authorized level of payments, and has been progressively declining. In fiscal year (FY) 2014, actual RRS payments were 23.7 percent of authorized levels.

Lands acquired by the Service through fee acquisition would lose their development potential in perpetuity. While this could affect local property tax and income tax revenues, conserved and protected land requires fewer municipal services. New and existing residential developments require local governments to provide services such as fire protection, police services and schools, and to construct new infrastructure such as roads, waste treatment facilities, and water and electrical delivery systems. Providing such services can be very expensive for municipalities in rural settings with a relatively low tax base. A majority of studies conducting community services analysis have concluded land in residential use requires more service expenditures (paid by the municipality) than it generates in tax revenues. Additionally, these studies have typically found land classified as open space to provide a net gain in local revenues. Table 34 below highlights the revenue-to-expenditure findings from service studies done for 11 towns in New Hampshire. A revenue-to-expenditure ratio of 1:1.30 translates to the town receiving $1 in revenue for every $1.30 it has to spend on that land use. Or in other words, for every $10,000 in property tax and other revenues the town receives from that land use, it spends $13,000 in providing services to it.

Table 23: Revenue-to-Expenditure Ratios by Land Use in New Hampshire Communities Studied

New Hampshire Community	Residential Land Use (including farm houses)	Commercial & Industrial	Working & Open Land	Source
Brentwood	1:1.17	1:0.24	1:0.83	Brentwood Open Space Task Force 2002
Deerfield	1:1.15	1:0.22	1:0.35	Auger 1994
Dover	1:1.15	1:0.63	1:0.94	Kingsley et al. 1993
Exeter	1:1.07	1:0.40	1:0.82	Niebling 1997
Fremont	1:1.04	1:0.94	1:0.36	Auger 1994
Groton	1:1.01	1:0.12	1:0.88	New Hampshire Wildlife Federation 2001
Hookset	1:1.16	1:0.43	1:0.55	Innovative Natural Resource Solutions 2008
Lyme	1:1.05	1:0.28	1:0.23	Pickard 2000
Milton	1:1.30	1:0.35	1:0.72	Innovative Natural Resource Solutions 2005
Mont Vernon	1:1.03	1:0.04	1:0.08	Innovative Natural Resource Solutions 2002
Stratham	1:1.15	1:0.19	1:0.40	Auger 1994

Source: American Farmland Trust 2010

King and Anderson (2004) examined the marginal property tax effects of conservation easements—representing a similar loss of development rights, but without any county payments—in 29 Vermont towns. Their analysis found conservation easements do slightly raise marginal property tax rates in the short run (2 to 3 years after conservation), as the overall tax base is lessened and bares more of the tax burden. However, in the long run (6 to 8 years after conservation)

they found conservation easements to be tax-neutral or even tax-suppressing as nearby property values increased.

As noted earlier, there is also the chance for land acquisition to spur development in other areas within the region as private landowners relocate and new residents are attracted by the publically conserved natural landscape and the almost guaranteed opportunities for compatible outdoor recreation. It is well documented that open space carries positive values to local residents and communities, as well as passers-by (McConnell and Walls 2005). This is evidenced by the success of open space preservation ballot initiatives at the local, county, and state levels. Banzhaf et al. (2006) point out that between 1997 and 2004, over 75 percent of the more than 1,100 referenda on open space conservation that appeared on ballots across the U.S. passed, most by a wide margin. Accessibility to outdoor trails and park usage can be prime attractions to new homebuyers (National Park Service 1995). It is also well documented that open space and protected natural areas can increase surrounding property values; that is properties in the vicinity of parks and preserved open space can have higher property values than those not in the vicinity (see McConnell and Walls 2005, for a comprehensive review). In essence, the real estate market is quantifying the demand and desirability of land that is nested within or adjacent to a conservation mosaic. For example, an analysis of properties surrounding multiple parks in Worcester, Massachusetts, revealed, on average, a house located 20 feet from a park sold for $6,445 (converted to 2012 dollars) more than a similar house located 2,000 feet away (More et al., 1982). Another study that was conducted in the early 1990s in Maryland showed that preserving a significant amount of forest land accounted for anywhere from 4 to 10 percent of the value of houses within 1 mile of the site, in three different counties (Curtis 1993; Crompton 2001).

Under this alternative (establishment of a new refuge), it is difficult to determine what the overall effects will be on local tax revenues. Generally, the area is experiencing population growth, but there are more localized areas where this is not the case. These trends could change over time. At this point in time, we are unable to predict (if the proposal were to be authorized) where and when refuge lands would be purchased within the RAFAs.

Effect on Local Property Values

The reciprocating value of open space on property values will vary depending on landscape characteristics and location attributes (e.g. distance to the conserved area) (Kroeger 2008). Permanence of the open space is also an influencing factor. Typically, open space that is permanently protected (such as refuge lands) will generate a higher enhancement value of local properties than land that has the potential for future development. A study done by Goeghegan (Goeghegan et al. 2003) in a suburban county in Maryland shows that permanently protected open space generates a property enhancement value of over three times that of developable open space. Irwin (2002) conducted a similar analysis (in context and location) and found that protected open space increases residential property values by between 0.6 percent and 1.9 percent more in absolute terms than developable open space. As noted, location and demographic factors in the region can influence the relative level of property enhancement value. For instance, open space may generate larger amenity premiums for property in a more urbanized area and where median incomes are higher (see Netusil et al., 2000); that is not to say there is not the chance for property values to increase substantially in rural areas as well (see Phillips 2000; Crompton 2001; Vrooman 1978; Thorsnes 2002).

Furthermore, protected open space is a public good that generates many benefits for local residents, communities, and governments. Protected open space can

protect values associated with biodiversity and wildlife abundance, maintain aesthetic beauty, and protect traditional, social, and culturally significant features of landscapes and livelihoods (Holdren and Ehrlich 1974; Ehrlich and Ehrlich 1992; Daily 1997; Millennium Ecosystem Assessment, MEA 2005). Ecosystem services, such as water purification, oxygen production, pollination, and waste breakdown, are also maintained for local residents through protected open space (MEA 2005). Some of these services provided by the landscape can reduce the need for certain municipal services (ex. expanding or building new waste treatment facilities). A primary public benefit of Service acquisitions is enhanced and preserved wildlife habitat. As development stressors increase over time, many key off-refuge habitat areas may become less available due to conversion to non-wildlife habitat uses. Unlike goods derived from natural resources that are traded in a traditional market setting, many of the benefits from land conservation, such as ecosystem services and intrinsic worth, can be difficult to quantify and value monetarily. We do not attempt to provide estimates of non-market values for this assessment; however, they can be significant in some cases.

Under this alternative (establishment of a new refuge), it is difficult to determine what the overall effects will be on local property values. Generally, the area is experiencing population growth, but there are more localized areas where this is not the case. These trends could change over time. At this point in time, we are unable to predict (if the proposal were to be authorized) where and when refuge lands would be purchased within the RAFAs.

Refuge Personnel Salary Spending
Refuge employees reside and spend their salaries on daily living expenses in communities within each sub-region, thereby generating impacts within the local economy. Household consumption expenditures consist of payments by individuals and households to industries for goods and services used for personal consumption. Salary expenditures made by refuge personnel contribute to the local economic impacts associated with the refuge.

Under alternative B, however, refuge lands will likely be managed by the nearest already-existing national wildlife refuge. While some staff may be added to these refuges to help manage additional lands, the impact of refuge personnel salary spending is likely to be minimal.

Refuge Visitor Spending
Spending associated with recreational visits to national wildlife refuges generates significant economic activity. The Service report Banking on Nature: The Economic Benefits of National Wildlife Refuge Visitation to Local Communities, estimated the impact of national wildlife refuges on their local economies (Carver and Caudill 2007). According to the report, more than 34.8 million visits were made to national wildlife refuges in FY 2006 which generated $1.7 billion of sales in regional economies. Accounting for both the direct and secondary effects, spending by national wildlife visitors generated nearly 27,000 jobs, and over $542.8 million in employment income. Approximately 82 percent of total expenditures were from non-consumptive activities, 12 percent from fishing, and 6 percent from hunting (Carver and Caudill 2007).

Under this alternative it is difficult to determine which lands would be open for public visitation because we do not yet know which specific lands we will acquire. Therefore, we are unable to predict the impact of alternative B on refuge visitor spending at this time.

Effects on the Biological Environment

Effects on Vegetation and Habitat Types

Impacts of Alternative A
Under the No Action alternative, benefits to this resource are not expected. Given past actions and land use trends, it is anticipated that human population growth, development, and other land use changes would continue. Within the AOI, native habitats and natural systems would continue to be converted to developed lands and other uses, resulting in continued loss of natural vegetation and further fragmenting existing habitat. It is likely that the amount of early successional habitat would continue to decline as very little management for shrublands and young forest would occur. Overall, alternative A is expected to result in moderate adverse impacts to habitat types.

Impacts of Alternative B
Under our proposed action, up to 15,000 acres of land would be conserved and managed for shrubland habitat. It will likely take many years before that amount of land is included in the refuge through acquisition or conservation easement. Overall impacts to vegetation would be positive as land that is protected would not be developed for residential or commercial uses. The amount of each specific type of habitat would change as some of the land is converted to shrubland from other habitat types. As described in Chapter 3–Affected Environment, the current rate of decrease in available shrublands is greater than that of other habitats. Therefore, we conclude that the overall effect on habitats would be minor and positive. In addition, there would be a temporary loss of vegetation as existing habitats are cut or burned, but this habitat management would not result in a complete loss of vegetation and species associated with early successional forest and shrubland habitats would quickly replace vegetation loss.

Invasive species management would be applied to areas owned in fee or easement, where appropriate. The native vegetation within these areas would likely benefit from the control of invasive plants that tend to dominate areas and inhibit native plant growth.

Some management activities, including invasive species control, would have short-term adverse impacts on vegetation, such as removal of plants, herbicide use, trampling, and other potential damage to plant structure. These short-term negative impacts would be minor and would be offset by providing long-term benefits to the diversity and health of the refuge's native plant community.

With the use of prescribed burns or mechanical means of thinning vegetation, there would be a reduction in certain tree species that would either be removed through thinning or that would burn because of the lack of fire tolerance. Any species associated with that vegetation would likely decline. Additional impacts to vegetation would occur within the areas designated as fire breaks where vegetation is removed and maintained for the prevention of wildfires and for the use during prescribed burning efforts. These adverse impacts are expected to be short-term and minor.

Effects on Birds

Impacts of Alternative A
Under the "no action" alternative, there would be an overall loss of habitat, especially shrubland and early successional, which would continue to decrease at a greater pace than other habitat types. Less breeding habitat availability would reduce the number of breeding pairs of birds within the areas of habitat loss. It is not known if those displaced birds would find other breeding sites. The

composition of bird species would change in conjunction with any habitat changes. Overall, alternative A is expected to have a moderate adverse impact on birds.

Impacts of Alternative B

The proposed acreage targets in alternative B for shrubland habitat management are expected to provide an estimated 12,000 additional acres of potentially suitable habitat for shrubland birds. This estimated acreage is based on the assumption that 80 percent of the 15,000 acres targeted for fee or easement acquisition under alternative B would be managed and maintained as shrubland habitat of suitable quality for breeding shrubland birds. These additional acres of managed shrubland habitat will make moderately beneficial contributions (i.e., thousands of additional birds for each species) to supporting populations of priority migratory bird species beyond what is currently supported by existing shrubland habitat within the RAFAs (see the *Birds* section in the Affected Environment chapter for description of current conditions).

Bill Thompson

Field sparrow

For selected shrubland-dependent birds identified as priorities in BCR 30 and/or as representative species for shrubland habitats within the southern New England region, we have estimated the total amount of potentially suitable habitat that will be created and maintained within the RAFAs under alternative B and the associated number of breeding birds supported by the newly created habitat. We also compare these habitat and population estimates with the habitat and population objectives that have been identified for each species in BCR 30, as reported in the BCR 30 Bird Conservation Plan (ACJV 2014), the Partners in Flight North American Landbird Conservation Plan (Rich et al. 2004) in conjunction with the Partners in Flight Population Estimates Database (PIF 2013), or the American Woodcock Conservation Plan (WMI 2008).

We estimate that the proposed combined target acres for shrubland habitat management within the RAFAs could potentially meet 35 percent of the BCR 30 breeding population objective for willow flycatcher as well as greater than 5 percent of the BCR 30 population objective for four other species: blue-winged warbler, prairie warbler, chestnut-sided warbler, and field sparrow. Estimated total number of birds potentially supported by the additional acres of managed habitat in the RAFAs ranges from 2,800 to 8,375 for these species. For the other species evaluated, the estimated total number of birds potentially supported by managed habitat in the Focus Areas ranges from 440 for American woodcock to 7,475 for eastern towhee. While these total numbers represent less than 5 percent

of the BCR 30 population objectives for these species, they still indicate the large number of additional total birds that could be supported by the targeted acres of habitat management within the RAFAs.

Table 24: Current and Proposed Breeding Bird and Habitat Estimates for all RAFAs Combined

Context:

Current suitable habitat for shrubland-dependent birds in all RAFAs combined = 24,500 acres.

