

## Chapter 3



USFWS

*Red shouldered hawk at Crooked Pond*

## Alternatives Considered, Including the Service-preferred Alternative

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## Introduction

This chapter describes our process for formulating alternatives, the actions that are common to the alternatives, and description of the two alternatives we analyzed in detail. At the end of this chapter, table 3-1 compares how each of the alternatives addresses key issues, supports major programs, and achieves refuge goals.

## Formulating Alternatives

### Relating Goals, Objectives, and Strategies

Refuge goals and objectives define each of the management alternatives identified below. Refuge goals are intentionally broad, descriptive statements of the desired future condition of refuge resources. By design, they define the targets of our management actions in prescriptive rather than quantitative terms. They also articulate the principal elements of the refuge purposes and vision statement, and provide a foundation for developing specific management objectives and strategies. All alternatives share the same goals.

Objectives are essentially incremental steps toward achieving a goal and further define management targets in measurable terms. They vary among the alternatives and provide the basis for developing detailed strategies that are the means by which we achieve our objectives. We also identify monitoring elements that help us evaluate progress toward meeting our objectives. “Writing Refuge Management Goals and Objectives: A Handbook” (USFWS 2004) recommends writing “SMART” objectives characterized by five attributes: Specific, Measurable, Achievable, Results-oriented, and Time-fixed.

Where possible, we incorporated the principles of SHC in the development of our objectives and strategies. According to “Strategic Habitat Conservation: Final Report of the National Ecological Assessment Team” (USFWS 2006a): “This approach focuses on the ability of the landscape to sustain species as expressed in measurable objectives. Developing a strategy to attain a biological outcome, such as a population objective, requires documented and testable assumptions to determine whether the objective is met.” Not only will this approach ensure refuges are contributing to the Refuge System and Service mission and goals in a strategic, standardized, and transparent way, but it also ensures that refuges contribute to local and regional conservation priorities and goals (USFWS 2008b).

Next we identified strategies, or the actions, tools, and techniques we may use to achieve each objective. The list of strategies in each objective represents the potential suite of actions we may implement. We will evaluate most of them further as to how, when, and where we should implement them when we write refuge stepdown plans. We will measure success by how well our strategies achieve our objectives and goals.

A rationale accompanies each objective to explain its context and importance. We will use the objectives in the alternative selected for the final CCP to write refuge stepdown plans, described later in this chapter.

### Developing Alternatives, including the “No Action” or “Current Management” Alternative

A wide range of possible management objectives and strategies that could achieve our goals were identified by the planning team, the public, and our partners. The planning team evaluated that input further and began the next step of designing management alternatives. Alternatives are essentially packages of complementary objectives and strategies, designed to meet refuge purposes and the Refuge System mission and goals, while responding to the issues and opportunities arising during the planning process. After evaluating how objectives might interact, their compatibility with refuge purposes, and the reality of accomplishing them within a reasonable period, objectives were further

*Dead trees (snag)  
benefit many wildlife*



refined and placed into either the “Current Management” or the “Expanded Management” alternative.

In this chapter, we fully describe two alternatives for managing the refuge over the next 15 years. As required by NEPA, we believe they represent a reasonable range of alternative proposals for achieving the refuge purpose, vision, and goals, and addressing the issues described in chapter 1. Unless otherwise noted, refuge staff would implement all actions.

Alternative A satisfies the NEPA requirement of a “no action” alternative, which we define as continuing the status quo, or current management. Alternative A describes our existing management priorities and activities, and serves as a baseline for comparing and contrasting alternative B (Expanded Management). Current management efforts consist of limited biological and enforcement activities as staff and funding allow (see chapter 2, “Affected Environment,” for detailed descriptions of current refuge resources and programs), primarily focused on the northern red-bellied cooter.

The objectives in alternative A do not strictly follow the objective-setting guidance in the Service goals and objectives handbook, but rather describe ongoing management actions established prior to that guidance. Consequently, objectives in alternative A are more subjective than those in alternative B. Descriptions of alternative A management actions devolve from a variety of pre-existing formal and informal management decisions and planning documents. However, informal applications of adaptive management are still an important component of wildlife and habitat management in alternative A.

Alternative B, the Service-preferred alternative, more formally emphasizes adaptive management to reduce uncertainty in stewardship decision-making and outcomes. Alternative B also places greater emphasis on understanding how the refuge fits into the context of the larger landscape. Priority resources

of concern were re-evaluated in light of new Federal trust resources, recent landscape-level plans and priorities (including but not limited to BCR 30, LCC Regional Prioritization, and 2015 Massachusetts SWAP), and additional biological information gathered on the refuge and surrounding lands. In addition, this alternative enhances public access and our present visitor services with opportunities to reach more visitors.

## **Actions Common to Both Alternatives**

Both alternatives share the following common actions or elements that occur at varying degrees or levels as described in each alternative, and summarized in table 3-1. Some of the actions are required by law or policy, or represent management decisions that have previously undergone NEPA analysis including public review, agency review, and approval. Others may be administrative actions that do not require public review, but that we want to highlight in this public document.

All of the following actions are current practices or policies that would continue under both alternatives:

- Implementing adaptive management.
- Monitoring and abating wildlife and plant diseases.
- Conducting biological and ecological research and investigations.
- Conducting non-lethal predator management.
- Reducing hazardous fuels.
- Providing some environmental education or interpretation opportunities through refuge partners.
- Fostering volunteers and partnerships.
- Providing refuge staffing and administration.
- Protecting resources and ensuring visitor safety.
- Managing access or rights-of-way.
- Prohibiting fishing.
- Distributing refuge revenue sharing payments.
- Completing stepdown management plans.
- Protecting cultural resources.
- Conducting additional NEPA analysis.

## **Implementing Adaptive Management**

All alternatives employ an adaptive management approach for improving resource management based on what is learned from management outcomes. In 2007, the Secretary of the Interior issued Secretarial Order No. 3270 to provide guidance on policy and procedures for implementing adaptive management in departmental agencies. In response to that order, an intradepartmental working group developed a technical guidebook to assist managers and practitioners: “Adaptive Management: The U.S. Department of Interior, Technical Guide.” It defines adaptive management, the conditions under which we should consider it,



the process for implementing it in a structured framework, and evaluating its effectiveness (Williams et al. 2009). The guidebook may be viewed at: <http://www.doi.gov/ppa/upload/TechGuide.pdf> (accessed December 2016).

The guidebook provides the following operational definition for adaptive management:

*“Adaptive management [is a decision process that] promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Careful monitoring of these outcomes both advances scientific understanding and helps adjust policies or operations as part of an iterative learning process. Adaptive management also recognizes the importance of natural variability in contributing to ecological resilience and productivity. It is not a ‘trial and error’ process, but rather emphasizes learning while doing. Adaptive management does not represent an end in itself, but rather a means to more effective decisions and enhanced benefits. Its true measure is in how well it helps meet environmental, social and economic goals, increase scientific knowledge, and reduces tensions among stakeholders.”*

This definition gives special emphasis to the uncertainty about management impacts, iterative learning to reduce uncertainty over time, and improved management as a result of learning. At the refuge level, monitoring management actions and outcomes, and key resources, is essential to implementing an adaptive management process. Our management of threatened and endangered species, migratory birds, and other wildlife habitats, are examples of refuge programs or activities in which an adaptive management approach may already be implemented or will be in the near future.

The final CCP covers a 15-year period, and periodic review of the CCP is required to ensure established goals and objectives are being met and that the CCP is being implemented as scheduled, provided adequate resources are available to do so. To assist this review process, a monitoring and evaluation program would be implemented, focusing on issues involving public use activities and wildlife habitat and population management, including the rates of coastal landscape change that determine the type, amount, and arrangement of wildlife habitats and populations.

Collecting baseline data on wildlife populations and habitats will be implemented where necessary. These data would update the limited existing records of wildlife species using the refuge, their habitat requirements, and seasonal use patterns. This data will also be used to evaluate the effects of habitat management on wildlife populations. Refuge habitat management programs would be monitored for positive and negative impacts on wildlife habitat and populations, and the ecological integrity of the ecosystem. Monitoring will assist in determining if management activities are meeting refuge goals and objectives. Information resulting from monitoring will allow staff to set more specific and better management objectives, more rigorously evaluate management objectives, and ultimately make better future management decisions. This process of evaluation, implementation, and re-evaluation is known as adaptive resource management.

The refuge manager is responsible for changing management actions and strategies that do not produce the desired conditions. Substantive changes from what is presented in our final CCP may warrant additional NEPA analysis and public comment.