Area of additional suitable habitat for shrubland-dependent birds in all RAFAs combined under Alternative B = 12,000 acres.

Total acres of suitable habitat (12,000) under Alternative B may overlap with some of the existing 24,500 acres of existing suitable habitat. However, because our estimate of existing suitable habitat includes protected and unprotected lands, we believe that any overlap would be absorbed by the loss of existing suitable habitat not already protected. Estimates for additional breeding birds would follow the same trend.

Species	% of BCR 30 habitat objective based on 24,500 acres	Current # of breeding birds (% of BCR 30 population objective)	Estimated % of BCR 30 habitat objective under Alternative B based on 12,000 acres	Estimated # of breeding birds under Alternative B (% of BCR 30 population objective)
Blue-winged warbler	8.2%	6,620 (11.0%)	4.0%	3,240 (5.4%)
Prairie warbler	10.5%	12,940 (13.9 %)	5.2%	6,335 (6.8%)
Brown thrasher	17.8%	4,090 (7.4%)	8.7%	2,005 (3.6%)
Eastern towhee	2.1%	15,260 (3.3%)	1.0%	7,475 (1.6%)
Chestnut-sided warbler	15.5%	17,100 (17.1%)	7.6%	8,375 (8.4%)
Field sparrow	15.5%	5,715 (3.4%)	1.7%	2,800 (5.6%)
Willow flycatcher	55.5%	14,445 (72.2%)	47.2%	7,075 (35.4%)
Gray catbird	1.6%	13,945 (1.7%)	0.8%	6,830 (0.9%)
American woodcock	0.01%	895 (0.01%)	0.01%	440 (0.01%)

In addition to assuming that 80 percent of proposed refuge lands would be managed and maintained as shrubland habitat, we also assumed that the proportion of upland and wetland shrub habitats in the acquired acres would be the same as the proportion currently existing within the RAFAs, which is approximately 80 percent upland and 20 percent wetland. Estimates of additional birds supported under alternative B were derived by applying published breeding density estimates for each species (see Emlen 1977, Inman et al. 2002, Chandler et al. 2009, King et al. 2009a, King et al. 2009b, Schlossberg et al. 2010) to these estimated acres of additional suitable upland and wetland shrub habitat types to be managed within the RAFAs.

In addition to contributions to breeding bird populations, the proposed target acres of managed shrubland habitat will also provide additional critical habitat during migration for many species of birds that breed in the northeast region and eastern Canada. Shrublands are considered to be some of the most important stopover habitat for migrant landbirds because they provide quality food resources in the form of fruits and berries that are not as abundant in other habitats during the fall migration. The dense vegetation of shrublands also provides high quality cover for resting and recovery by birds that have completed migratory flights. Southern New England is also thought to be an important

stopover location for American woodcock (Wildlife Management Institute 2008) that breed in northern New England and eastern Canada. An analysis of Next Generation Weather Radar (NEXRAD) data (Buler and Dawson 2012, 2014) has identified the southern New England coastal area as one of the areas in the northeast region that supports the highest density of migrating birds during the fall migration and most of the RAFAs overlap with at least some areas of high or moderate densities of migrating birds (see Figure 1 in the "Birds" section of Chapter 3 - Affected Environment). While it is difficult to quantify the benefit to migrating birds of managing and maintaining additional shrubland within the RAFAs, we assume that providing thousands of additional acres of shrubland habitat will have moderately beneficial impacts for migratory birds stopping over in southern New England during migration, particularly in areas that already support moderate to high densities of migrating birds. We anticipate that the additional shrubland habitat will result in increased body condition and ultimately increased survival for birds using these habitats as stopover sites.

Effects on Mammals

This section considers impacts to those mammals associated with shrublands to varying degrees, except for the NEC, which is discussed later in the section entitled, "Federal Listed Species and other Species of Concern."

Impacts of Alternative A
Under this alternative, there would be no designation of the 10 proposed RAFAs, and the Service would not be authorized to acquire additional lands and conservation easements across the six-state partnership area, to be managed as part of the Refuge System. The Service's Partners for Fish and Wildlife program could still provide assistance to private landowners and partners, but there would be no additional refuge land acquisition and no related certainty of long-term management and maintenance. It is likely that there would be some continuation of conversion of wildlife habitat to either residential or commercial development over time. This fragmentation and reduction of available habitat would have minor, but long term adverse and cumulative effects to the overall population levels of mammal species in the areas of habitat loss.

Shrublands and young forest throughout the six-state partnership area will continue to be subject to existing regulations, pressures, land use trends, and current management to maintain shrubland conditions for the cottontail and shrubland-dependant birds. No additional contributions to the accomplishment of partnership shrubland goals and objectives are expected beyond existing partnership commitments. We expect there will be an overall continuation of the loss of early successional, shrubland and young forest habitat. One uncertainty that will continue to exist is whether the rangewide effort can enlist and manage enough private land to create an effective habitat network.

Impacts of Alternative B
Proposed acquisition targets within RAFAs under this alternative would allow us to protect, restore and maintain an additional 12,000 acres of shrubland and young forest habitat, beyond the current capacity of the existing rangewide partnership effort. As explained above in the "Birds" section, the 12,000 acres within RAFAs is derived from the assumption that the Service would likely conduct shrubland management on approximately 80 percent of each parcel acquired in fee or easement, since many parcels contain a mix of habitat types. The majority of these lands would be managed to benefit the numerous wildlife species that depend on these habitats, including those mammal species discussed earlier in chapter 3 that demonstrate some preference for young forests, shrublands, or old-field habitats.

Available parcels of land that contain, are adjacent to, or are in close proximity to known populations of NEC will receive high priority, as will lands that allow us

opportunities to contribute to multiple overlapping Strategic Growth priorities of the Refuge System. The approach of applying pre-approved acreage targets within the larger strategically placed RAFAs will allow us the flexibility to help state land management teams react to willing-seller opportunities, and secure key parcels with respect to important core/source NEC populations. Acquiring tracts in close proximity to partners would allow the Service and partners to pool management resources, and provide greater certainty that shrublands would continue to be managed over the long-term. The high degree of certainty of long-term management provided by Service acquisition will help to ensure that the partnership is able to maintain a network of shrubland habitats across the landscape with suitable connectivity and patch size to maintain all shrubland-dependent species.

Management for early successional and shrubland habitats would occur through mechanical means such as cutting and mowing, and through the use of prescribed fire (see Appendix A: Conceptual Management Plan for more detail on habitat management techniques for shrubland and young forest habitats). Mammals that prefer more open canopy conditions that allow for a dense understory layer would benefit from the prescribed fire regime and thinning measures. A variety of mammals would benefit from additional foraging, nesting or cover habitat, including both obligate and opportunistic inhabitants noted earlier in chapter 3 that demonstrate a preference for young forests, shrublands, or old-field habitats. Examples mentioned earlier include the bobcat, black bear, little brown bat, white-tailed deer, white-footed and deer mice, red and grey fox, raccoon, opossum, striped skunk, and semi-aquatic species like the beaver and mink.

In addition, the network of partner-protected lands that alternative B would allow the Service to contribute to is intended to promote the development of habitat corridors and facilitate landscape connectivity, thus enabling the movement and migration of shrubland wildlife necessary for long-term population viability and resiliency in the face of changing climate. We expect alternative B to result in overall positive impacts on mammals dependent upon shrubland habitats, including obligate, part-time and opportunistic users.

Any prescribed burning on the refuge may benefit bat species but could cause some harm to their habitat if precautions are not taken. Prescribed burning can have short-term detrimental effects on bats by eliminating some snags and stumps used for roosting (Taylor 2006). Roosting bats may also be killed under intense fire conditions. Juveniles and adults that depend on torpor, a diurnal hibernation-like state, may be especially at risk because of the time it takes for them to arouse from torpor (i.e., time it takes them to fly) (Dickinson et al. 2010). Neonatal bats that cannot fly and are too heavy for the mother to carry may be at greater risk from smoke than adults and juveniles (USFWS 2007b). This impact would most likely be minimal because prescribed burns are likely not to occur during the height of summer when neonatal bats are still in their roost (Dickinson et al. 2009).

Other mechanical means for managing shrubland habitats include tree cutting, which also has the potential to impact bat habitat. For these and any other management techniques that could potentially impact bats, we will consult with the Ecological Services Field Office nearest to the project area to determine if there are any bat maternity roost trees or hibernacula before we burn or remove trees. For example, our entire project area is located within the range of the northern long-eared bat, which was listed as threatened under the ESA in an interim 4(d) rule, published in the Federal Register on April 2, 2015. However,

forest management practices are exempt from the final listing as long as they include the following measures:

- Activity occurs more than 0.25 miles (0.4 km) from a known, occupied hibernacula.
- Activity avoids cutting or destroying known, occupied roost trees during the pup season (June 1 to July 31).
- Activity avoids clearcuts (and similar harvest methods, e.g. seed tree, shelterwood and coppice) within 0.25 miles (0.4 km) of known, occupied roost trees during the pup season (June 1 to July 31).

By consulting with our Ecological Services colleagues and following best management practices when appropriate, we will ensure minimal adverse impacts to bats under this alternative.

Effects on Federal-Listed Species and other Species of Concern

Bog Turtle

Impacts of Alternative A
Under this alternative, there would be no designation of the proposed Upper Housatonic RAFA, and the Service would not be authorized to acquire lands and conservation easements in southeastern New York and western Connecticut to be managed as part of the Refuge System. The Service's Partners for Fish and Wildlife program could still provide assistance to private landowners and partners, but there would be no additional refuge land acquisition and resulting certainty of long-term management and maintenance.

Bog turtles had suffered a 50 percent decline in range and numbers in the 20 years leading up to the issuance of the Bog Turtle Recovery Plan (recovery plan) (USFWS 2001). One of the most significant threats to the survival of this species is outright loss and alteration of its habitat, as well as the ecological systems that sustain these habitats. The shallow wetlands inhabited by bog turtles have been easily drained. Conversely, farm ponds, reservoirs, and other impoundments have been created by inundating the shallow, open wet meadows and fens required for bog turtle survival. Although light grazing may be beneficial in controlling succession, intensive pasturing can be detrimental.

Bog turtle

USFWS

The recovery plan acknowledges that existing protected areas for bog turtles have generally been relatively small and, although encompassing the turtle's primary habitat, leave the drainage basin largely unprotected. Some of the most persistent and widespread problems associated with maintaining bog turtle habitat are succession of open meadows to wooded swamps, drainage

and flooding of habitats through diversion or damming of feeder streams, pollution, nutrient enrichment, and the establishment of alien plants. Without the possibility of additional Service acquisition, bog turtle sites in this area would continue to be subject to existing regulations, pressures, land use trends, and lack of specific management to maintain open wetland conditions for the turtle. No additional contributions to the accomplishment of recovery plan goals and objectives are expected, leading to minor adverse impacts to the bog turtle.

Impacts of Alternative B
The bog turtle's range in New York is concentrated primarily in the southeastern corner of the State, and generally restricted to extreme western Connecticut in Fairfield and Litchfield counties (USFWS 2001). These turtles inhabit sub-climax seral wetland stages and are dependent on riparian systems that are unfragmented and sufficiently dynamic to allow the continual creation of meadows and open habitat to compensate for the closing-over of habitats caused by ecological succession. Succession of many wetlands from open-canopy fens to closed-canopy red maple swamps may account for the turtle's irregular and shrinking distribution.

The recovery plan recommends protection of additional turtle sites through purchase, conservation easements and voluntary agreements, by agencies and organizations dedicated to the species' conservation, to achieve long-term protection. This includes protection of upland buffers surrounding turtle wetlands, and the groundwater recharge areas supporting those wetlands. Like shrubland habitats, these sites will likely require management to ensure their suitability for turtles. The recovery plan acknowledges bog turtle habitat as an intermediate stage of succession, requiring management of succession and invasive plants, and also recommends implementation of measures to minimize collection of turtles. Active management and maintenance is generally required to replace the natural processes (e.g., flooding by beaver, fire, grazing by wildlife) that have been lost and to control exotic plants, in order to restore or maintain suitability for the turtles.

The overall objective of the recovery program is to protect and maintain the northern population of this species and its habitat, enabling the eventual removal of the species from the Federal List of Endangered and Threatened Wildlife and Plants. Actions specified in the recovery plan include the management of turtle populations at extant sites, maintenance of turtle habitat to ensure its continuing suitability, and reintroduction of turtles into areas where they have been extirpated or removed. Other recommended recovery actions that become possible with acquisition of turtle sites include the control of invasive plant species, restoration of hydrology to altered sites where ditching and draining have occurred, and reconnection of fragmented habitats.

The recovery plan specifies that long range protection be secured for at least 185 populations distributed among five recovery units (USFWS 2001). For the Hudson/Housatonic Recovery Unit, it specifies the protection of 40 viable bog turtle populations and sufficient habitat to ensure the sustainability of these populations, including at least 10 populations in each of the following subunits: the Wallkill River watershed, the Hudson River watershed, and the Housatonic River watershed, which includes our project area. Under alternative B of this proposal, suitable wet portions of acquired parcels and easements would be managed to maintain and restore open meadow or fen conditions for bog turtles, particularly in the vicinity of existing populations, and where potential exists to improve connectivity between populations. These sites would be co-managed along with adjacent shrublands for migratory birds and the cottontail. While it is not possible to predict with certainty where acquisition opportunities will arise

over time, this protection plan will contribute to bog turtle population goals for the Housatonic River sub-unit, thus resulting in moderate beneficial impacts to the bog turtle overall.