**Monitoring and Abating Wildlife and Plant Diseases**



CDC

*Photograph of a black-legged tick, also known as a deer tick (Ixodes scapularis)*

As the Service has not published its manual chapter on disease prevention and control, we derive guidance on this topic from the Refuge Manual and specific directives from the Director of the Service or the Secretary of the Interior. The Refuge Manual (7 RM 17.3) lists three objectives for the prevention and control of disease:

- Manage wildlife populations and habitats to minimize the likelihood of the contraction and contagion of disease.
- Provide for the early detection and identification of disease mortality when it occurs.
- Minimize the losses of wildlife from outbreaks of disease.

The Service published these objectives in 1982. Since then, in addition to diseases that cause serious mortality among wildlife, diseases transmitted through wildlife to humans, such as Lyme disease, eastern equine encephalitis (EEE) or West Nile virus (WNV), have received considerable attention.

In addition to diseases affecting wildlife, we will be attentive to the diseases and pests that affect the health of the ecosystems that the refuge supports. However, the occurrence of any wildlife or habitat disease will be responded to only if it poses an immediate or serious threat to indigenous wildlife and habitat, at a level commensurate with Service staffing and funding.

These are the general strategies for preventing or controlling disease:

- Continue to conduct disease surveillance in conjunction with other field work.
- Cooperate with partners by providing access for sampling and following protocols in the event of an outbreak.
- Inform volunteers and others who work in the field about the dangers of diseases transmitted through wildlife and measures to avoid contracting them.
- Monitor habitats for indicators of the increased occurrence of pests or disease. For example, note changes in flowering or fruiting phenology that do not appear to be linked to global climate change, such as physical damage, decay, weakening, or sudden death, particularly of major host species; also note changes in wildlife use of habitats, such as the absence of breeding birds that used to appear regularly.
- Follow the protocols in national, state, and refuge disease prevention and control plans.

**Conducting Biological and Ecological Research and Investigations**

The Refuge Manual and the Service Manual both contain guidance on conducting and facilitating biological and ecological research, and investigations on refuges. In 1982, the Service published three objectives in the Refuge Manual for supporting research on units of the national wildlife refuge system (4 RM 6.2):

- To promote new information and improve the basis for, and quality of, refuge and other Service management decisions.
- To expand the body of scientific knowledge about fish and wildlife, their habitats, the use of these resources, appropriate resource management and the environment in general.

- To provide the opportunity for students and others to learn the principles of field research.

In 2006, the Service Manual replaced the Refuge Manual and provided guidance on the appropriateness of research on refuges: “We actively encourage cooperative natural and cultural resource research activities that address our management needs. We also encourage research related to the management of priority general public uses. Such research activities are generally appropriate. However, we must review all research activities to decide if they are appropriate or not as defined in section 1.11. Research that directly benefits refuge management has priority over other research” (603 FW 1.10D (4)).

All research conducted on the refuge must be determined (in writing) to be both appropriate and compatible, unless we determine it to be an administrative activity. Research projects also must contribute to a need identified by the refuge or the Service. Opportunities to conduct research on the refuge may arise under either of the alternatives we propose in this draft CCP/EA. In determining the appropriateness and compatibility of future research proposals, we will follow the guidance in the manuals, and will employ the following general strategies:

- Seek qualified researchers and funding to help answer refuge-specific management questions.
- Participate in appropriate multi-refuge studies conducted in partnership with others.
- Coordinate with partners to initiate or conduct research on priority issues identified at local and regional scales.

All researchers will be required to submit detailed research proposals following the guidelines established by Service policy and refuge staff (see appendix B, Research by Non-Service Personnel). SUPs will also identify the schedules for progress reports, the criteria for determining when a project should cease, and the requirements for publication or other interim and final reports. All publications will acknowledge the Service and the role of Service staff as key partners in funding and/or operations.

### Conducting Non-lethal Predator Management

Under both alternatives, refuge staff, volunteers, and partners would use non-lethal predator management techniques to minimize loss of northern red-bellied cooter nests (eggs and hatchlings) on Massasoit NWR. The only technique used to date has been enclosing northern red-bellied cooter nests (and excluding predators) with wire mesh cages in situ as soon as they are located to prevent depredation. Nest enclosures (predator exclosures) are left on the nests until the hatchlings hatch and emerge, or until late incubation when staff collect the nests to finish incubation in captivity. Nest enclosures work very well if the nests are found soon after the eggs are laid, but many nests are depredated before staff or volunteers have a chance to protect



*Protecting a northern red-bellied cooter nest*

Kourtaine Bouley/USFWS



them. For this reason, additional non-lethal predator management techniques are proposed and discussed in alternative B. It is not believed that lethal predator control measures are necessary for management purposes at this time.

**Reducing Hazardous Fuels**

Under both alternatives, refuge staff with assistance from partners would use prescribed fire in combination with mechanical mowing, cutting, and/or mastication (chipping/mulching), to maintain fuel loads below hazardous levels in accordance with the approved Fire Management Plan and Annual Burn Plans, and secondarily to open forest and shrub canopies to increase sunlight reaching the forest floor. Fire suppression in the past has resulted in an increase in fuel loads that put the neighboring community and refuge resources at risk for wildland fires. The area managed with prescribed fire and mechanical means varies by alternative.

The same partners assisting the Service with refuge fuels projects need the Service to reciprocate by providing refuge firefighting and other resource assistance to them to complete similar hazardous fuel reduction treatments in their respective jurisdictions (off-refuge), across the larger at risk community. This assistance would continue identically under both alternatives.

**Providing Limited Environmental Education or Interpretation**

Under both alternatives, SUPs would continue to be issued to refuge partners who wish to provide environmental education or interpretative opportunities that are consistent with refuge purposes and management goals and objectives, and coordinated with refuge staff. A compatibility determination is included in appendix B.

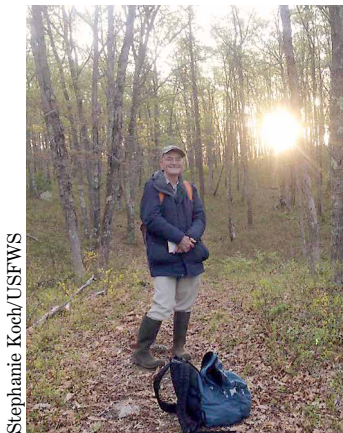
**Fostering Volunteers and Partnerships**

Strong support in the community and the region contributes to the refuge’s success. Helping hands are needed for program development, data gathering, and other opportunities discussed in these alternatives. Only with this type of assistance can the refuge goals and objectives, the Service and Refuge System missions, and community needs be achieved.

Although the refuge volunteer program is currently small, volunteers have made important contributions toward habitat management and inventory and monitoring programs by conducting vegetation surveys (including rare and non-native invasive species), assisting with efforts to improve northern red-bellied cooter nesting habitat, and monitoring northern red-bellied cooter nesting and hatchling emergence. The refuge volunteer program would continue under both alternatives.

In addition to volunteer contributions, our conservation partners play a crucial role in the success of refuge resource management and public outreach programs. Both alternatives would maintain the existing partnerships identified in chapter 2, and later in this chapter under goal 3, while also seeking new ones. These relationships are vital to our achievements in all aspects of refuge management—conserving land, managing habitats and protecting species or cultural resources, conducting outreach and education, and providing wildlife-dependent recreation. Our relationships include MassWildlife, particularly when we can manage our refuges in a manner that benefit species that are listed by the state as endangered or threatened. We would pursue new partnerships in areas of mutual interest that benefit refuge goals and objectives and also provide additional opportunities for visitors.

Our proposals in this document do not constitute a commitment for staffing increases or funding for operations or maintenance. Congress determines our annual budgets, which our Washington headquarters and regional offices distribute to field stations. Chapter 2 presents our current staffing levels,



Stephanie Koch/USFWS

*Volunteers participating on a bird survey*

**Providing Refuge Staffing and Administration**

operating, and maintenance funds for the Refuge Complex. The activities shared among the alternatives described below pertain to staffing, administration, and operations, and collectively support achieving all three refuge goals.

In both alternatives, we strive to sustain levels of annual funding and staffing that allow us to achieve refuge purposes, by achieving the goals, objectives, and strategies in this draft CCP/EA. As a rule, the Service's Northeast Region works toward maintaining a ratio of 75 percent of funding for refuge staff and salaries and the remaining 25 percent for on the ground management. Often, many highly visible projects are conducted through special project funds that typically have a 1- to 2-year duration. Although vitally important, their flexibility is limited because we cannot use those funds for any other priority project that may arise. Additionally, we rarely know when or if we will receive these funds in advance of when work must begin.

Under both alternatives, the Service will continue to investigate additional sources of funding to complement and extend or "leverage" existing budget allocations. Additional opportunities may emerge and will be pursued as a result of expanding outreach and partnerships with key conservation partners.