Northern Red-Bellied Cooter (Plymouth Red-bellied Turtle)

Impacts of Alternative A
Under this alternative, there would be no designation of the proposed Plymouth RAFA. The Service would not be authorized to acquire lands or conservation easements in southeastern Massachusetts beyond existing refuge boundaries. The Service's Partners for Fish and Wildlife program could still provide assistance to private landowners and partners, but there would be no additional Service acquisition and associated certainty of long-term habitat maintenance. The 209-acre Massasoit NWR, established in 1983 to help support the northern red-bellied cooter (cooter), is located within this RAFA. The refuge has acquired all lands contained within its current approved boundary. We would continue to manage existing Service lands within the Massasoit NWR, with no additional Service contribution to land acquisition in this area. The Miles Standish State Forest is also located within the area, and the State is likely to continue to place some degree of land protection attention here as future funding allows.

Many factors have contributed to the current endangered status of the cooter. Its small population size and restricted range are foremost among factors limiting its long-term viability. Other factors include adverse modification of water quality, due to events such as siltation from land clearing adjacent to ponds; pollution and excess nutrients in ponds; pollution of groundwater or reduction in the water levels of ponds from groundwater pumping; and draining or filling of wetlands adjacent to occupied ponds and shoreline modifications such as filling, dredging for beaches, dikes, and real estate development. The Plymouth County area, particularly along pond shores, has undergone rapid residential and commercial development in recent times. Closure of the forest canopy plays a significant role in diminishing habitat suitability for cooters. Historically, the pine barren habitat was burned often. Today, the area has been largely protected from fire and most remaining undeveloped areas near ponds are now closed-canopy pine forest, resulting in a scarcity of nesting habitat with adequate sunlight for nesting (USFWS 1994).

Habitat alteration as a result of agricultural development and practices may affect the status of the cooter population. It is unknown to what extent cooters have been affected by the growth of the cranberry industry in Plymouth County. Cranberry bog acreage increased greatly during the last century, and the industry owns and manages more than 14,000 acres in Massachusetts (Cranberry Growers Association 2014). Many of the reservoirs and upland watershed areas managed by the industry provide habitat for cooters. Some of these areas have become increasingly important, as surrounding habitat is lost to residential development or becomes over-shaded through forest succession. Overall, the cranberry industry in Plymouth County has been supportive of recovery efforts, and individual growers are important partners in the program. Due to changing markets and socioeconomic pressures, a potential decrease in acreage owned by these growers could pose new threats of development and disturbance to cooters.

To increase survival and recruitment by reducing predation rates, the MDFW, in partnership with the Service, began a headstarting program (i.e., raising wild hatchlings in captivity for nine months) in 1985 that continues today. This is the longest and most intensive freshwater turtle headstarting program in existence. Since 1985, over 3,500 wild-born individuals have been headstarted and released at 28 sites, including two large river systems and 13 new ponds, three of which have been wholly or partially protected by the Massasoit NWR. Anecdotal observations and some preliminary field work suggest that the headstarting

program has provided a significant contribution to the recovery of the species, but the increase in population numbers and landscape occupancy has not been quantified.

Without the possibility of additional Service acquisition, cooters in southeastern Massachusetts would continue to be subject to existing regulations, pressures, land use trends, and lack of specific management to maintain quality habitat. No additional contributions to the accomplishment of recovery plan goals and objectives are expected under alternative A, leading to minor adverse impacts to the cooter.

Impacts of Alternative B
The Service already has a presence within the Plymouth RAFA, for the purpose of contributing to cooter recovery efforts. The turtle was placed on the Federal endangered species list in 1980, and the original recovery plan was completed in 1981. Since the 1994 plan revision, a recent 5-year review assessed its status and objectives towards delisting. The review indicates progress in population growth, with an estimated 400 to 600 breeding-age individuals occurring in more than 20 ponds, but also documents the need for continued listing (USFWS 2007a). Threats still include restricted range, habitat alteration including closed canopies at nesting sites, collection and disturbance by people, and high mortality due to nest failure and predation on hatchlings (USFWS 1994, 2007a). The proposed Plymouth RAFA includes a 3,269-acre area formally designated as critical habitat (USFWS 1994). The species will be considered for delisting when populations collectively include greater than or equal to 1,000 breeding-age individuals among 20 self-sustaining populations.

The Massasoit NWR was established in 1983 with the purchase of the 183-acre main parcel, Crooked Pond, and shoreline of Gunner's Exchange Pond, ". . . to conserve the federally endangered northern red-bellied cooter, as well as other wildlife and plant species" 16 U.S.C. § 1534 (ESA of 1973). Additional parcels were purchased in 2002 (Island Pond) and 2006 (Hoyt's Pond). The Service remains committed to assisting with recovery plan goals, and expanded land protection authority in this area would allow additional effort towards recovery tasks, including protecting occupied and potential habitat, improving habitat at ponds with known populations by clearing nesting sites and providing basking sites, and helping to locate and protect nests at ponds with major populations.

Under alternative B, the Service would work closely with other Federal and state agencies, as well as local land trusts, universities, and other non-government organizations (NGOs) to coordinate land protection activities as opportunities arise. The Service would be authorized to contribute additional land protection through management agreements with partners and private landowners, purchase of conservation easements, and fee acquisition for key parcels. Parcels that are located along pond shorelines or that could help ensure connectivity between ponds would be a high priority, and management of pine barren and pitch pine-oak habitat in this area is expected to provide overlapping species benefits for shrubland birds, rare moths and butterflies, bats, and the NEC.

The 5-year review assessed known ponds and critical habitat based on surveys and previous headstart release efforts. Of the 22 to 25 ponds identified with populations, only 4 are protected through conservation. Ninety percent of the pond habitat that may support cooter populations is in private ownership, with only 10 percent protected through permanent conservation. As much as 50 percent is contained within the privately owned Federal Furnace Pond, and the MDFW has a long standing relationship with the landowner of that pond for cooter management.

Management activities in alternative B would have moderate beneficial impacts on the cooter population. Closure of the forest canopy plays a significant role in diminishing habitat suitability. Historically, the pine barren habitat that makes up most of Plymouth County was frequently burned, causing a mosaic of pitch pine-scrub oak barrens with frequent openings. Today, the area has largely been protected from fire and most of the undeveloped areas are closed-canopy pine forests. These forests surround the ponds that, with adequate sunlight, could provide needed nesting habitat. Mechanical and prescribed burning measures would have a positive impact by creating openings that cooters need for nesting. Collaboration with the State and other partners across the Plymouth RAFA would increase the potential opportunity for genetic variation within the species by helping to ensure contiguous habitats and connectivity for cooter populations (USFWS 2007a).

New England Cottontail

Impacts of Alternative A

Under this alternative, there would be no designation of the 10 proposed RAFAs, and the Service would not be authorized to acquire additional lands and conservation easements across the six-state partnership area, to be managed as part of the Refuge System. The Service's Partners for Fish and Wildlife program could still provide assistance to private landowners and partners, but there would be no additional refuge land acquisition and related certainty of long-term management and maintenance.

Meagan Raecy/USFWS

Young New England cottontail released into transition pen at Ninigret National Wildlife Refuge

Limited regulatory mechanisms exist to directly prevent the destruction or modification of wildlife habitat. Today, habitat impacts occur mainly on private lands. Existing zoning ordinances appear to provide inadequate protection of NEC habitat, since much habitat destruction and modification has already occurred under zoning ordinances designed to regulate development. The destruction of NEC habitat could be lessened by possibly persuading conservation commissions or other municipal permitting authorities to more actively limit development of habitats used by NEC.

Regulatory activity under state endangered species laws has preserved habitat for NEC on utility rights-of-way, protected habitat patches through deed restrictions and voluntary easements, and secured mitigation funding to help restore habitat. Rangewide, the NEC benefits from state and Federal regulatory mechanisms protecting other wildlife that share their habitats, including migratory birds, the bog turtle, and the eastern box turtle; these species' ranges substantially overlap that of NEC in southern New England. Both state and Federal agencies currently have authority to manage land that is suitable for NEC, which could collectively and substantially lessen the threat to the population from continued habitat modification and fragmentation. However, all these efforts are already occurring to the extent possible with the rangewide partnership effort, which has requested and supports the proposed Refuge System contribution.

Under the no-action alternative, shrublands and young forest throughout the six-state partnership area will continue to be subject to existing regulations,

pressures, land use trends, and current management to maintain shrubland conditions for the cottontail and shrubland-dependant birds. No additional contributions to the accomplishment of NEC Conservation Strategy goals and objectives are expected beyond existing partnership commitments. We expect there will be an overall continuation of the loss of early successional, shrubland and young forest habitat. One uncertainty that will continue to exist is whether the rangewide effort can enlist and manage enough private land to create an effective habitat network. Overall, we expect moderate adverse impacts to the NEC population under alternative A.

Impacts of Alternative B
While this proposal is intended to help reverse the decline of an entire suite of species, one of its most important individual purposes is to contribute to accomplishing NEC Conservation Strategy goals for the cottontail. Proposed acquisition targets within RAFAs under this alternative would allow us to protect or restore, and provide long-term maintenance for, an additional 12,000 acres of shrubland and young forest habitat, beyond the current capacity of the existing rangewide partnership described in alternative A. The 12,000 additional acres within RAFAs is derived from the assumption that it is not reasonable to expect 100 percent of lands or easements acquired by the Service would be managed as shrubland, but that 80 percent of the 15,000 acres proposed in alternative B reflects a strong management commitment by the Service. The majority of these lands would be co-managed as shrubland habitat for both NEC and migratory birds.

Available parcels of land that contain or are in close proximity to known populations of NEC will receive high priority, as will lands that allow us opportunities to contribute to multiple overlapping Strategic Growth priorities of the Refuge System. The approach of applying pre-approved acreage targets within the larger strategically placed RAFAs will allow us the flexibility to help state land management teams react to willing-seller opportunities, and secure key parcels with respect to important core/source NEC populations. Acquiring tracts in close proximity to partners would allow the Service and partners to pool management resources, and provide greater certainty that shrublands would continue to be managed over the long-term. The high degree of certainty of long-term management provided by Service acquisition was identified as an extremely important contribution to the successful implementation of the NEC Conservation Strategy, and was taken into consideration when the Service decided not to list the rabbit under the ESA in 2015.

The locations of RAFAs and acquisition target acreages represent the Service's contribution to accomplishing NEC Conservation Strategy habitat and population goals. The strategy established a landscape design and conservation goals based on principles of population viability and biogeography that would: (1) keep or return NEC to most of its historic range; (2) protect existing populations by ensuring that enough individuals are present to overcome environmental and genetic uncertainty; and (3) provide multiple populations to guard against unexpected events such as disease outbreaks. It outlines goals to be reached by year 2030 that the NEC Technical Committee believes will best ensure long-term conservation of NEC. Consideration was given to rangewide goals developed by the Service, individual state goals, and sub-goals for NEC focus areas within each state.

To conserve NEC, the Service had set a regional habitat restoration goal of 27,000 acres to support 13,500 rabbits (see Table 25). The NEC Technical Committee delineated 47 focus areas for NEC conservation, each having 11 or more habitat patches, with a combined capacity to support 80 metapopulations

of NEC. The rangewide partners plan to manage 31 focus areas between 2012 and 2020, with a target level of 35,987 acres of habitat, including 15,595 on private land, 1,290 on municipal land, 18,555 on state land (to include 10,475 acres managed through controlled burning), 525 on Federal land, and 25 acres on Native American Tribal land.

Table 25: NEC Conservation Strategy-Recovery Goals

Goal Level	Habitat (acres)	Population
USFWS Range wide Goals	27,000	13,500
Connecticut	19,000	9,500
Massachusetts	6,800	4,500
Maine	3,640	1,150
New Hampshire	2,000	1,000
New York	10,000	5,000
Rhode Island	1,000	500
Total All State Goals	**42,440**	**21,650**
Total All Focus Area Sub-Goals	**51,665**	**28,100**

The proposed 12,000 additional acres of managed shrubland habitat are expected to make measurable contributions towards NEC Conservation Strategy and State Land Management Team habitat and population goals for the rabbit, beyond numbers currently supported by existing habitat under alternative A. Strategic placement of acquisition efforts is expected to help improve and maintain critical landscape connectivity between patches of habitat containing NEC, important to population viability. Additional securement of lands through Service acquisition is expected to increase the long-term certainty of management and success in key locations, as opposed to the uncertainty of other approaches such as short-term private land enrollments. Overall, alternative B is expected to have moderate beneficial impacts on the NEC population.