**Protecting Resources and Ensuring Visitor Safety**

Currently, no law enforcement officer position is assigned specifically to the refuge or stationed onsite. Law enforcement staff assigned to the Refuge Complex headquarters in Sudbury provides resource and visitor protection for all eight refuges, including but not limited to Massasoit NWR. When necessary, supplemental policing may be conducted by other Service law enforcement officers on detail, Massachusetts Environmental Police, and police officers commissioned by the town of Plymouth.

**Managing Refuge Access or Rights-of-Way (340 FW 3)**

The refuge will use and maintain its existing rights-of-way on Gunners Exchange Road and Cannon Road and access a dirt road off Snake Hill Road to access its properties for refuge resource management and law enforcement.

**Prohibiting Fishing**

Although fishing is identified as a priority public use of the Refuge System and is therefore an appropriate use, this activity is not compatible with the purpose for which Massasoit NWR was established. Along shorelines where northern red-bellied cooters nest and bask, increased human presence (especially during the late spring, summer, and early fall) would also cause direct disturbance to northern red-bellied cooters, could impact nesting success, and could result in an increased predator presence at these locations. Allowing angler access to any of the refuge-owned shorelines could also degrade habitat.

**Distributing Refuge Revenue Sharing Payments**

Under both alternatives, refuge revenue sharing payments (see chapter 2, Socioeconomic Environment section) will continue in accordance with the law, commensurate with changes in the appraised market value of refuge lands, the extent of the property, and appropriation levels provided by Congress.

**Completing Stepdown Management Plans**

Service planning policy identifies 25 stepdown plans that may be applicable on any given refuge. As previously discussed in chapter 1, six have been completed for the Refuge Complex as a whole, which includes Massasoit NWR. We have identified the additional plans that are the most relevant to this planning process and have prioritized their completion. Several are ongoing as part of Refuge Complex-wide planning, but others will be completed depending upon the alternative chosen and available funding and staffing.

The following refuge stepdown management plans would be completed after a final Massasoit NWR CCP is complete:

*Northern red-bellied cooter nesting habitat at Crooked Pond*



- Habitat Management Plan, within 2 years following CCP approval (see discussion below).
- Annual Habitat Work Plan, annually beginning within 3 years of CCP approval (see discussion below).
- Inventory and Monitoring Plan, within 2 years following CCP approval (see discussion below).
- Avian Disease Contingency Plan, within 5 years of CCP approval.
- Integrated Pest Management Plan, within 5 years of CCP approval (see discussion below).
- Cultural Resources Management Plan, within 5 years of CCP approval.

**Habitat Management Plan (HMP)**

An HMP is a dynamic working document that provides refuge managers with a decision-making process, guidance for the management of refuge habitat, and consistency for habitat management on refuge lands. Each plan incorporates the role of refuge habitat in international, national, regional, Tribal, state, ecosystem, and refuge goals and objectives. The plan guides analysis of specific habitat management strategies to achieve habitat goals and objectives, and utilizes key data, scientific literature, expert opinion, and staff expertise. Specifically, the HMP defines management areas and treatment units, identifies the type or method of treatment, establishes the timing for management actions, and defines how we will measure success over the next 15 years. The HMP for the refuge is the first step toward achieving goal 1 objectives, regardless of the alternative selected for implementation. The goals, objectives, and list of strategies in each objective identify how we intend to manage habitats on the refuge, based on current resource information, published research, and our own field experiences. In the HMP, we will update our methods, timing, and techniques as new, credible information becomes available. To facilitate our management, we will regularly maintain our geographic information system (GIS) database, documenting any

major changes to the refuge wildlife habitats. As appropriate, we will incorporate the actions common to all alternatives into the HMP.

**Annual Habitat Work Plan (AHWP)**

The AHWP is an essential component of an adaptive management approach. It details incremental (or annual) tasks in support of goals and objectives, and identifies habitat management strategies outlined in the CCP and HMP to be completed within the plan year. Typically, the AHWP evaluates progress toward achieving the habitat objective(s) from present management strategies and prescriptions by evaluating the response of the resources of concern as well as non-target resources to the habitat management strategies and prescriptions. The refuge uses this information to help select the management strategies with the most positive effect on refuge resources as a whole.

**Inventory and Monitoring Plan (IMP)**

The refuge IMP is a priority for completion upon CCP approval. Regardless of the alternative chosen, an IMP is vital for measuring our success in meeting objectives, though inventory and monitoring methods and intensity will vary according to the alternative chosen. The IMP will outline the methodology to assess whether our original assumptions and proposed management actions support our habitat and species objectives. The IMP may also be used to monitor the potential effects of global climate change on refuge habitats and wildlife populations. We will prioritize our inventory and monitoring needs for the selected CCP alternative in the IMP. The inventory and monitoring results will provide us with more status information on our natural resources.

**Integrated Pest Management (IPM) Plan**

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

The IPM Plan is a stepdown plan from the CCP and supplements both the CCP and HMP, with documentation on how to manage specific invasive or pest species. It will be written and kept on file at the Refuge Complex headquarters when complete. Along with a more detailed discussion of IPM techniques, this plan describes the selective use of pesticides for pest management on the refuge, where necessary.

Pesticide use, with appropriate and practical best management practices for habitat management, would be approved for use on the refuge when there likely would be only minor, temporary, and localized effects on species and environmental quality, by not exceeding threshold values in the chemical profiles. We adhere to all administrative requirements for completing pesticide use plans. Our control program would address the most critical problems first and can be adjusted to reflect regional Service priorities, new information, or a new resource.

**Protecting Cultural Resources**

As a Federal land management agency, we are responsible for locating and protecting all historic resources; specifically, archeological sites and historic structures eligible for listing or listed on the National Register of Historic Places. This applies not only to refuge land, but also to land affected by refuge activities. The Service files indicate two cultural resources within the refuge boundaries (two abandoned cabins) that have subsequently been demolished due to vandalism and disrepair. The MHC and Service files indicate no other known sites within the current refuge boundaries. However, archaeological sites might be exposed at any time through erosion.

Under both alternatives, we will evaluate the potential for impact on archeological and historical resources as required. We will consult with the Massachusetts SHPO and the Tribal Historic Preservation Officers (THPOs) for the Mashpee Wampanoag Tribe, the nearest federally recognized Tribe. These activities ensure our compliance with Section 106 of the NHPA, regardless of the alternative. Compliance may require a State Historic Preservation Records survey, literature survey, or field survey.

### **Conducting Additional NEPA Analysis**

For all major Federal actions, NEPA requires site-specific analysis and disclosure of expected impacts, either by categorical exclusion, or in an EA, or environmental impact statement. NEPA provides for categorically excluding other routine activities from that requirement. Generally, those include the administrative actions listed in chapter 4. Many of the actions proposed in the alternatives, and fully analyzed in this draft CCP/EA, are described in enough detail to comply with NEPA and will not require additional environmental analysis prior to implementation. Although this list is not all-inclusive, the following projects fall into that category:

- Research and refuge inventory and monitoring activities.
- Habitat management activities.
- Implementation of predator or pest management programs.

Additional NEPA analysis would be required if we were to implement a significant public action (e.g., hunt program) or construction project not considered in detail in this document.

### **Alternatives or Actions Considered but Eliminated from Further Study**

Based on public scoping and internal agency discussions the following alternative management actions were considered, but eliminated from further study. All other actions identified are incorporated into at least one of the two proposed CCP alternatives presented.

#### **Trail Proposal**

The town of Plymouth requested that the Service consider allowing a trail across the refuge and adjoining tracts owned by TNC that links parts of a larger system of trails within the Plymouth region. The Town-proposed trail would connect a tax title parcel owned by the town of Plymouth that abuts the northern corner of the Crooked Pond parcel to MSSF trails. The town of Plymouth's proposal would use existing informal footpaths that were created by fire breaks and by unauthorized use on the refuge.

The town of Plymouth parcel is connected to a large parcel owned by TNC that is part of a larger Eel River Restoration Project conducted in collaboration with the Service. TNC expressed concerns over possible adverse off-refuge resource impacts with the current trail proposal. As originally proposed by the Town, the new connecting trail segment on Massasoit NWR also would traverse a steep grade requiring switchbacks. Portions of the proposed trail route would have passed close to known northern red-bellied cooter habitat. Therefore the proposed trail routing suggested by the town of Plymouth was eliminated from further study.

#### **Habitat Management**

The Service considered an alternative to not conduct any habitat management other than for enhancing cooter nesting along pond shorelines. The refuge currently manages up to 50 acres of upland habitat primarily to reduce hazardous wildland fuel loads, and proposes to manage additional upland acres to achieve additional hazard fuel reduction and improve habitat for several species of migratory birds, rare Lepidoptera, and the New England cottontail. If the



refuge were to discontinue all upland habitat management, we would no longer be meeting regional or national hazard fuel management goals and objectives. The risk from wildfire would continue to increase for the surrounding communities. Upland habitats would also be at risk of being negatively altered by catastrophic wildfires. Without frequent lower intensity fire events, upland habitats will continue converting to a white pine dominated forest which is not typical and less biologically diverse than the native habitat type.