Monarch Butterfly

Impacts of Alternative A

The Service's Northeast Region is taking a cross-programmatic approach and identifying ways to work with diverse partners to restore and enhance monarch habitat on Federal and non-Federal lands. Under alternative A these efforts would continue. Projects include work on refuge lands, state, county, and municipal lands, NGO properties, utility right of ways (ROWs), schools, private lands, and others. In addition to habitat and restoration projects underway for 2015, additional potential opportunities to work with other Federal, state, private, and NGO landowners have been identified to incorporate monarch habitat considerations into ongoing management. These opportunities are still being explored and may not result in new habitat in 2015, but we are committed to exploring the folowing ideas to increase habitat in the future:

- We will continue to identify refuge lands that currently allow farming but will likely be discontinuing the practice in the next few years. There are about 1,000 acres on eight different refuges, and some of these acres may provide opportunity for monarch habitat restoration.

- On Service-owned lands we will develop and implement Best Management Practices (BMPs) where mowing and prescribed fire are commonly used management tools to benefit monarch butterflies and other pollinator species.

Monarch butterfly

Bill Thompson

Service programs will continue to identify and engage potential land management partners to develop BMPs applicable to non-refuge lands, including improved mowing, invasive species control, and burning practices. We will incorporate nectar producing plants and milkweed in habitat restoration and enhancement projects wherever appropriate in wetland, stream, riparian, early successional, and upland habitat projects.

The Service's Ecological Services program expects to continue to work with USDA's Natural Resources Conservation Service (e.g. Conservation Stewardship Program, Environmental Quality Incentives Program, Working Lands for Wildlife) at the state level to assess, plan, and implement cooperative conservation practices, including incorporating milkweed and nectar-producing species, that provide direct benefits to pollinators and monarchs.

Cooperative conservation practices include:
- Incorporating prescribed fire management
- Incorporating mowing and haying
- Seed collection, propagation, seeding and planting
- Invasive plant management
- Establishing pollinator gardens of various sizes
- Management of ROWs and other frequently mowed habitats such as roadsides
- Management practices for wetland mitigation sites to include pollinator friendly plants

Impacts of Alternative B
The recent Service Monarch Butterfly Conservation Framework (Framework) identifies a strategy based on the principles of SHC, which relies on public-private partnerships to address habitat, engagement, and science needs to help restore monarch butterfly populations. The Service intends to work to protect, restore, and enhance monarchs and their habitats through landscape conservation on both public and private lands across North America. The Framework identifies a population objective of 300 million monarchs by 2024 and an intent to restore and enhance 150,000 acres of habitat in FY15 through Service programs and lands.

The Northeast Region's Regional Monarch Conservation Action Plans for 2014 include "exploring potential overlap of habitat use and management practices for monarch butterflies, grassland birds, and shrubland birds/New England

cottontail." There are already identified opportunities for alterations in grassland habitat management on Service lands to benefit monarch butterflies. Alternative B offers a great deal of opportunity to contribute to monarch and pollinator habitat goals, given the 15,000-acre acquisition target and our intention to restore, manage and maintain 12,000 acres of potential early successional/ shrubland habitat over time on these lands and easements. One example would include the acquisition of fee or easement rights for former farmland parcels, where complementary management would be a matter of timing and rotation of mowing regimes to maintain juxtaposed shrubland and open lands. We intend to make every effort to incorporate pollinator and monarch habitat management on acquired lands and easements as part of alternative B.

Other Species

Impacts of Alternative A
As native and natural habitats continue to decline in quality and spatial extent, and as habitat patches become more fragmented, the animal species that use these habitats would decline in numbers or fitness. Under the alternative A, there would be few additional benefits to native fish or wildlife populations with the possible exception of those species that can tolerate or thrive in urbanized, agricultural, or otherwise altered environments. Examples of such species include deer (*Odocoileus virginianus*), coyote (*Canis latrans*), raccoon (*Procyon lotor*), gray squirrel (*Sciurus carolinensis*), blue jay (*Cyanotta cristata*), mocking bird (*Mimus polyglottos*), and various fish species that can live in low-quality waters.

As native and natural habitats continue to decline in quality and spatial extent, and as habitat patches become more fragmented, the animal species that use these habitats would decline in numbers or fitness. The No Action alternative would exacerbate this decline in the area's unique flora and fauna. Nuisance species that prefer forest edges would increase, such as the brown-headed cowbird (*Molothrus ater*), raccoon, fox (*Vulpes vulpes*), and opossum (*Didelphis virginiana*). These species are predators on other wildlife and increases in their populations would cause further disruption of native ecosystems. Nonnative aquatic species would also likely increase. Depending on the rarity of the native species affected that are likely to occur in the RAFAs, this impact is expected to be moderate.

Impacts of Alternative B
If alternative B is implemented, the rate of loss of shrubland habitat would be slowed slightly. This relative increase in shrubland habitat, as compared to alternative A, would benefit shrubland-dependent species. This increase in available habitat would allow shrubland-dependent species to achieve higher levels of fitness, which could lead to higher reproductive rates and slightly greater abundance. Since these species are highly represented in SWAPs as species of greatest conservation need, this alternative would have a minor beneficial impact on the overall positive health of the RAFAs.

Edge species and species dependent on late successional forest would have slightly less available habitat as early successional habitats are maintained or late successional habitats are converted to shrublands or early successional forests. However, this is not anticipated to have any impact on those species that use late successional forests, since overall the amount of available late successional habitat would decrease only slightly.

Cumulative Impacts

According to the Council on Environmental Quality regulations on implementing NEPA (40 CFR 1508.7), a cumulative impact is the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes the other actions. Cumulative

impacts can result from individually minor but collectively significant actions taking place over time.

This cumulative impacts assessment includes the actions of other agencies or organizations, if they are interrelated and influence the same environment. Thus, this analysis considers the interaction of activities at the RAFAs with other actions occurring over a larger spatial and temporal frame of reference. Specific to this analysis we considered the continued residential and commercial development of undeveloped lands, state wildlife agency and NGO acquisition of lands for conservation, Service acquisition and management of shrublands associated with existing national wildlife refuges within and adjacent to the RAFAs, and the continuation of climate change effects. We have considered these actions in the context of implementing Service actions over the next 30 years.

We have identified those resources that could be cumulatively affected by the combination of actions described to implement this land protection plan, along with the other activities described in this section. It is likely that there could be a cumulative impact to habitat and vegetation, wildlife species, and socio-economics.

Air Quality

Projected land/habitat acquisitions and restoration of native shrublands and young forest should generate beneficial impacts to air quality locally. While both alternatives would facilitate continued and increased land protection ability, alternative B would have the most beneficial impact with an additional 15,000 acres of protected lands. These beneficial habitat impacts would derive from the refuge's capacity to continue to filter out many air pollutants harmful to humans, wildlife, and the environment. In some cases the Service would set back succession on refuge lands by, for example, brush hogging or thinning trees, to create better habitat for shrubland-dependent species. These management activities could have adverse impacts on air quality as these areas would no longer have the capacity to absorb as much carbon. However, these types of land management activities would be staggered throughout the RAFAs over a period of 30 or more years, resulting in only short-term, minor impacts.

With our partners, we would continue to contribute to improving air quality through cooperative land conservation and management of shrublands. Protecting valuable fish and wildlife habitat from development and maintaining it in natural shrubland vegetation assures these areas would continue to filter out many air pollutants that, incrementally, may be harmful to humans and the environment.

Some short-term, local and immediate deterioration in air quality would be expected from air emissions of motor vehicles associated with public use and heavy equipment associated with land management activities. These incremental sources of emissions potentially do contribute to a degradation of air quality of the local and regional environment, but such contributions are extremely minor and of very short duration. Future refuge lands are generally not expected to be a recreation destination where visitors are drawn from distant places. Most visitors would already be in the area or would be passing through the area on vacation and would seek out the refuge for a day trip. Therefore, the presence of the refuge alone would only account for a small percentage of vehicle emissions generated in the AOI and even in the individual RAFAs.

Hydrology and Water Quality

Under both alternatives, habitat protection and restoration would result in cumulative benefits to hydrology and water quality. The Service and its partners would protect and maintain lands in their natural vegetated state, thus preventing these lands from being converted to impervious surfaces.

Furthermore, the Service would restore lands containing unnecessary buildings and structures (e.g. removing impermeable surfaces), other disturbed sites, and unused roads and trails on acquired and protected lands. Protecting, managing, and restoring shrubland habitats that currently exist and that may be acquired in the future will improve the health of local watercourses and aquatic resources, resulting in greater diversity and functionality of refuge habitats and watersheds in general.

Both alternatives also include some level of management to maintain early successional habitat. Both limited habitat restoration and passive natural succession would result in improvements in water quality in terms of chemistry, reduced sediment, and mitigation of any contaminated run-off from off-refuge sources. Collectively and over time, those actions would improve the ability of Service lands to process nutrients and store carbon and contribute to other state watershed regulation standards and initiatives that are designed to maintain and improve local water quality within the RAFAs.

There would be a very slight potential for herbicide dispersal into wetlands and streams, but not to any measurable or chronic proportion that could add to local or regional cumulative adverse impacts. Based on the relatively short half-life and the limited acreage likely to require treatment, it is not expected that any discernible effects would occur to these water resources as a result of herbicide treatments.

BMPs and erosion and sediment control measures would be used on building, road, trail, and other recreation infrastructure construction sites to ensure any impacts on hydrology and water quality are minimized. Management actions would also be adaptive to address climate change cumulative impacts on the physical environment.

In addition, when the conservation actions by the Service are combined with actions by state wildlife managers, non-profit organizations, private landowners, and local communities, there will be considerable cumulative progress in stemming and mitigating the urbanization and development changes that can directly and indirectly impair good water quality and productive habitats within the AOI.

Soils

In both alternatives, permanent protection of watershed soils in areas potentially to be acquired and managed by the Service would result in beneficial impacts to overall soil conservation in the AOI.

As with many areas nationwide, the greatest cumulative impact on soils is from land development. With the cessation of development, watershed soils on lands managed by the refuge should improve in natural fertility and productivity. Logically, more soil benefits are to be gained with alternative B since it proposes expanded land/habitat protection. Both alternatives would employ best management practices to minimize impacts to soils.

Positive consequences and beneficial cumulative impacts of managing soils in native vegetation for the long term include increasing capacity for carbon sequestration from the environment. Biological CO_2 sequestration can be enhanced in managing natural habitats that increase the natural absorption of atmospheric carbon in soils. The long-term cumulative potential is limited to how the land is used and managed, and the refuge would maintain and, where possible, enhance the ability of Service-owned lands to sequester carbon.

There would be some potential adverse cumulative impacts to refuge soils from shrubland management. However, in both alternatives, these types of land

management activities would be staggered throughout the AOI over a period of 30 or more years. Therefore, even when added to other past, present, and reasonably foreseeable future actions, these impacts would result in only short-term, minor impacts.

We will minimize any potential for adverse cumulative impacts by continuing to use best management practices when setting back succession in shrubland habitats. Habitat management tools used for setting back succession include mowing, brush-hogging or prescribed burning. Under both alternatives, we expect to reclaim problem areas dominated by invasive species and restore them to native plant communities, which should improve nutrient recycling, restore native soil biota and soil fertility, and return soils to natural productivity regimes.

Climate Change

There would be no significant cumulative adverse effects to biological resources under any of the alternatives because the changes in habitat components that we would manage for directly or expect to realize through natural succession would on balance be beneficial.

DOI Secretarial Order 3226 states that "there is a consensus in the international community that global climate change is occurring and that it should be addressed in governmental decision making. This order ensures that climate change impacts are taken into account in connection with Departmental planning and decision making." Additionally, it calls for the incorporation of climate change considerations into long-term planning documents, such as LPPs.

The Wildlife Society published an informative technical review report in 2004 titled Global Climate Change and Wildlife in North America (Inkley et al. 2004). It interprets results and details from publications such as the Intergovernmental Panel on Climate Change reports (1996 to 2002) and describes the potential impacts and implications on wildlife and habitats. It mentions that projecting the impacts of climate change is hugely complex because it is important to predict changing precipitation and temperature patterns, their rate of change, and the exacerbated effects of other stressors on the ecosystems. Those stressors include loss of wildlife habitat to urban sprawl and other developed land uses, pollution, ozone depletion, exotic species, disease, and other factors. Projections over the next 100 years indicate major impacts such as extensive warming in most areas, changing patterns of precipitation, and significant acceleration of sea level rise. According to the Wildlife Society report, "…other likely components of ongoing climate change include changes in season lengths, decreasing range of nighttime versus daytime temperatures, declining snowpack, and increasing frequency and intensity of severe weather events" (Inkley et al. 2004). The Wildlife Society report details known and possible influences on habitat and wildlife, including changes in primary productivity, changes in plant chemical and nutrient composition, changes in seasonality, sea level rise, snow, permafrost, and sea ice decline, increased invasive species, pests and pathogens, and impacts on major vertebrate groups.

The effects of climate change on populations and range distributions of wildlife are expected to be species specific and highly variable, with some effects considered negative and others considered positive. Generally, the prediction in North America is that the ranges of habitats and wildlife will generally move upwards in elevation and northward as temperature rises. Species with small or isolated populations and low genetic variability will be least likely to withstand impacts of climate change. Species with broader habitat ranges, wider niches, and greater genetic diversity should fare better or may even benefit. This will vary depending on specific local conditions, changing precipitation patterns, and the particular response of individual species to the different components

Old field habitat suitable for New England cottontail at Libby River Farm, Scarborough, Maine

Kelly Boland/USFWS

of climate change (Inkley et al. 2004). The report notes that developing precise predictions for local areas is not possible due to the scale and accuracy of current climate models, which is further confounded by the lack of information concerning species-level responses to ecosystem changes, their interactions with other species, and the impacts from other stressors in the environment. In other words, only imprecise generalizations can be made about the implications of our refuge management on regional climate change.

Our evaluation of the proposed action concludes that the activities that may contribute negligibly, but incrementally, to stressors regionally affecting climate change: our prescribed burning program, our use of vehicles and equipment to manage habitat and administer the refuge, and visitor use of motorized vehicles. We discuss the direct and indirect impacts of those activities elsewhere in this chapter. We also discuss measures to minimize the impacts of both. For example, with regard to prescribed burning, we will follow detailed burn plans operating only under conditions that minimize air quality concerns. In addition, many climate change experts advocate prescribed burning to manage the risk of catastrophic fires (Inkley et al. 2004). Federal mandates require all Federal agencies to reduce petroleum fuel use by 2 percent annually based upon 2005 fuel use, having a goal of reducing petroleum fuel use by 30 percent. More than any other factor, this mandate will drive fleet management practices through 2020, and the refuge will attempt to replace older, inefficient vehicles, with more fuel efficient models. With regard to our equipment and facilities, we are trying to reduce our carbon footprint wherever possible by using alternative energy sources and energy-saving appliances, and using recycled or recyclable materials, along with reduced travel and other conservation measures. In our professional judgment, neither alternative would exacerbate climate change in the AOI or in any of the RAFAs, and some might incrementally prevent or slow local impacts.

Biological Resources

In general, native habitat protection and varying levels of management (including both active and "passive" management) will have cumulative beneficial impacts on the biological environment, even and especially when considered within the context of past, present, and future actions of other agencies and organizations. We expect to increase select species populations in targeted situations (e.g., New England cottontail, blue-winged warbler) through habitat protection and active management (e.g., silviculture operations). Native habitat protection and management cumulatively benefits the biological environment by increasing and enhancing healthy soil biota, restoring and enhancing native plant resources, potentially increasing resident wildlife populations of mammals, fish, reptiles, and amphibians, and enhancing invertebrate populations such as dragonflies and pollinators. Cumulative beneficial impacts on adjacent protected lands will also accrue from reducing habitat fragmentation across the watershed landscape through refuge land protection activities.

There would be no cumulative adverse effects to biological resources under either of the alternatives because the changes in habitat components that we would manage for directly or expect to realize through natural succession would on balance be beneficial.

USFWS

Indiana bat

Proposed habitat enhancement and restoration activities (e.g., tree thinning) under alternative B will limit any potential adverse cumulative impacts effects on the biological environment by careful employment of best management practices, as noted earlier. Occasionally, mowing or brush hogging could result in the loss of some small mammal, reptiles or other species. However, even when combined with management activities of our partners, these losses are short-term and minor. When managing habitats that are used by federally listed species (e.g. bog turtle, Plymouth red-bellied turtle) we will follow recovery plan guidelines.

Chapter 5

USFWS

Karner blue butterfly

Coordination and Consultation

- Partners
- New England Cottontail Coordination
- Refuge Acquisition Focus Areas
- Public Involvement

Partners

The matter of declining wildlife associated with early successional habitats has become a major conservation issue facing partners in the Northeastern United States. In addition to Service and NALCC concern for this suite of species, all six state partners have identified shrubland and young forest wildlife as high priorities for conservation in the first round of SWAPs completed in 2005. Updates to these plans, currently in progress, continue to highlight this high priority. Over the last 10 years, this situation has been the topic of much discussion, consultation, and coordination between the Service and partner agencies and organizations, and internally between and among Service programs.

Conservation agencies in the northeast have established a broad range of partnerships for fish, wildlife and habitat conservation, including PIF for birds, the Northeast Partners for Amphibian and Reptile Conservation (NEPARC), the Joint Ventures and Atlantic Coast Fish Habitat Partnership for migratory bird and fish conservation, and, most recently, the LCCs. A driving force behind these and other wildlife conservation initiatives has been regional coordinating bodies such as the Northeast Association of Fish and Wildlife Agencies (NEAFWA) and its Fish and Wildlife Diversity Technical Committee (Fish and Wildlife Diversity Committee), which operate on a separate and broader level than the individual partnerships.

Wildlife management agencies from the states of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Virginia, and West Virginia, as well as the District of Columbia participate in the NEAFWA. The NEAFWA is tasked with promoting and coordinating conservation activities across the Northeastern United States. The Fish and Wildlife Diversity Committee has led wildlife diversity conservation projects for the NEAFWA and comprises the Wildlife Diversity representative from each Northeast state and District of Columbia.

In executing their charge under the Region 5 State Wildlife Grant Regional Conservation Needs Program (RCN), the Fish and Wildlife Diversity Committee in 2007 named NEC as the top-priority Species of Greatest Conservation Need for regional landscape-scale habitat conservation. The Committee then began a cooperative effort to secure Competitive SWG funding for a multi-state conservation effort, with the goal of averting the need for the Service to list the NEC as threatened or endangered.

Shrublands and young forests were identified by the Northeast Monitoring and Performance Reporting Framework of NEAFWA (NEAFWA 2008) as one of eight habitat types for monitoring the status of wildlife in the northeast states. It is acknowledged that active management will be required to retain these habitats, and to maintain a certain proportion of early successional habitat on the landscape, and that strategic planning and placement of these habitat patches will be critical.

Extensive coordination has taken place between the Service's WSFR, Migratory Birds, and Science Applications programs with the states and numerous other partner organizations with respect to joint prioritization of shrublands, during both the development of the first round of SWAPS and the current update. This habitat type has been highlighted as a priority in numerous SWAP public informational meetings, open houses, and during draft review and comment periods.

New England Cottontail Coordination

Beginning in 2008, state and Federal wildlife biologists convened to organize the conservation effort for NEC and shrublands. A governance structure was formalized in 2011 when MDIFW, NHFG, MDFW, RIDEM, CT DEEP, NYDEC, NRCS, and the Service, facilitated by WMI, convened an Executive Committee

and adopted bylaws. The bylaws set forth guidelines to coordinate efforts among the participating agencies "to promote recovery, restoration, and conservation of the NEC and their associated habitats so that listing is not necessary." Critical to this effort was the commitment to produce a conservation strategy to effectively conserve the NEC.

A Technical Committee was formed to oversee the creation of the conservation strategy, development of habitat models to identify high priority landscapes for conservation, identify NEC/shrubland focus areas, and set population objectives and conservation goals for each focus area, among other things. Multi-agency state land management teams have been an important part of the effort to develop the strategy and deliver conservation projects, many already in progress, on the ground. The Technical Committee also involves designated working groups, including a Land Protection Working Group (LPWG). The conservation strategy itself identifies numerous objectives, including several that recommend securement of additional lands in focus areas that are lacking in adequate secured lands upon which to perform management.

The LPWG began working in November 2011 on the development of draft rangewide land protection ranking criteria, to be used by state management teams during the development of their business plans. It also drafted the initial proposal for this LPP, worked to support the SWG-funded business plan development by assisting state management teams to identify locations and level of contribution by partners for land protection, and helped develop a strategy to acquire lands for NEC conservation. Its primary function was to identify land protection priorities for each state and identify areas for potential inclusion into the Refuge System.

Since 2011, there has been a succession of regular meetings of state land management teams, and annual meetings, more frequent as necessary, of the Technical and Executive Committees. One major result has been the development and approval of the NEC Conservation Strategy, which identifies habitat goals and objectives for shrubland restoration and maintenance. The strategy identifies objectives for restoration and management of shrubland habitat on existing state, Federal and other secured lands; creation of additional habitat on private lands; and proposes expansion of land protection efforts associated with appropriate NWRs. In addition, continual coordination through recent years has occurred through workgroups designated by the Technical Committee:

- Population Management Working Group
- Research Working Group
- Habitat Management Working Group
- Communications and Outreach Working Group
- Land Protection Working Group
- Land Management Teams

Refuge Acquisition Focus Areas

Our proposed Refuge Acquisition Focus Areas have been developed through direct interaction with each State's Shrubland/NEC Land Management Team and the NEC Technical Committee, with concurrence from the NEC Executive Committee, to identify areas where additional strategic securement of land is needed to contribute to the range wide effort. Refuge acquisition focus areas were developed through review of NEC Focus Area evaluations provided by each State Team, along with further Technical Committee and State Team involvement and guidance. This information was then paired with biological data

on Federal trust resources such as listed species and migratory birds. Maps with draft Refuge Focus Areas were then reviewed by NEC Technical Committee members, State Land Management Teams, Federal partners, conservation organizations, university researchers, Refuge Managers, and others to further shape the proposal.

Coordination meetings with land management teams were held in each of the six states, and generally included Service program staff (NWRS LPP planning staff, refuge managers and biologists, and Endangered Species, Partners for Fish and Wildlife, Coastal Program biologists); state agency biologists, land managers, and migratory bird specialists; NRCS biologists; WMI representatives; and in some cases other conservation organizations and researchers from universities. The goal of these meetings was to present and analyze biological data and identify overlapping resource priorities. Primary working meetings were as follows:

Maine—May 5, 2014	USFWS, Maine Department of Inland Fisheries and Wildlife, Maine Bureau of Public Lands, Wildlife Management Institute, NRCS, Maine Coast Heritage Trust.
New Hampshire—May 20, 2014	USFWS, New Hampshire Fish and Game Department, Wildlife Management Institute, NRCS, University of New Hampshire.
Massachusetts—May 15, 2014	USFWS, Massachusetts Division of Fisheries and Wildlife, Wildlife Management Institute, NRCS.
Rhode Island—June 3, 2014	USFWS, Rhode Island Department of Environmental Management, Wildlife Management Institute, NRCS, University of Rhode Island.
Connecticut—July 9, 2014	USFWS, Connecticut Department of Energy and Environmental Protection, Wildlife Management Institute, NRCS, University of Connecticut, Audubon Society, Ruffed Grouse Society.
New York—December 4, 2014	USFWS, New York Department of Environmental Conservation, Wildlife Management Institute, NRCS.

There were several rounds of individual meetings with each state team, and additional coordination occurred through webinar and conference calls. The resulting draft RAFAs were further refined and developed through review by state representatives and other members of the full NEC Technical Committee at its January 13, 2015, annual meeting. The draft Refuge Acquisition Focus Areas ultimately received review and support by vote of the full NEC Executive Committee, including all six state directors, at its February 26, 2015, annual meeting.

Public Involvement

With respect to public attitude, young forest/shrubland habitat and NEC management has generally received positive public response, although it is sometimes met with resistance or concern when trees are cut. All six state fish and wildlife agencies support proposed Federal land acquisition benefiting early successional habitat. Many local groups, land trusts, schools, and conservation commissions have voiced their support for preserving shrubland habitat for birds and NECs. The NEC Outreach Working Group is working to develop a communications and outreach plan to coordinate and streamline outreach

messages. These messages are intended to foster support and awareness about the importance of shrubland habitat and to educate the public about controversial shrubland management methods, such as even-aged stand management.

All refuges within the project area have approved CCPs, and all have goals and objectives related to the restoration, maintenance, and continuing management of shrubland and young forest habitat. All of the CCPs were released for public and partner review and comment, with accompanying public meetings in their respective areas. The importance of this declining habitat, and the intentions of each refuge to contribute attention to this issue, has been discussed in numerous CCP-related meetings. Our proposal is being presented in the form of a draft LPP/EA and distributed for a 45-day public review and comment period. We will be conducting extensive local outreach to municipalities, land trusts, and affected citizens within the proposed ten focus areas. We may conduct public meetings if there is significant public interest. The comments we receive will help shape our final decision, which is expected in 2016.