### Refuge Expansion

The Service considered a strategic expansion of the refuge to protect additional tracts of land in order to better support the recovery of the cooter as well as protect and manage additional lands to benefit early successional or shrubland dependent species in focal areas identified by the Service and conservation partners. This action was considered to be well beyond the geographic scope of the Massasoit NWR CCP process and, therefore, eliminated from further study. However, a separate ongoing effort by the Service to protect shrubland habitats on a larger landscape level is underway that will address such landscape scale concerns, and if approved, can be incorporated during future Massasoit NWR CCP updates.

### Mosquito Control

The Service considered the potential need for surveillance monitoring or control of mosquito species known as potential vectors of human or wildlife diseases, such as WNV or EEE which is historically documented in the Plymouth-Carver area. Past mosquito control operations in the area focused on cedar swamps, which do not occur within Massasoit NWR. Any future operations can be adequately addressed by applying the Service's existing IPM (569 FW-1) and biological integrity, diversity, and environmental health (601 FW 3) policies to the specific circumstances. Treatment options will be chosen based on these policies, and will emphasize human safety and environmental integrity, effectiveness, and cost factors. We will use human, wildlife, or domestic animal mosquito-associated health threat determinations, combined with refuge mosquito population estimates, to determine the appropriate refuge mosquito management response. We will use current monitoring data for larval, pupal, and adult mosquitoes to determine the need for larvicides, pupacides, and adulticides, respectively. We will allow the use of adulticides only when there are no practical, effective alternatives to reduce a health threat during a declared public health emergency.

### Alternative A. Current Management

Alternative A reflects current management, including activities previously undertaken or already planned or approved. In addition to the actions common to both alternatives, under the "Current Management" alternative, there would be little or no change in our current management programs at the refuge. The refuge would continue operations and maintenance activities within current staffing and funding levels. Alternative A (current management) is summarized in table 3-1, which compares the two management alternatives considered.

*Notching a northern red-bellied cooter for tracking purposes*



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### Habitat and Population Management

Currently, refuge habitat management consists of improving approximately a 1/4-acre of northern red-bellied cooter nesting habitat along the Crooked Pond shoreline using mechanical

means every few years. Non-lethal predator management (enclosing nests with wire mesh) is also implemented to reduce northern red-bellied cooter nest depredation. These actions would continue under alternative A.

**Inventory and Monitoring** Under alternative A, refuge staff would continue updating baseline information, including species presence, as funding and volunteer time permits. Staff would also continue monitoring northern red-bellied cooter nest attempts and success along the Crooked Pond shoreline. Inventory and monitoring activities are a major component of evaluating the success of refuge management.

**Hazardous Fuel Reduction** Under alternative A, with support from New England Zone fire management resources, refuge staff would continue to manage 50 acres of oak-pine forest and woodland to reduce hazardous fuel loading. Prescribed fire and mechanical means would be used within the wildland urban interface. Existing fire breaks would be managed to reduce wildfire risk to refuge neighbors as well as provide defensible space for wildland firefighters.

**Visitor Services** Under alternative A, the refuge would remain closed to general public use. Wildlife interpretation and environmental education would be allowed under a SUP on a case-by-case basis, when refuge staff are involved with programming or are working with partners to conduct it. There would also be small scale outreach and virtual interpretation via the refuge Website and distribution of materials such as the Refuge Complex brochure in the area.

**Refuge Administration** In alternative A, refuge staffing would remain at current levels, with all support staff stationed at the Refuge Complex headquarters in Sudbury, Massachusetts. There would be no dedicated staff for Massasoit NWR under alternative A.

In the discussion that follows, we describe in detail the goals, objectives, and strategies that we would implement under alternative A.

**GOAL 1:** **Perpetuate the biological integrity, diversity, and environmental health of the pitch pine-oak forest habitat type and associated coastal plain ponds and wetlands on Massasoit NWR to sustain native wildlife, especially species of conservation concern such as the federally listed northern red-bellied cooter.**

**Objective A1.1.** **On the Crooked Pond parcel, contribute to rangewide northern red-bellied cooter population recovery by: (1) continue protecting 10 acres of existing pond habitat and associated shoreline from human disturbance, (2) creating and maintaining ¼-acre of high quality nesting habitat for the northern red-bellied cooter, and (3) increasing nest success and hatchling survival.**

**Rationale**

The northern red-bellied cooter is a federally listed and a State-listed endangered species. Massasoit NWR was specifically established to conserve the northern red-bellied cooter and is entirely located within a 3,269-acre area formally designated as critical habitat (USFWS 1985). Chapter 2 includes more details about northern red-bellied cooter ecology and range-wide status. Continued threats to northern red-bellied cooters include (but are not limited to): a restricted geographic range; collection and disturbance by people; habitat alterations including closed canopies at nesting sites, and; high mortality of eggs, hatchlings, and juvenile turtles due to nest failure, nest predation, and predation on hatchlings following emergence (USFWS 1994 and 2007).

The Massachusetts SWAP (MassWildlife 2015) notes that Statewide, only 27 percent to 35 percent of non-open-water habitat required by freshwater turtles

*Crooked Pond at  
Massasoit National  
Wildlife Refuge.*



Kourtne Bonley/USFWS

(northern red-bellied cooter, bog turtle, Blanding’s turtle, and wood turtle) is currently protected.

At Massasoit NWR, headstarted northern red-bellied cooters (see chapter 2 for details on the rangewide project) were released annually into Crooked Pond from 1985 to 1991 (81 headstarted hatchlings total; USFWS 1994), and mark-recapture surveys were conducted to monitor their survival. Research showed high annual survival rates averaging over 85 percent, and that the estimated population was about 40 (Haskell 1993). From surveys conducted from 1985 to 2001, the Crooked Pond northern red-bellied cooter population composition was almost entirely headstarted, with a male-biased sex ratio (USFWS 2007). The current refuge northern red-bellied cooter population was recently estimated to still be very small. However, 2011 and 2012 research by refuge staff in confirmed breeding-age females present in Crooked Pond, with three gravid females confirmed in 2012. Re-initiating habitat improvements in 2014 and increased monitoring in 2014 and 2015 resulted in five and eight confirmed nests, respectively. Therefore, although this resident population may be small compared to other sites throughout the range, the efforts at Massasoit NWR are important and are contributing to population recovery.

Our objective of contributing to recovery through habitat protection and management, and our supporting strategies, specifically addresses Recovery Plan Task #3 (USFWS 1994):

**Task 3.1:** Protect occupied and potential habitat.

**Task 3.2:** Improve habitat at ponds with known populations by clearing nesting sites and providing basking sites where necessary.

**Task 3.3:** Annually locate and protect nests at ponds with major populations.

**Task 3.4:** Enforce all laws protecting the cooter and its habitat.

By protecting the 10-acre Crooked Pond and maintaining approximately 1/4-acre of nesting habitat along the shoreline, we would benefit this resident population. High quality northern red-bellied cooter nesting habitat is characterized by open, sandy substrate, with little canopy cover and a southern aspect. Historically, the land surrounding Crooked Pond consisted of pine barren habitat that occasionally burned from lightning strikes and fires set by Native Americans. Closure of the forest canopy around the pond edges may be detrimental as research suggests that both hatchling success and early hatchling survival may benefit from management which provides nesting habitat with ample sunlight (USFWS 1994). Although we were unable to monitor the shoreline daily for nesting activity until our recent deployment of trail cameras, northern red-bellied cooter nests have been confirmed in all three shoreline areas where habitat was improved on Crooked Pond (see chapter 2).

In addition to monitoring northern red-bellied cooters' response to habitat improvements, we would continue to protect nests from predators using non-lethal means whenever possible. Predation of northern red-bellied cooter nests and hatchlings following emergence is likely limiting population growth. Predators may include predatory fish, bullfrogs, herons, snapping turtles, raccoons, striped skunks, and other mammals. Wire nest enclosures (predator exclosures) placed around nests as soon as they are found have been used for decades at other sites to protect nests and hatchlings from predators (USFWS 1994). Hatchlings are trapped inside the enclosures as well and can be collected by researchers for either release directly back into ponds, or for headstarting which substantially increases their first year survival (see chapter 2). Hatchlings collected at the refuge since 2013 have been contributing to the headstarting program, and some of these hatchlings are released the following spring at non-refuge sites contributing to range-wide recovery.