Mary Konchar

Birdwatching

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Bill Thompson

Willow flycatcher

Acronyms

- Acronyms

Acronyms

Acronym	Full Name
ACJV	Atlantic Coast Joint Venture
BCC	Birds of Conservation Concern
BCR	Bird Conservation Region
CCP	Comprehensive Conservation Plan:
CT DEEP	Connecticut Department of Energy and Environmental Protection
EA	Environmental Assessment
ESA	Endangered Species Act of 1970
IBA	Important Bird Areas
LPP	Land Protection Plan
LCC	Landscape Conservation Cooperative
LCD	Landscape Conservation Design
LWCF	Land and Water Conservation Fund
NEC	New England Cottontail
NECIA	Northeast Climate Impacts Assessment
NEPA	National Environmental Policy Act
NWR	National Wildlife Refuge
NRCS	Natural Resources Conservation Service
NEC Focus Areas	New England Cottontail Focus Areas
NALCC	North Atlantic Landscape Conservation Cooperative
NEPA	National Environmental Policy Act
NHFG	New Hampshire Department of Fish and Game
PIF	Partners in Flight
RAFA	Refuge Acquisition Focus Areas
SGCN	Species of Greatest Conservation Need

Acronym	Full Name
SWG	State Wildlife Grants
SHC	Strategic Habitat Conservation
TRACT	Targeted Resource Acquisition Comparison Tool
UCS	Union of Concerned Scientists
USGS	United States Geologic Survey
WAP	Wildlife Action Plan
WMI	Wildlife Management Institute
WSFR	Wildlife and Sport Fish Restoration

USFWS

Shrubland habitat area at Scarborough Wildlife Management Area, Maine

Glossary

- **Glossary**

Glossary

Common Name	Scientific Name
Alder species	*Alnus* spp.
American beech	*Fagus grandifolia*
American holly	*Ilex opaca*
Ash species	*Fraxinus* spp.
Atlantic white cedar	*Chamaecyparis thyoides*
Asiatic bittersweet	*Celastrus orbiculatus*
Autumn olive	*Elaeagnus umbellata*
Azalea	*Rhododendron* spp.
Bayberry	*Myrica pensylvanica*
Beach heather	*Hudsonia tomentosa*
Beach plum	*Prunus maritima*
Bearberry	*Arctostaphylos uva-ursi*
Big bluestem	*Andropogon gerardii*
Birch species	*Betula* spp.
Black ash	*Fraxinus nigra*
Black cherry	*Prunus serotina*
Black grass (salt meadow rush)	*Juncus gerardii*
Black gum	*Nyssa sylvatica*
Black huckleberry	*Gaylussacia baccata*
Black oak	*Quercus velutina*
Black spruce	*Picea mariana*
Black willow	*Salix nigra*

Common Name	Scientific Name
Bluebell	*Mertensia virginica*
Blueberry species	*Vaccinium* spp.
Bluejoint	*Calamagrostis canadensis*
Broom Crowberry	*Corema conradii*
Bulrush	*Scirpus* spp.
Buttonbush	*Cephalanthus occidentalis*
Cattail	*Typha* spp.
Cherry species	*Prunus* spp.
Chestnut oak	*Quercus prinus*
Common buckthorn	*Rhamnus cathartica*
Common reed *(Phragmites)*	*Phragmites australis*
Clubmosses	*Lycopodium* spp.
Dogwood	*Cornus* spp.
Eastern hemlock	*Tsuga canadensi*
Eastern red cedar	*Juniperus virginiana*
Fir species	*Abies* spp.
Garlic-mustard	*Alliaria petiolata*
Giant cordgrass	*Spartina cynosuroides*
Giant hogweed	*Heracleum mantegazzianum*
Glossy buckthorn	*Frangula alnus*
Golden Heather	*Hudsonia ericoides*
Gray birch	*Betula populifolia*

Common Name	Scientific Name
Groundsel tree	*Baccharis halimifolia*
Hickory species	*Carya* spp.
Highbush blueberry	*Vaccinium corymbosum*
Huckleberry	*Gaylussacia baccata*
Japanese knotweed	*Fallopia japonica*
Little bluestem	*Schizachyrium scoparium*
Lowbush blueberry	*Vaccinium* spp.
Maple species	*Acer* spp.
Marsh elder	*Iva frutescens*
Milkweed	*Asclepias* spp.
Mountain laurel	*Kalmia latifolia*
Narrow-leaved cattail	*Typha angustifolia*
Northern white cedar	*Thuja occidentalis*
Oak species	*Quercus* spp.
Paper birch	*Betula papyrifera*
Peat mosses	*Sphagnum* spp.
Pennsylvania Sedge	*Carex pensylvanica*
Pitch pine	*Pinus rigida*
Post oak	*Quercus stellata*
Poison ivy	*Toxicodendron radicans*
Purple loosestrife	*Lythrum salicaria*
Redbud	*Cercis canadensis*

Common Name	Scientific Name
Red clover	*Trifolium pratense*
Red fescue	*Festuca rubra*
Red maple	*Acer rubrum*
Red oak	*Quercus rubra*
Red pine	*Pinus resinosa*
Red spruce	*Picea rubens*
Reed canary grass	*Phalaris arundinacea*
Rhododendron	*Rhododendron maximum*
Rose mallow	*Hibiscus moscheutos*
Rushes	*Juncus* spp.
Saltgrass	*Distichlis spicata*
Saltmarsh cordgrass	*Spartina alterniflora*
Saltmeadow cordgrass	*Spartina patens*
Saltmeadow rush	*Juncus gerardii*
Saltwort	*Salicornia* spp.
Sassafras	*Sassafras albidum*
Scarlet oak	*Quercus coccinea*
Scrub oak	*Quercus ilicifolia*
Sedges	*Carex* spp.
Shadbush	*Amelanchier* spp.
Sheep laurel	*Kalmia angustifolia*
Silky dogwood	*Cornus anomum*
Smooth cordgrass	*Spartina alterniflora*
Speckled alder	*Alnus incana*

Common Name	Scientific Name
Sphagnum moss	*Sphagnum* spp.
Spikegrass (Salt grass)	*Distichlis spicata*
Spruce species	*Picea* spp.
Sugar maple	*Acer saccharum*
Swamp loosestrife	*Decodon verticillatus*
Sweet gale	*Myrica gale*
Switchgrass	*Panicum virgatum*
Timothy	*Phleum pratense*
Tree of Heaven	*Ailanthus altissima*
Tussock sedge	*Carex stricta*
Viburnum spp.	*Viburnum* spp.
Virginia creeper	*Parthenocissus quinquefolia*
Virginia pine	*Pinus virginiana*
Water hemp	*Amaranthus cannabinus*
Water willow	*Decodon verticillatus*
White oak	*Quercus alba*
White pine	*Pinus strobus*
Wild grape	*Vitis* spp.
Wild rice	*Zizania aquatica*
Willow species	*Salix* spp.
Yellow birch	*Betula alleghaniensis*

Appendix A

Kelly Boland/USFWS

Fall winterberry in a wetland in Wellfleet on Cape Cod

Conceptual Management Plan

- Introduction
- Criteria and Target Acreages
- Managing Habitat for Priority Shrubland Species
- Acquisition Decisions and Management Planning
- Bibliography

Introduction

Numerous conservation tools are currently being applied within the Northeastern United States by state, Federal and non-governmental partners, in a six-state effort to protect and restore shrublands for wildlife species that rely on this specific habitat type. This effort includes restoration on existing state and Federal lands, including national wildlife refuges, and assistance by numerous agencies and organizations to restore shrublands on private lands. As part of that effort, we prepared a draft Land Protection Plan and Environmental Assessment (draft EA/LPP) intended to create the Great Thicket National Wildlife Refuge (NWR, refuge). This proposed refuge would allow an expanded contribution by the National Wildlife Refuge System (Refuge System) to help secure additional lands in key locations to be managed in a mosaic of successional conditions targeted to shrubland and young forest. In this Appendix A - Conceptual Management Plan, we discuss in general terms how lands would be managed for shrubland dependent wildlife once the lands become part of the Refuge System.

Early-successional habitat is one of the rarest habitats in this region, yet it remains a crucially important resource for numerous wildlife species. Although we are working with several public and private stakeholders to manage this habitat stage, conservation by these partners alone will not be sufficient. Although some tracts of land on existing national wildlife refuges in the northeast are already being managed for early-successional habitat, additional refuge expansion is intended to help ensure future connectivity, provide management capability and provide rotational management activities to maintain this habitat type on the landscape. One of the important benefits of refuge acquisition is greater long-term certainty of habitat maintenance that comes with permanent easements and fee acquisition, as compared to shorter-term private land enrollments.

Criteria and Target Acreages

We have delineated Refuge Acquisition Focus Areas (RAFAs) in key locations within a larger partnership project area across the six states. Within each RAFA we identify a floating "target acreage" for Service acquisition based on New England Cottontail (NEC) Conservation Strategy estimates of the need for additional management beyond current capacity on existing agency-secured lands. Opportunities for refuge fee and easement acquisition will be evaluated and guided over time through the use of a pre-determined set of the following refuge acquisition criteria:

- *Strategic Growth Priorities*—The Service's Strategic Growth Policy lists three priorities for conservation: threatened and endangered species, migratory birds in decline, and waterfowl. We will acquire lands that contain or are in close proximity to the greatest intersection of these three priorities.

- *New England Cottontail*—The NEC has been designated as a surrogate species because it is the most dispersal-limited of the variety of associated, high-priority shrubland-dependent species. We will prioritize tracts that contain or are in close proximity to known populations of NEC.

- *Landscape Connectivity*—We will give priority to parcels that can potentially provide critical connectivity between two extensive patches of habitat containing target wildlife species or shrubland-related habitat types.

- *Site Suitability*—Prioritizing tracts that naturally lend themselves to shrubland habitat will allow us to use our resources more wisely and efficiently.

- *Proximity to partners*—Acquiring tracts in close proximity to our partners, where protection would be complimentary to their efforts, will allow the Service and its partners to pool management resources and provide greater certainty that shrublands will continue to be managed over the long-term.

Additional factors to be considered in determining the suitability of land for easement acquisition include:

- Landowner desire to retain fee title to the property
- Landowner willingness to permit habitat management on the property
- Long-term vision for the property to continue to be managed and maintained as shrubland habitat

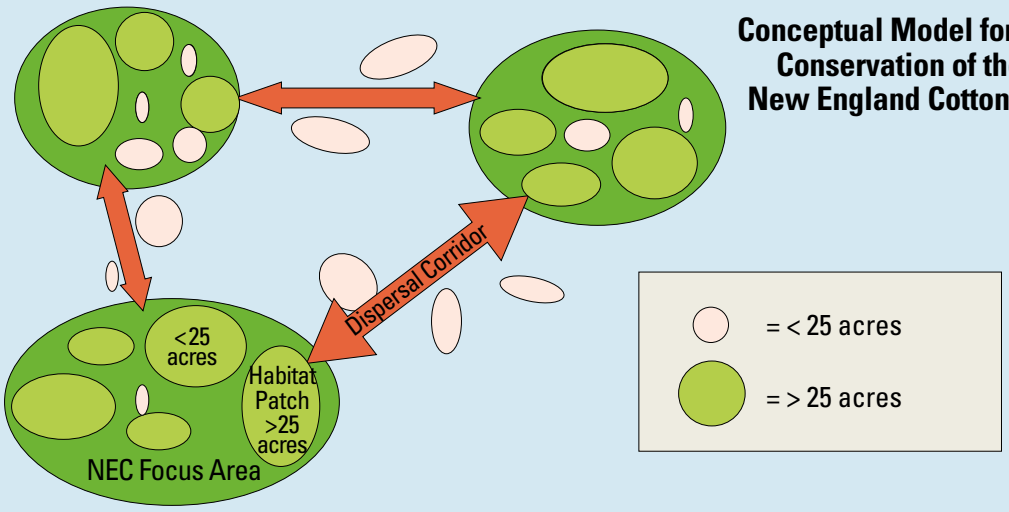
Land acquisition by the Refuge System is but one tool proposed to be used in combination with other partner and landowner efforts. This tool will be used where it can assist the states, National Resources Conservation Service, the Service's Private Lands Program, and other partner efforts with securement of key parcels to improve connectivity, share management capability, and help create substantial cores. This proposal identifies a combined target acreage of 15,000 acres, to be distributed across ten RAFAs that encompass a 290,000-acre project area. Target acreages have been distributed across the RAFAs based on habitat and population goals identified by the range wide conservation partnership for the most dispersal-limited surrogate species, the NEC. While habitat must be located in the vicinity of remaining core cottontail populations for it to be useful, surrogate bird species are adapted to locating and utilizing this habitat where it is created. The estimated target acreage distribution is shown in Table A.1 below.

Table A.1: Refuge Acquisition Focus Area Target Acres

Refuge Acquisition Focus Area	Refuge Acquisition Focus Area Size	Target Acres
Cape Elizabeth-Scarborough (ME)	3,254	~800
Berwick-York (ME)	26,410	~2,000
Rollinsford (NH)	4,705	~500
Oyster-Dover-Bellamy (NH)	10,913	~500
Merrimack Valley North (NH)	36,495	~500
Pachaug-Ledyard (CT)	38,208	~3,500
Plymouth (MA)	43,035	~500
Mashpee (MA)	28,633	~1,500
RI East -West (RI)	71,440	~3,200
Northern Housatonic (NY-CT)	35,727	~2,000
Totals	**298,820**	**15,000**

Habitat recommendations for the NEC were developed by the range wide collaborative partnership and presented in the Conservation Strategy for that species. The general conceptual configuration and intent is presented below (Figure A.1). Shrubland migratory bird species and other Species of Greatest Conservation Need (SGCN) are intended to benefit in direct relationship to amounts of shrubland restored, with exact location being less critical. The habitat protected through this proposal aligns with recovery plan goals for Service priorities, including the bog turtle, northern red-bellied cooter, and karner blue butterfly in specific focus areas.

Figure A.1: Conceptual Model for the Conservation of the New England Cottontail: An example configuration of habitat networks or metapopulations.



Each Focus Area should:

– Contain at least 1,000 acres of habitat to support 500 NEC;

– Consist of one or more metapopulations separated by less than 3 miles (5 km), each containing 15 or more habitat patches (fewer when patches are greater than 50 acres), several of which should be 25 acres or greater in size; and

– Have each habitat patch within 1 mile or less of one or more other patches (within reasonable dispersal distance for individual NEC).

It it best, although not necessary, for connectivity to exist or be established between metapopulations and focus areas, although that may not be feasible within the five geographic areas currently known to have NEC.