The northern red-bellied cooter is protected by the ESA (16 USC 1531) and associated regulations (50 CFR 17), and by the MESA (MGL, Chapter 131A) and associated regulations (321 CMR 10.00). The Federal and State designations prohibit taking or possessing northern red-bellied cooters without a permit. Although the entire refuge is closed to the public, trespass issues persist and establishing a physical closure at nesting sites may prevent trespassers from entering sensitive nesting areas. Law enforcement staff enforces the closure of the refuge to prevent degradation of habitat and minimize disturbance to northern red-bellied cooters, especially at Crooked Pond. It can take a female cooter several hours once she emerges from the water to find a nesting spot, dig the nest chamber, lay her eggs, and cover the nest (USFWS unpublished data). Any human presence during the day, even for a short amount of time, could disrupt this behavior. Year-round closure of the refuge to public use would continue and limit access to northern red-bellied cooters and their habitat to minimize human disturbance.

**Strategies**

*Continue to:*

- Use mechanical and hand tools (such as rototiller, rakes, shovels, axes, and chainsaws) to reduce encroaching shrubby vegetation, remove herbaceous vegetation, girdle large canopy trees, and loosen soil at two sites on the Crooked Pond shoreline by late May at least every third year.
- Protect northern red-bellied cooter nests with predator exclosures (nest enclosures) to protect eggs and emerging hatchlings at Crooked Pond.

- Coordinate with conservation partners and participate in the State headstarting program when northern red-bellied cooters successfully nest on the refuge.
- Support and facilitate collaborative research on northern red-bellied cooters on refuge lands to determine the population and factors limiting survival and reproduction, and establish short-term population objectives.
- Use temporary signs to establish a physical closure at northern red-bellied cooter nesting sites along the Crooked Pond shoreline annually from mid-May through mid-September, and address trespass issues as they occur.
- Make appropriate changes in management for northern red-bellied cooters within 6 months of completion of any 5-year reviews or recovery plan updates to accommodate updated recovery criteria, research needs, or any additional needs identified.

Refer also to objective A3.1 for landscape scale, off-refuge strategies.

### **Inventory and Monitoring Elements**

*Continue to:*

- Collaborate with conservation partners to search nesting habitat along the Crooked Pond shoreline for nesting northern red-bellied cooter activity from late May through August by walking through nesting areas at least once per week, and more often as time allows.
- Coordinate with conservation partners to install trail cameras at nesting sites to document nesting activity and trespass as time allows.
- Record location and monitor nest success (total eggs laid and hatched) if nests are found.

### **Objective A1.2.**

**Manage 50 acres of mixed pine-oak forest and other upland habitats on the refuge to reduce hazardous fuel loading through mechanical and prescribed fire.**

#### *Rationale*

The wildland urban interface has gained increasing importance as more Americans build homes in rural settings adjacent to public lands. Since the development and implementation of the National Fire Plan, there has been a marked increase in reduction of hazardous fuels in the wildlife urban interface on the edge of Federal lands. ([http://www.fws.gov/fire/living\\_with\\_fire/wildland\\_urban\\_interface.shtml](http://www.fws.gov/fire/living_with_fire/wildland_urban_interface.shtml), last accessed 11/06/2015).

Plymouth was named a Federal “Community at Risk” in 2001 because of the high risk to the community from wildfire on Federal lands. A community is considered at risk from wildland fire if it lies within the urban/wildland interface, defined as: “where humans and their development meet or intermix with wildland fuel” (*Federal Register* Vol. 66, No. 3, Pages 751-754, January 4, 2001). To reduce risk of wildland fires to homes nearest to the refuge, the Service began using mechanical means and prescribed burns as management tools to reduce hazardous fuels. Firefighters from the Service, TNC, the Commonwealth of Massachusetts, and Plymouth Fire Department, performed controlled burns on 20 acres of the refuge in (spring) 2007. These same 20 acres and an additional adjacent 30 acres were burned in the spring of 2011. Controlled burns reduce the build-up of leaf litter, dead wood, and other plant material that could otherwise



fuel a wildland fire, and also help prepare sites for seedling establishment, promote oak re-sprouting, and foster plant nutrient recycling.

The primary aims of prescribed burning under alternative A (see map 2-5) are to reduce hazardous fuel accumulations, establish fuel breaks between the refuge and neighboring residential communities, and reestablish the natural role of fire within the pine-oak community. Moreover, these management actions can secondarily benefit native habitat and wildlife by restoring more structural habitat and species diversity across the landscape.



USFWS

White pine habitat on Massasoit National Wildlife Refuge

The pitch pine-oak community is a fire-dependent habitat type. Pitch pines often have shoots that can grow directly from the trunk, enabling trees to re-sprout after fire has killed the crown, and thick bark protects the trunk from damage unless the fire is very severe. When fires occur in this community type on a frequent basis, they are generally of low severity, which helps maintain the plant community structure. If fires are not sufficiently frequent, the flammable material (fuel load) accumulates. Fires can burn much hotter and with greater severity. In such situations, a hot (high severity) fire may kill trees and, under certain wind conditions, potentially expand into surrounding communities at the wildland urban interface. The refuge is surrounded by several densely populated communities at risk of wildfire due to their close proximity to the hazardous fuels and lack of defensible space.

### Strategies

*Continue to:*

- Evaluate the entire refuge in the context of wildland urban interface risks and along with Service partners, facilitate planning of additional hazardous fuel reductions to protect neighboring communities.
- Utilize prescribed fire and mechanical clearing including mowing, cutting, and masticating in accordance with the approved FMP and Annual Burn Plans every 3 to 5 years initially to maintain approximately 75- to 100-foot-wide shaded fuel breaks between the refuge and residential areas, and 10 to 25-foot fire breaks between burn units. Transition to a 5- to 10-year interval on the northeastern portion of the Crooked Pond parcel over time. The target shaded fuel break effective width is 100 feet, and the target fire break effective width between burn units is 12 feet.

### Inventory and Monitoring Elements

*Continue to:*

- Document all management actions using GIS.
- Fulfill monitoring elements as outlined in annual burn plans to evaluate how well burn objectives are met.

## GOAL 2:

**Promote awareness and support for the protection of sensitive resources on Massasoit NWR through community outreach and opportunities for connecting the public to the refuge's natural resources.**

### Objective A2.1.

**Provide environmental education and interpretation programming via permit or special staff-led events, and conduct community outreach working through partnerships, to inform the public about the refuge and its resources.**

#### *Rationale*

Based on duty locations, budgetary and staffing constraints, regular onsite environmental education or interpretative programming is not offered. The Service has provided a limited amount of interpretation regarding the refuge

and its resources through its partners and Website. For example, the Service currently posts information on the management and natural history of the northern red-bellied cooter on the Massasoit NWR Website. The Refuge Complex brochure also provides information to the public about the refuge.

Informational signage on the refuge is currently minimal. Signs indicate closures to promote wildlife and habitat conservation. There are currently no interpretive resource signs on the refuge.

Continuation of current management under alternative A would retain the closure to all public uses, see map 3-1), providing environmental education and interpretation exclusively by SUP or when led by refuge staff. Environmental education and interpretation are proposed as compatible uses for Massasoit NWR when guided by a Service partner or refuge staff (see appendix B). The amount of future outreach would also remain minimal under this alternative with only the basic amount of community outreach conducted. It is standard practice for the Service to inform the public of any large scale management practices, including prescribed burns. We would continue to issue press releases for large-scale management activities taking place on the refuge to keep the Plymouth community informed.

It is important to cultivate an awareness and appreciation in local communities of the refuge's unique contribution to the Refuge System mission. Both environmental education and interpretation are among the six priority public uses for the Refuge System. In addition, the President has directed all Federal agencies, as part of his Transparency and Open Government memorandum and directive, to provide information to the public. Agencies "should harness new technologies to put information about their operations and decisions online and readily available to the public" (The White House 2009).

**Strategies:**

*Continue to:*

- Allow occasional guided interpretative field trips on the refuge hosted by partners under SUP.
- Use the refuge Website to provide information about the northern red-bellied cooter and explain refuge management.
- Disseminate the Refuge Complex brochure to provide information on refuge and wildlife management.
- Notify the public of large scale management activities (e.g., prescribed burns), their purposes, and possible impacts through press releases and the refuge Website.
- Manage the refuge volunteer program.
- Coordinate with local organizations to promote awareness about the refuge and its resources.

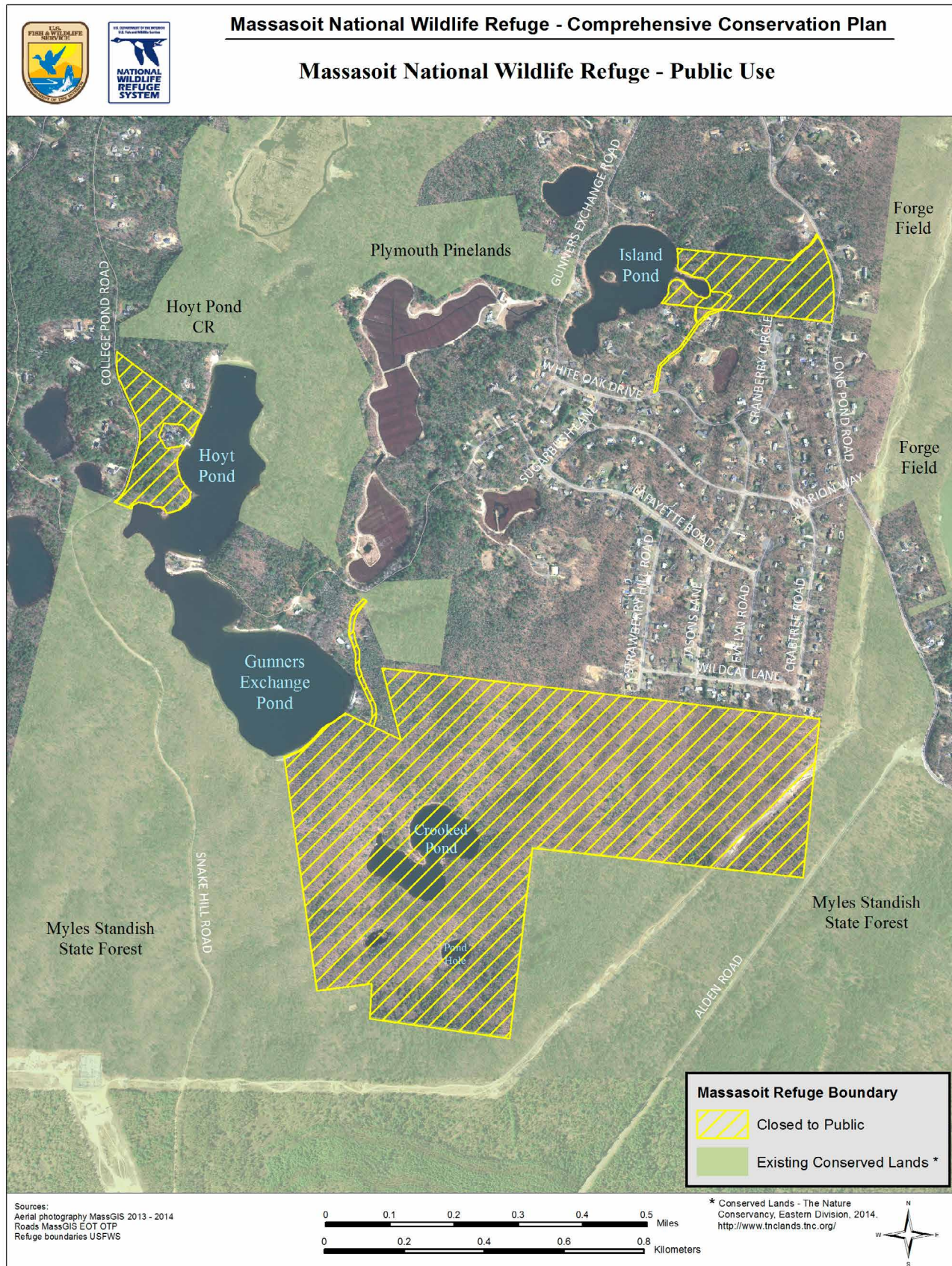
**Monitoring Elements:**

*Continue to:*

- Record number of interpretive programs and number of attendees.
- Record volunteer hours.
- Record number of press releases.



Map 3-1. Alternative A Public Use (Closures).





**GOAL 3:** Enhance collaborations with Federal and State agencies, conservation organizations, and local communities to promote species and habitat conservation across the pitch pine-oak landscape in southeastern Massachusetts, and to support Massasoit NWR's purpose and the Refuge System and Service missions.

**Objective A3.1.** Work with the northern red-bellied cooter recovery team and species experts to refine our understanding of species habitat requirements, methods for assessing the quality of habitat range-wide, and the factors limiting survival and reproduction. Also, work with these experts to determine high priority areas for habitat management across its range and determine suitable management actions.

**Rationale**

Although the refuge lies entirely within the formally designated critical habitat for northern red-bellied cooters (USFWS 1984), the refuge is comparatively small and supports only a small percentage of the total population. Actions taken on refuge lands will benefit northern red-bellied cooters, but the Service has an additional responsibility and opportunity to support rangewide recovery through research efforts and increased partnering. This objective specifically addresses Recovery Plan Tasks #2 (research) and #4 (population management informed by research):

**Task 2.1:** Expand studies to determine and mitigate limiting factors.

**Task 2.2:** Continue natural history studies.

**Task 4.1:** Continue to conduct and improve the hatchling headstart program.

**Task 4.2:** Evaluate the status of each pond/river population and supplement turtle numbers if and where warranted.

Research needs outlined in the recovery plans (USFWS 1981, 1994) and the 5-year update (USFWS 2007) will be best met with a collaborative approach involving many conservation partners. Funding for research is often difficult to secure. Currently, the Service has been working with the MassWildlife and the Massachusetts Cooperative Fish and Wildlife Research Unit, and has secured

*Northern red-bellied cooter hatchling*



Megan Cook

funding and entered into a cooperative agreement for 2015 and 2016. The overall aims of that cooperative agreement are to evaluate indicators of progress toward recovery, determine if down-listing or delisting criteria are met, and to make recommendations for listing reconsiderations. Specific research project objectives are: (1) document the current geographic distribution and abundance of cooters in southeastern Massachusetts; (2) document demographic parameters, such as growth rates and sex ratios, and evidence of reproduction and recruitment to model the ability of subpopulations to persist as self-sustaining subunits over time; (3) temporarily increase the headstart program and evaluate the efficacy of the 25-year headstart program as a cost-effective strategy to augment cooter populations, further expand geographic distribution, and reduce the risk of local extinction; (4) assess site specific habitat conditions and evaluate effectiveness of management at sites; and, (5) prioritize land protection. Protocols for assessing habitat and for conducting rapid assessment surveys to determine presence of northern red-bellied cooters are also being developed as part of this project. The Service will continue to provide staff and equipment support whenever possible and administer funds for this research.

### **Strategies**

*Continue to:*

- Work with MassWildlife, Massachusetts Cooperative Fish and Wildlife Research Unit, and other partners to fulfill priority research objectives.
- Support efforts and research toward rangewide recovery of the northern red-bellied cooter.

### **Inventory and Monitoring Elements**

*Continue to:*

- Record the number of research projects funded and research objectives met annually.

## **Objective A3.2.**

**Work with local and regional wildland and structural fire management professionals to continue to protect communities at risk in southeastern Massachusetts from wildfire.**

### **Rationale**

Plymouth was named a Federal “Community at Risk” in 2001 because of the high risk to the community from wildfire on Federal lands, as described in objective A1.2. A community is considered at risk from wildland fire if it lies within the urban wildland interface, defined as: “where humans and their development meet or intermix with wildland fuel” (Federal Register Vol. 66, No. 3, Pages 751-754, January 4, 2001). To reduce risk of wildland fires to homes nearest to the refuge, the Service began using mechanical means and prescribed burns as management tools to reduce hazardous fuels. Firefighters from The Nature Conservancy, the State of Massachusetts, and the Plymouth Fire Department, assisted the Service with controlled burns on the refuge in (spring) 2007 and again in 2011 and provided the Service with technical and logistical support for planning and implementing other hazardous fuel reduction projects.

These same Service partners need the Service reciprocate by providing refuge firefighting and other resource assistance to them to complete similar hazardous fuel reduction treatments in their respective jurisdictions (off-refuge), across the larger at risk community. As all governmental budgets continue to decrease, collaborating and sharing resources across agency and ownership boundaries is becoming the norm throughout the wildland fire community.



**Strategies:**

*Continue to:*

- Coordinate with abutters, private landowners, and conservation partners to ensure protection of communities at risk as well as natural resources.
- Work with the MADCR to implement ‘Fire Wise’ (<http://www.firewise.org>) educational programs in neighboring communities.
- Support other land management agencies with their fuel reduction projects by providing assistance through training, equipment, staff time, and technical expertise.

**Inventory and Monitoring Elements**

- Annually record the number of partnership hazardous fuel reduction projects the Service participates in.
- Annually record the number of Fire Wise programs implemented and number of attendees.
- Annually record the number of acres treated.