Managing Habitat for Priority Shrubland Species

In addition to a partial focus on protection and maintenance of more persistent/stable types of shrubland where possible, our land acquisition proposal will also require active restoration and maintenance of shrubland and young forest habitat types. We can no longer depend on natural disturbances to create enough early-successional habitat to reverse the trend of species loss. Habitat must be actively and continuously maintained and regenerated through human intervention if current population levels of declining species are to be sustained or improved. Habitat management techniques described below (excerpted from Arbuthnot, M. 2008, A Landowners Guide to New England Cottontail Management) will be used to improve conditions for shrubland birds, NECs, bog turtles, and other declining species.

Overview of Early-Successional Habitat Management

In areas with more persistent and stable types of shrublands we encourage passive management techniques and allow for natural vegetative growth. In other areas, we will engage in active restoration and maintenance of shrublands and young forest habitat types, where appropriate. Managing habitat for shrubland species can take many forms, depending on the acreage and current condition of the tract of land and how much effort we are able to commit to management. Depending on soils, hydrologic regimes, and vegetation, we may consider mechanical cutting, prescribed burning, herbicides, riparian area restoration, or planting habitat areas to create and maintain optimal conditions.

Special Considerations

Some management actions (e.g., brush-hogging a field, clearcutting a forest, or burning a pitch-pine scrub oak barren) may temporarily eliminate the existing shrub structure, making it necessary to ensure that year-round residents, like the NEC, will always have a sufficient amount of suitable habitat available in the area. A rotational management scheme that distributes restorative treatments over time and space can be used to maintain a shifting mosaic of early-successional habitat that is likely to meet multiple species long-term needs. If possible, for NEC purposes, treatment units should be at least 25 acres in size. New habitats should be made available and suitable for use by cottontails before re-starting succession on old habitats. Management of smaller parcels will require coordination with neighbors who are also managing habitat, to ensure that patches are located close enough together for cottontail dispersal, and that restoration work is spread out over time.

The ecology of different habitat and forest types differs. Guidelines for promoting early-successional habitat in various types of vegetative cover—from fields to shrubs to forests—are found in the following sections.

Managing and Maintaining Existing Early-Successional Habitat

Typical shrublands in the northeast need regular management in order to prevent their succession to forest. Some shrubland habitats are relatively short-lived and will mature into forest after 20 to 25 years of inactivity, for example, an aspen-birch stand. Periodic monitoring of stem density and plant diversity, coupled with maintenance management every 5 to 15 years (depending on method, soil, and vegetation type) should be sufficient to maintain appropriate habitat for the suite of shrubland-dependent species. As described below, wetlands and coastal shrublands may require less frequent management.

Restorative management is generally only necessary when invasive plants are problematic, when stem density falls below 30 stems per 10-by-10 foot block (if the target is NEC), or when habitat is determined to be past suitability for target species by technical experts. In these cases, the shrubland will need to be cut or burned and allowed to re-grow to achieve an appropriate density. A combination of techniques is often used to hinder growth of invasive and other undesirable plants in restored shrubland. It is easier to monitor for and to control invasive plants before they become well-established, than it is afterward. Also, by selectively removing young trees as they emerge above the shrub canopy, it is possible to delay the need to mow the whole patch by many decades. This is a good approach with limited land, as it can help avoid the need to have multiple areas that would be clearcut on a rotating basis. In addition to upland shrub thickets, appropriate early-successional habitat can take many forms, including the vegetation types listed below.

Coastal Shrublands
Between the high salt marsh of New England coasts and the adjacent upland vegetation, or on the backside of dune and cobble beaches, coastal shrublands are often present. These shrubby areas occur above the average high tide line but can be flooded by storm tides. Wind, flooding, and heavy salt spray keep the seaward vegetation, in a shrubby state by suppressing succession. Vegetation exposed to these conditions may remain in a shrub state indefinitely, and will just need to be monitored periodically to prevent invasion by exotic species. In less exposed areas, coastal shrublands will grow more densely and will need management similar to that of other upland areas. Coastal shrublands are rare habitat types, which provide high quality foods for many types of wildlife and include fruit and seed producing shrubs targeted by migrating birds (e.g., northern bayberry).

Shrub Swamps
Wetlands dominated by dense woody vegetation less than 20 feet tall are known as shrub swamps. Common scrub-shrub species in these habitats include speckled alder, buttonbush, red osier dogwood, and willows. Soils are seasonally

or permanently flooded with up to one foot of water. These shrub habitats are less prone to succession than some upland shrub areas because they are often too wet for trees to grow at their normal rate of maturation. These are essential habitats for feeding and brooding American woodcock, especially those on fertile soil, and also heavily utilized by spotted and blandings turtles, and year round habitat for NECs. To retain the shrub-like structure of these habitats, trees that may form a large canopy periodically should be cut to allow sunlight to penetrate to the shade-intolerant shrub species. They do not need to be extracted from the swamp, however, because the fallen trunk adds diversity to the understory and becomes habitat for many species.

Alder thickets provide particularly good foraging and brood rearing habitat for the American woodcock and are also utilized by NEC and other shrubland birds. This hardy shrub species grows rapidly, at a high density, and in a variety of soil types. Since alders suffer from shading, removing the overtopping trees in a wetland forest or strip/brush cutting in shrub swamps will often result in rapid alder sprout growth, particularly in winter and spring. Dormant season cutting of alders is also a beneficial management tool since alders are capable of vigorous growth from stump sprouts. In the early spring, prescribed fires that kill only the aerial stems are also recommended for regeneration of speckled alder. Prescribed fire intervals of about nine years are adequate to keep alder stands in the desired condition. Alternatively, under the right conditions, alder can be propagated by planting seeds or planting seedlings.

Pitch Pine – Scrub Oak Barrens

Pine barrens are shrubby habitats characterized by pitch pine, scrub oak, and low-growing woody shrub and heath species such as blueberry, wintergreen, and black huckleberry. They typically occur on dry coastal sand plains or on former New England coastal pastures with nutrient-poor soils. When exposed to occasional wildfire or prescribed fire, pitch pine and scrub oak communities have the ability to suppress forest regeneration and tree development, resulting in habitat that can benefit NECs and other shrub obligate species for centuries. Some old pine barrens that have experienced an absence of fire for 50 to 100 years are undergoing forest succession, with the arrival of white pine and hardwoods such as red maple, red oak, and beech. However, in pine barrens where fires occur at least every 40 years, fire-adapted species such as pitch pine and scrub oak remain dominant. Fire clears away the leaf litter on the forest floor and eliminates fire-intolerant species that have invaded the community. After fire suppression is implemented, shrubs and groundcover re-grow quickly, while pitch pine and scrub oak re-sprout at higher densities than before.

To maintain pine barrens for our target species, like eastern towhees and brown thrashers, the recommended management includes the careful use of prescribed fire once every 10 to 40 years. In communities that have become overgrown with hardwoods, 3 to 5 annual burns will initially be necessary to exclude the unwanted species, followed by a regular 10 to 40 year burn cycle. In suburban areas or lands adjacent to residential development, prescribed burning can be challenging. In these areas, cutting or brush hogging scrub oak and pitch pine will maintain dense cover, since both species re-sprout vigorously from cut stems.

Old Fields

Throughout the project area, many sites occupied by NECs and shrubland birds are old fields such as idle agricultural lands, in many cases approximately 10 to 25 years after farming or tree-cutting activities are stopped. Old fields will naturally persist as good habitat for 20 to 25 years. We recommend periodic monitoring for invasion of exotic plants, but otherwise, occasional management actions such as selective cutting, mowing, or selective removal of undesirable

trees should be all that is required to maintain the field in an appropriate environment. If these activities are performed about once every 5 to 15 years, they should prevent trees from becoming too large while still providing forage and cover plants, thus ensuring decades of early-successional habitat.

Reclaiming old fields that have thinned out or are more than 20 to 25 years post-disturbance requires more aggressive initial management. Grown trees (including all saplings over 3 inches in diameter) can be removed using a tree shear, hydro-ax, Brontosaurus, or other heavy-duty land clearing equipment. Afterwards, the area can be maintained by removing saplings and performing the treatments mentioned above every 5 to 15 years. More productive areas will require more frequent attention, with maintenance activities taking place every 1 to 3 years. In some cases, such as a large amount of aspen or birch, the site may need to be to be sectioned into large blocks or strips and entered on a rotating 5 to 15 year schedule, depending on the target wildlife and surrounding habitat matrix. A more exact management schedule will be determined based on the properties of each individual site.

In some instances, it is undesirable to wait for an old field habitat to succeed into a shrub dominated habitat. This is particularly true in croplands and grasslands that were intensively grazed or in previously developed areas, where shrublands will develop very slowly without some intervention. If travel corridors need to be established quickly, or a particular vegetative species composition is desired, planting can help jump-start the areas into suitable habitat. In areas where invasive, non-native species are dominant, planting shrublands may help prevent the establishment of a non-native monoculture.

Old Orchards

Abandoned orchards provide great food, cover, and nesting opportunities for a multitude of species. Interspersed with the apple trees are clumps of shrubs and seedling or sapling trees as well as a thick blanket of herbaceous ground cover. Bats, snakes, and many small mammals make their homes in this habitat. Once the area becomes dominated by overtopping hardwoods, however, there is a decline in early-successional wildlife species and apple trees die. Orchards can be returned to an early-successional state by removing overtopping trees and any trees larger than 3 inches in diameter, while leaving all apple trees. Invasive exotic plants can be treated with herbicide to control their growth and inhibit them from taking over the orchard. To maintain a mosaic of natural shrubs and trees, the orchard should be mowed or brush-hogged every 5 to 7 years.

Black racer

Vicki DeLoach Flickr.com

Young Aspen Stands

Aspen saplings are known habitats for numerous shrubland species. During the herb/shrub stage of an aspen stand, which typically lasts only a year or two, aspens grow at high densities of 4,000 to 6,000 stems per acre. The aspen's underground system of root suckers sends up new sprouts on a regular basis, resulting in large colonies of trees that all originated from a single seedling. In order to maintain

biodiversity and keep habitat in an early-successional stage, intensive initial management and frequent upkeep of aspen-dominated lands are required.

First, a half-acre of land surrounding an aspen tree should be clearcut, including all other aspens in the area. The hardy root system, which can even survive intense forest fires, will produce seedlings up to a half acre from the single standing tree. Most regenerating sprouts appear within two years of disturbance, and many come from stump re-sprouting. Clearcutting and prescribed burning will promote growth of other seedling species in addition to aspen, resulting in a diverse young stand of habitat within just a few years. Management must involve frequent cutting in order to prevent the area from maturing into a closed-canopy forest.

Aspens occur naturally on a variety of dry and wet sites. Opening up an aspen stand on a sandy or gravelly dry site often results in an abundance of shrubs and herbs, including blueberry, beaked hazel, and wintergreen. Wet-site shrubs in aspen stands with fine-textured sediments and poor drainage include highbush blueberry, mountain holly, common winterberry, alders, viburnums, wood sorrel, and goldthread. This type of habitat will require frequent management including periodic selective cutting, but will ensure quick regrowth of a dense understory favorable to cottontails.

Invasive Shrub Species and Methods for Control

NECs, shrubland birds, and associated species often occupy habitat patches that contain exotic shrub species. Many of these invasive species (e.g., autumn olive, multiflora rose, Japanese barberry, buckthorn, and bush honeysuckle) contribute to the density of understory cover, but often spread at the expense of native species that may provide a better source of food. When undertaking management work, we consider it important to avoid any actions that may promote the spread of invasives, and proactive monitoring and management are recommended to prevent exotic species from dominating a particular site. However, removing all invasive plants at once may be detrimental to the cottontail and other wildlife populations. A plan for sequential removal of exotic plants over a period of years may be warranted.

Since invasive plants can come to dominate an area within just two or three years, periodic inspections will be conducted for the presence and spread of these species, which should preferably be treated or removed prior to seedset. If control of well-established invasive plants is deemed appropriate, we will follow species-specific guidelines. All other habitat management activities will also be carefully evaluated for their effect on exotic species, since activities such as cutting and burning can inadvertently lead to invasive seed dispersal or creation of habitats more favorable to invasives.

The Field-Forest Interface

Many shrubland birds and the NEC use edge habitat, such as the transition from forest to field, as long as it is in a thick and shrubby condition. Since herbaceous food comprises the majority of the rabbit's diet during the summer season, open herbaceous areas proximal to shrub habitat may be beneficial if properly managed. Often the border or edge between forest and open land is straight and abrupt and does not provide optimum habitat conditions for the NEC. In this case, we may want to manage or plant field borders to improve availability of high quality foods. Cut-back borders or feathered edges can be used to create a softer transition between field and forest. An ideal cut-back border will exhibit a rough, irregular edge and the interior will be composed of a variety of shrubs, trees, blackberry, raspberry, vines such as greenbrier, and herbaceous plants. Desirable trees and shrubs (e.g., dogwoods, viburnums, serviceberry, etc.) should be retained. Border width may vary, but a minimum width of 50 feet is recommended and much wider borders are preferred. Once the cutback border

is fully mature or the transition zone becomes abrupt, it may be necessary to re-establish the border.