**Alternative B.  
Expanded Management**

In addition to actions common to all alternatives, alternative B represents an extension and progression of all areas of refuge management. Alternative B reflects expanded management through additional biological work, as well as increased visitor services opportunities. Under alternative B, northern red-bellied cooter habitat management and monitoring would be conducted on additional refuge-owned parcels, and prescribed burning would be expanded and targeted toward increasing structural habitat and species diversity to benefit species of conservation concern. In addition, we would consider opening most of the Crooked Pond parcel to hunting, and would undertake a separate process for developing a hunt plan. We propose to open for the white-tailed deer and wild turkey hunt seasons, and perhaps others. All hunt seasons would be evaluated as part of this process. Wildlife observation and photography, interpretation and environmental education would be allowed on special occasions when led by refuge staff or partners working under an SUP. These activities would allow visitors to gain a better understanding of the unique natural resources the refuge protects and ideally for become better stewards and advocates for resource conservation. Under alternative B, refuge staffing and funding levels would support new wildlife population, habitat, and invasive/overabundant species management activities, and new compatible, wildlife-dependent recreational opportunities. Public use evaluations, along with wildlife and habitat monitoring programs, would assist us in assessing the intensity of public use and adapting our management strategies and practices. Alternative B goals, objectives, and strategies are summarized in table 3-1.

**Habitat and Population  
Management**

Alternative B expands current habitat and population management over the next 15 years. Alternative B expands efforts to improve northern red-bellied cooter nesting habitat enhancement work from Crooked Pond to additional refuge pond shorelines. We would also improve biological integrity, diversity, and environmental health refuge-wide by removing non-native invasive species, and expand the purpose of prescribed fire and mechanical treatments to improve habitat for breeding migratory songbirds such as ovenbirds, eastern towhees, eastern wood pewees, and prairie warblers.

**Inventory and Monitoring**

Inventory and monitoring efforts would expand to include more consistent and frequent monitoring of nesting northern red-bellied cooters. We would also initiate additional baseline inventories to expand our knowledge of plants,

invertebrates, and other species of conservation concern on the refuge and adjoining landscape. The increase in management, such as prescribed burning, to benefit trust resources (including migratory birds) would result in an increased monitoring effort to carefully document how well management actions are achieving biological objectives, for example, by monitoring vegetation and bird response to habitat treatments and/or human disturbance.

### Visitor Services

Under alternative B, the Service would provide opportunities for guided wildlife observation and photography, environmental education and interpretation. Hunting could occur in the future after completion of a separate assessment and public review process.

The following criteria are provided to ensure quality wildlife-dependent recreation on national wildlife refuges by the General Guidelines for Wildlife-Dependent Recreation, Fish and Wildlife, in the Service Manual, 605 FW 1:

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



USFWS

*Turkey tracks*

### Refuge Administration

Expanding northern red-bellied cooter conservation and management as proposed under alternative B would require additional staff resources to fully implement. A 2008 national staffing model for the Refuge System indicated that the Refuge Complex should have one additional law enforcement officer with shared responsibilities on several refuges and an additional biologist for the refuge. Alternative B proposes a staffing level consistent with the minimum requirements for a Refuge Complex of this size and importance by adding one additional law enforcement officer on the Refuge Complex and one (term/permanent) biologist dedicated to Massasoit NWR. Any staffing increases must be based on permanent sources of funding, and in consideration of all regional and Refuge Complex priorities. We would prioritize hiring a shared Federal wildlife officer for the Refuge first. Hiring a full-time biologist is a lower priority within the Refuge Complex.

The following describes in detail the goals, objectives, and strategies that we would implement in alternative B.

**GOAL 1:**

**Perpetuate the biological integrity, diversity, and environmental health of the pitch pine-oak forest habitat type and associated coastal plain ponds and wetlands on Massasoit NWR to sustain native wildlife, especially species of conservation concern such as the federally listed northern red-bellied cooter.**

**Objective B1.1.**

**Contribute to rangewide northern red-bellied cooter population recovery and long-term persistence of other native coastal plain pond biota by: (1) protecting 10 acres of existing pond habitat at Crooked Pond and all refuge-owned shoreline from human disturbance; (2) creating and maintaining 1 acre of high quality nesting habitat on the shorelines of Crooked, Island, Gunners Exchange, and Hoyt Ponds on Massasoit NWR; and, (3) increasing northern red-bellied cooter nest success to at least 60 percent by protecting nests from mammalian predators and increasing hatchling survival through headstarting.**

**Rationale**

The need for active management for northern red-bellied cooters (including habitat management) is described in chapter 2 and in the rationale for objective A1.1 under alternative A. In alternative B, however, we propose to expand our active management from  $\frac{1}{4}$  acre to at least 1 acre of nesting habitat for northern red-bellied cooters on refuge lands. More resources would be directed toward improving existing nesting areas, as well as creating new nesting areas along additional pond shorelines. Please also see objective B3.1 for more information about landscape scale work off refuge.

As previously discussed in chapter 2, coastal plain pond and shoreline habitats also provide habitat for many other species occurring almost exclusively on coastal plain ponds. The plants of the pondshore community are particularly adapted to the nutrient-poor conditions, and although often restricted to that environment, are able to compete with more widespread plants that require more nutrients. Several Massachusetts plant species of greatest conservation need occur only in coastal plain ponds, including the globally rare species Plymouth gentian, rose coreopsis, and terete arrowhead, (MassWildlife 2015) all of which are documented from Massasoit NWR. Many rare plant species associated with coastal plain ponds are regionally rare species as well, as indicated by Brumback and Gerke (2013). Coastal plain pond shorelines are important habitat for dragonflies and damselflies (over 45 odonate species are known to occur on coastal plain ponds and several of those species are rare), and coastal plain ponds have been listed (White et al. 2014) as the most vulnerable odonate habitats in the northeastern United States. The water willow stem borer is a Massachusetts threatened (noctuid moth) species known from coastal ponds in MSSF that may also be present on Massasoit NWR pond shorelines. Larger ponds are used by migrating and wintering waterfowl. Sudden alterations to natural hydrologic regimes pose the greatest threats to these systems. Many Massachusetts coastal plain ponds are in a fragile balance (MassWildlife 2015).

Gunners Exchange, Hoyt and Island Ponds all host natural populations of northern red-bellied cooters and, like Crooked Pond, they all were among the early release sites chosen for headstarted hatchlings during the first few years of the program (USFWS 1994). These ponds are also within the 3,269-acre area designated as critical habitat. In alternative B, we would expand efforts to promote northern red-bellied cooter nesting by evaluating all refuge-owned shoreline on these ponds, and identifying areas where nesting habitat could be created or enhanced. We expect an additional  $\frac{3}{4}$  acres of habitat to be identified and managed through this expanded effort. Methods would be similar to those

already described in chapter 2 and in objective A1.1, and are likely to include mechanical and hand tools to reduce encroaching low shrubby vegetation, reduce canopy cover and increase sun exposure, and (if necessary) loosen soil. Additionally, felled trees will be used to create additional turtle basking opportunities. The best basking sites have prolonged sun exposure, are easily accessible to turtles, and provide safety from predators and disturbance. Turtles often bask on logs that are partially in water and partially on the shore. These slanted logs give the turtles a choice to either climb completely out of the water or remain partially submerged.

All nests found in these expanded nesting areas would be enclosed with predator exclosures, as described in objective A1.1. We will carefully monitor hatch success of all nests to determine how well the exclosures are contributing to success. Additional non-lethal predator management techniques may also be explored and implemented under this alternative if nest success objectives are not being met. In particular, electric fencing has been an effective method for reducing predator impacts for other turtle nesting species (Geller 2012, Quinn et al. 2015) in nesting areas where depredation occurs. Electric fencing may be an effective means for preventing nest loss at Massasoit NWR if staff are unable to enclose nests immediately after eggs are laid. Trespass issues would likely persist under this alternative, but establishing a physical closure at nesting sites may prevent trespassers from entering these areas.

Land use practices (e.g. herbicide and insecticide use from forestry, agriculture, and mosquito abatement) that were implemented on or near Crooked Pond prior to refuge establishment may influence survival of the northern red-bellied cooter. Although the cranberry industry used a substantial amount of organochlorine-based and other pesticides in Plymouth County from the late 1940s to 1960s, there have been no studies to determine whether long-lived northern red-bellied cooters still carry pesticide burdens (USFWS 1994). Although Crooked Pond is currently protected and isolated from surface land uses that may contribute to contamination in the kettle-hole ponds, groundwater sources in the region could potentially become contaminated from such sources as lawn fertilizers, pesticide use on nearby agricultural lands, storm water run-off, and septic tanks. Under this alternative, it would be important for refuge staff to conduct baseline monitoring to determine the existing water quality conditions at Crooked Pond.

As previously discussed in chapter 2, water rises and falls in most Massachusetts coastal plain ponds with seasonal changes in the water table, periodically leaving an exposed shoreline in late summer, though in wet years the pondshore may remain inundated year-round. Dominant plants on the exposed shore as the water levels drop are herbaceous and graminoid species. As the water levels go down, any aquatic organic material is subjected to oxidation and removal from the system, changing the water-holding capacity of the pond's substrate, and possibly making the pond more vulnerable during future water drawdowns. Groundwater connections provide cool, low-nutrient water to ponds, and would normally enhance water quality. In areas with polluted groundwater however, ponds can acquire the pollutants with negative effects on the habitat. In the winter, when there is little evaporation and much precipitation, the groundwater and ponds rise, and the ponds are recharged (MassWildlife 2015). Under alternative B, the refuge would coordinate with the MADEP and other partners to assure water quality is supportive of northern red-bellied cooters.