Linear habitat features such as forest-field borders, hedgerows, and riparian buffers can serve as important travel corridors for NEC and help connect rabbit populations, thereby reducing fragmentation effects.

Creating Young Forest Habitat

The seedling stages of aspen, birch, northern hardwood, and red maple forests are also important to certain bird species (e.g., American woodcock) and contain some of the cottontail's preferred winter habitats. Management can be conducted on a small scale by constantly maintaining a patch of forest to keep it at an early successional stage, or it can be integrated into larger forestry operations, which incorporate rotations of patch cuts to ensure that at least one patch is always suitable. Smaller areas (5 to 10 acres) may be maintained as satellite patches as part of a larger, multi-property habitat management plan. A larger timber harvest to create early-successional habitat could be pre-commercial, break-even, or commercial, depending on the quantity and quality of forest products generated. Because the harvesting of timber and the size and distribution of clearcuts is regulated by many states and towns, cutting activity would be coordinated as necessary.

Maintaining Continuous Young Forest Habitat

Although most trees are late-successional species, dense, regenerating stands in the seedling/sapling stage provide good habitat for early-successional obligate wildlife species. There is a 10 to 15 year window during which regenerating hardwood forests provide suitable understory habitat before the tree canopy closes. Establishing early-successional forest with adequate understory density for the cottontail will, under most circumstances, require the intensive initial effort of clearcutting a tract of grown forest and allowing the trees and shrubs to re-sprout or grow from seed. Small patch cuts or small group selection cuts will not create the same habitat type, as remaining trees will expand their canopies quickly, blocking needed light from reaching the forest floor. Only larger clearcuts (five or more acres in size) will enable shade-intolerant herbaceous plants, shrubs, and vines to grow, resulting in thicker ground cover.

In a mature maple forest, for example, a dense understory can be created by clearcutting a tract of the forest and then allowing a few years of re-growth. During the initial clearcutting phase, individual trees larger than 3 inches in diameter can be cut with a chainsaw, and the remainder can be mowed with a brush hog, or a feller buncher can do both at once. After this initial treatment, the stand should be re-entered every one to three years in order to remove undesirable trees. As long as the tree canopy is kept open, appropriate habitat should be able to grow on the forest floor.

To maintain a constant supply of young forest habitat with less frequent management, forests should be managed on a rotational schedule. When one patch begins to enter the mid-successional stage, a more recently clearcut patch will be developing a dense understory of saplings ideal for NEC use. Maintaining two or three patches of 10 or more acres each on a rotating schedule of management once every five years will ensure constant habitat for New England cottontails. Each type of forested community regenerates differently, which must be kept in mind in determining treatment.

Integrating Habitat Management into Forestry Operations

Habitat management for shrubland species is compatible with long-term or large-scale forestry operations, as long as the rotational cutting scheme ensures that a patch of suitable habitat will be available at any given time. An example of an

effective plan would be a 100-year rotation of an 80 to 90 acre tract, consisting of five 10 to 15 acre even-aged forest stands centered around a 10 acre alder swamp. The goal is to eventually have adjacent forest stands differing in age by approximately 20 years, with at least 16 percent of the tract in regenerating early-successional forest integrated with permanent shrub refugia.

Acquisition Decisions and Management Planning

The following guidance will be taken into consideration as opportunities arise and we make decisions regarding management possibilities for new lands and easements that may be acquired:

Manage large areas. Since NECs experience low survival in habitat patches less than 12 acres in size, the most valuable areas under management for this species will be at least this size. Blocks of 25 acres or more will be preferred, since this is the minimum amount of habitat thought to sustain cottontail populations. Shrubland birds are less area-restricted, and this same placement and maintenance of shrubland on the landscape is intended to directly support breeding and migration stopover needs for numerous species.

Maintain dispersal corridors. If we manage smaller satellite patches of habitat, corridors linking these patches to a larger core patch will be essential for the cottontails' population stability. Corridors can be narrow strips of shrubs along field edges, streams, or roads.

Create a rotational management plan. Most NECs and shrubland bird habitat needs to be periodically restored by cutting, which usually makes the habitat unsuitable for the species for several years. Alternating management activities on two or more patches will ensure that shrubland-dependent species will always have suitable habitat.

Coordinate with partners. Where possible, we will consult with neighboring partners and adjacent landowners interested in shrubland habitat restoration, for the purpose of combining and coordinating efforts to support shrubland species. We will work with neighboring landowners interested in managing for early-successional habitat, especially those with significant open space or shrubland habitat, to coordinate such things as timetables for management activities, so that appropriate habitat will always be available.

Conduct periodic habitat reviews. We will monitor the presence of invasive species, which can completely dominate a habitat area within two or three years if left unchecked. To avoid setbacks and maintain native plant diversity, exotic species will be monitored on a regular basis. We will also monitor the density and height of the vegetation in habitat management areas.

Monitor NECs, shrubland birds, and other early-successional wildlife. Periodic monitoring will be conducted to check for target species (e.g., bog turtle).

Bibliography

Arbuthnot, M. 2008. A Landowner's Guide to New England Cottontail Habitat Management.

Environmental Defense Fund. In collaboration with U.S. Fish and Wildlife Service, USDA Natural Resources Conservation Service, and Maine Department of Inland Fisheries and Wildlife. 37 pp.

Appendix B

Bill Zinni/USFWS

Shrubland along powerline corridor, southern Maine

FAQs about Refuge Land Acquisition

■ FAQs about Refuge Land Acquisition

U.S. Fish & Wildlife Service

Great Thicket National Wildlife Refuge *(proposed)*

FAQs about Refuge Land Acquisition

The U.S. Fish and Wildlife Service (Service) is proposing to establish a new national wildlife refuge over a six-state area in southern New England and eastern New York to conserve declining wildlife species that are dependent on shrubland habitats. We propose to name this new refuge Great Thicket National Wildlife Refuge. A total of 10 proposed Refuge Acquisition Focus Areas (RAFAs) have been identified in Maine, New Hampshire, Massachusetts, Connecticut, Rhode Island and New York. We prepared a Draft Land Protection Plan/Environmental Assessment (draft LPP/EA) that evaluates two alternatives to achieve the goal of improving and permanently conserving land for the New England Cottontail and other shrubland-dependent wildlife.

The Service's proposed action would increase our authority to purchase land from willing sellers within the identified RAFAs up to a total of 15,000 acres, including the purchase of conservation easements. The increased authority would also allow us to accept donations of land within the same areas.

Refuge land acquisition programs typically generate a lot of interest. Here are a few questions and answers pertaining to the program and its procedures.

How does the Service decide which lands to include in a refuge expansion, or new refuge, proposal?
There are many considerations in developing a refuge proposal. The Service usually initiates the process by working with state fish and wildlife agencies and other partners to identify lands that are important as habitat for Federal trust resources, but are not considered to be permanently protected. In this case the trust resources include the New England Cottontail, shrubland-dependent migratory birds (i.e. prairie warbler, blue-winged warbler), and Federal listed threatened or endangered species (i.e. bog turtle, Northern red-bellied cooter). This process is also vetted in a public forum in an effort to share information, engage stakeholders, and seek input to better inform the final recommendation.

Areas of interest to the Service are generally based on such considerations as habitat values, long-term sustainability, connectivity to other core habitats and partner-conserved lands, the potential for impacts from climate and land use changes, administrative and operational efficiency, and ease of access for compatible public uses.




(Clockwise) New England cottontail, American woodcock, Red-bellied cooter, Prairie warbler

Over what period of time does the refuge anticipate acquiring the lands identified?
Service policy is to work with willing sellers as funds become available. It often takes decades for identified lands to be acquired.

What does it mean for me if my property is located within an area the refuge has identified for acquisition?
Refuge acquisition boundaries identify areas the Service believes are important for our Federal trust resources. The acquisition boundary merely gives the Service the approval to negotiate with landowners that may be interested in selling their land, or may become interested in selling their land in the future. We must secure approval of the refuge boundary by the Director of the Service before we can work with willing sellers. Lands within the acquisition boundary do not become part of the refuge unless their owners sell or donate them to the Service; the boundary has no impact on property use or who an owner can choose to sell to.

What if I don't want to sell – can the Service acquire my land through eminent domain?
While the Service has authority to use eminent domain, our long-standing policy, as evidenced by our record, is to work with willing sellers only.

What is a conservation easement?
A conservation easement allows the Service to protect wildlife habitat on a property that remains in private ownership. For example, the Service may purchase property rights that restrict certain uses and allow for necessary habitat management to occur. However, other activities, such as farming, forestry, hunting and fishing, could continue when they are consistent with both parties' conservation goals. All conservation easements purchased or accepted through donation will be permanent. They will be recorded with the county as part of the deed

description of the property. Properties with easements may be sold or otherwise transferred as usual, but the conditions of the easement remain attached to the property.

How does the Service decide between fee and easement acquisition?
The landowner has the greatest influence over whether fee or easement acquisition is used. As the property owner, it is ultimately their decision. Service policy is to acquire the minimum interest necessary to accomplish refuge purposes.

How is a value assigned to my property?
The Service is required by law to offer fair market value for lands to be acquired. This estimate of value is based upon a professionally prepared appraisal, which in turn is reviewed and approved by an experienced review appraiser. This review assures that the price offered is reflective of the sale prices of comparable properties in the vicinity.

Do I have to accept this appraised price?
If the seller is not satisfied with the appraised value there is no obligation to sign the Service's offer. However, the Service does not negotiate the value of an offer; the price is established by the appraisal. A seller may provide an appraiser with reportedly relevant comparative sales or other information that may affect the appraised value.

What funding sources are used to acquire property?
Refuge lands are acquired with funds from two primary sources – the Land and Water Conservation Fund (LWCF) and the Migratory Bird Conservation Fund (MBCF) – and not from Federal tax dollars. LWCF was established by Congress in 1965 to provide funds to federal, state, and local governments for the acquisition of land and water for the benefit of all Americans. The primary source of income to the fund is royalties paid by companies drilling offshore for oil and gas. MBCF dollars are generated through the sale of federal Duck Stamps and certain import duties, and are used to acquire important wetland habitats.

How will the Service's acquisition of my neighbor's property affect my property (e.g., what I can/can't do, property values)?
The Service is obligated to maintain the integrity of those lands acquired with public funds. Therefore, the only concern for neighboring properties would involve contaminated or adulterated air or water entering onto the refuge or for noxious species entering the refuge from surrounding lands. Data show that the presence of a refuge generally increases the value of neighboring properties.

How will the Service manage the lands acquired; will they be available for the public to use?
Yes, the lands will generally be available for public use. Public uses, especially activities like hunting, fishing, wildlife observation and photography, and environmental education and interpretation, are encouraged, provided they can be accomplished safely and do not harm the resources for which the land was acquired. That being said, the balance of where, how much, and when these programs are offered may differ across the refuge to avoid user conflicts. The degree to which the public is invited to use lands under conservation easement will depend on negotiations with the landowner(s) when the easement language is crafted.

Will I be reimbursed for expenses incurred in selling?
Yes. The Service strives to minimize or eliminate any adverse impact on the landowner due to the acquisition process. The Service pays for title evidence, mortgage pre-payment penalties, mortgage releases, boundary surveys, recording fees, relocation assistance and moving costs (if applicable), and other expenses incidental to the transfer of title. However, it cannot pay for realtor brokerage fees or for fees charged by attorneys retained by the landowner.

If I sell my land, will the Service help me to move my residence, farm, and/or business?
Renters, lessees, and businesses are generally eligible for relocation assistance. Relocation benefits are paid in addition to the market price paid for the land. The amount of relocation assistance will be determined based on your specific situation.

What does Service acquisition of private property mean for the tax rolls?
Although land acquired by the Service is removed from tax rolls, the affected county or other taxing authority receives annual revenue sharing payments. The baseline for these payments is calculated using one of the following, whichever is largest: 75 cents per acre, three-quarters of one percent of the fair market value, or twenty-five percent of net refuge receipts. The market value is generally updated every five years. If refuge receipts are insufficient to allow full payment, the disbursement may be reduced proportionally.

Congress may appropriate additional funds to increase payments up to the calculated baseline amount as authorized by the Refuge Revenue Sharing Act of 1935, as amended. Due to a shortage of refuge receipts and congressional appropriations, payments to localities have been averaging about 24 percent of the baseline amount in recent years.

Are there potential economic benefits to my community from refuge lands?
Refuges can benefit communities in many ways. National wildlife refuges in the United States are visited 47 million times a year by birdwatchers, photographers, educators and researchers, hunters, anglers, hikers, and many others. These visitors are an important source of revenue for the local economy. Refuges also enhance the quality of life for local residents, both preserving the region's aesthetic beauty and affording numerous recreational and educational opportunities.

For more information:
For additional information about the proposed Great Thicket National Wildlife Refuge please visit our website at: *http://www.fws.gov/northeast/refuges/planning/landprotectionplans.html*. You may also reach the Northeast Region Division of Realty staff by telephone at: 413/253 8588.

For additional information on the Service's Realty procedures, please visit our website at: http://www.fws.gov/refuges/realty/index.html.

For additional information on the National Wildlife Refuge System, please visit our website at: *http://www.fws.gov*.

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1 800/344 WILD

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