The need for clean water sometimes leads water companies or water districts to view conservation areas as ideal locations for public water supplies, without considering impacts to wetland dynamics when issuing water supply permits. Municipal and irrigation well withdrawals can lower water levels within a pond

dramatically, allowing expansion of shrubs into the historically open bank shoreline areas. However, there is also a concern of rising groundwater levels

due to climate change which leads to higher than normal water levels, preventing the natural water level cycling in the ponds. Shrub and tree encroachment threaten pond shorelines in areas with excessive withdrawal. Seasonally high water levels prevent tree and shrub encroachment, and seasonal low water is necessary to expose the pondshore for plant germination and growth. Excessive drawdown from pumping for water consumption or cranberry bog irrigation reduces natural fluctuations and allows woody species to advance down the shores. Use of coastal plain ponds as recipients of irrigation runoff from cranberry bogs introduces nutrients and pesticides into the water. The nutrients and pesticides can alter which species can survive, and encourage excessive growth of algae and vascular plants (MassWildlife 2015). Under alternative



USFWS

*Forest habitat on  
Massasoit National  
Wildlife Refuge*

B, the refuge would support expanded collaborative research, including off-refuge surface water and groundwater withdrawal effects on refuge pond water quality, harmful algal bloom, and shoreline habitats.

As noted in chapter 2, an exotic invasive species that has recently invaded a number of Massachusetts coastal plain ponds is gray willow. Gray willow is not as averse to seasonally high water as native shrubs are, and seems to thrive along these pond shores, particularly where soil disturbance has occurred and poses a threat to the water willow, the willow stem borer host plant. Both fanwort and hydrilla are increasingly detected in Massachusetts coastal plain ponds and control of these species is very difficult. The control of nuisance aquatic plants, particularly submerged aquatic vegetation, often requires the use of herbicides at concentrations that can harm local populations of rare native plants and animals if present (MassWildlife 2015), or expensive manual and mechanical removal methods. Under alternative B, the refuge would assess and control aquatic non-native invasive species and other invasive species using various methods in coordination with partners.

Changes in climate and local weather patterns will likely affect aquatic systems by exacerbating or accelerating habitat degradation due to other identified threats (MassWildlife 2015). Warmer temperatures will warm water in coastal plain ponds faster than normal, and may make some ponds inhospitable to their suite of current species. Warming of surface and groundwater in coastal plain ponds may create conditions that favor invasive species, and increase growing seasons for harmful algal blooms. Additionally, increases in severe rain and snowfall events will increase runoff of pollutants from agricultural and urban areas into waterbodies. Increases in rain will also increase atmospheric deposition of pollutants, including nitrogen deposition. In addition to increased nutrient pollution from runoff and atmospheric deposition, increased surface water temperatures will allow longer growing seasons for nuisance aquatic plants and harmful algal blooms (MassWildlife 2015). Extended periods of drought could



result in lowered water levels and the loss of littoral habitat, used for foraging, rearing, reproduction, and refuge for northern red-bellied cooters plus a myriad of other species including mussel, odonate, fish, and invertebrates.

Recent research indicates that the last two decades have been the wettest years in the Northeast in 500 years (Pederson et al. 2013, Newby et al. 2014, Weider and Boutt 2010). The Sustainable Water Management Initiative, administered by the MADEP, with input from multiple state agencies, is also supporting research by USGS into the degree of hydrological alterations imposed by water supply withdrawals and climate change (MassWildlife 2015). Additionally, the USGS has modelled the impact of sea level rise on the Sagamore and Monomoy flow lenses on Cape Cod. More low-lying coastal areas including near the refuge would have shallow depths to water (5 feet or less) for projected sea-level rises of 2, 4, and 6 feet above 2011 levels. The USGS study indicates that while the potential exists for groundwater inundation in some area, the effects of sea-level rise on depths to water and infrastructure likely will not be substantial on a regional level (Walter et al. 2016).

In addition, the northern red-bellied cooter's habitat may be impacted by climate change. The *Climate Change and Massachusetts Fisheries and Wildlife* report indicates that kettle hole ponds have a *medium vulnerability* rating (score of five with one low and seven high) for impacts from climate change under both the low and high global carbon emissions scenarios. This means that these ponds are *vulnerable* to climate change and at risk of being reduced or greatly reduced in extent under either emissions scenario. The factor most influencing this score is the vulnerability to aquatic invasive species (Manomet and MassWildlife 2010). If invasive species were to proliferate within refuge ponds such as Crooked Pond, essential vegetation for northern red-bellied cooters such as native water milfoil may be diminished. Climate change induced drought conditions could reduce groundwater table levels and subsequently lower water levels in Crooked Pond and other refuge ponds supporting northern red-bellied cooters. Warmer water temperatures could also decrease dissolved oxygen levels in the pond. Therefore monitoring water depth and dissolved oxygen are important to protecting the northern red-bellied cooter. See also objective B3.1 for a discussion of landscape scale (off-refuge) work under alternative B.

As previously discussed in chapter 1, Massachusetts has been collaborating with other northeastern state and Federal wildlife agencies and non-government conservation organizations to complete standardized surveys, assessments, and develop standardized monitoring protocols for species of conservation need and the habitats upon which they depend. The consistent and widespread use of common monitoring methodologies and survey protocols will help support regional assessments of the status and trends for SGCN and their habitats, such as the NEAFWA Monitoring and Performance Reporting Framework (NEAFWA 2008, see <http://rcngrants.org/content/regional-monitoring-and-performance-framework>).

Some of the regional and statewide surveys and assessments and standardized monitoring protocols completed or now in process with funding from the RCN Grant Program that are relevant for coastal ponds conservation include dragonflies and damselflies (odonates), freshwater aquatic habitats (Gawler 2008), and frogs. In addition, the NEAFWA also funded development of a database for regional invertebrate SGCN through a partnership with the Carnegie Museum of Natural History in Pittsburgh (Fetzner 2012). A simple results chain model (Margoluis and Salafsky 1998; Foundations of Success 2009) for assessing northern red-bellied cooter headstarting effectiveness was also developed. Another more complex, multiple (parallel) conservation action

results chain model for Plymouth Gentian, another indicator of coastal plain pond health (ecological integrity) has also been developed to help assess effectiveness of conservation actions. Constructing and using results chains like these can illuminate the complexities in effecting conservation to managers, policy makers, regulators, and concerned citizens.

### **Strategies**

*Continue to:*

- Use mechanical and hand tools (such as rototiller, rakes, shovels, axes, and chainsaws) to reduce encroaching shrubby vegetation, remove herbaceous vegetation, girdle large canopy trees, and loosen soil at two sites on the Crooked Pond shoreline by late May at least every third year.
- Protect northern red-bellied cooter nests with predator enclosures (nest enclosures) to protect eggs and emerging hatchlings at Crooked Pond.
- Coordinate with conservation partners and participate in the State headstarting program when northern red-bellied cooters successfully nest on the refuge.
- Support and facilitate collaborative research on northern red-bellied cooters on refuge lands to determine the population and factors limiting survival and reproduction, and establish short-term population objectives.
- Use temporary signs to establish a physical closure at northern red-bellied cooter nesting sites along the Crooked Pond shoreline annually from mid-May through mid-September, and address trespass issues as they occur.
- Make appropriate changes in management for northern red-bellied cooters within 6 months of completion of any 5-year reviews or recovery plan updates to accommodate updated recovery criteria, research needs, or any additional needs identified.

### **In addition:**

*Within 3 years of CCP implementation:*

- Prioritize refuge-owned shoreline of Gunners Exchange, Hoyt, and Island Ponds for opportunities to create and expand nesting habitat for northern red-bellied cooters. Develop and implement appropriate strategies including mechanical and hand methods to reduce encroaching shrubby vegetation, remove herbaceous vegetation, girdle large canopy trees to increase sun exposure, and (if appropriate) loosen soil.
- Provide basking logs for northern red-bellied cooters refuge-wide by placing large, downed trees along pond shorelines.
- Protect northern red-bellied cooter nests with predator enclosures (nest enclosures) to protect eggs and emerging hatchlings refuge-wide. Implement additional non-lethal predator management techniques, such as electric fencing, if necessary to meet nest success objectives.
- Use temporary signs to establish physical closures at potential northern red-bellied cooter nesting sites refuge-wide, and particularly along refuge-owned shoreline of Island Pond, Gunners Exchange Pond, and Hoyt Pond annually from mid-May through mid-September. Address trespass issues as they occur.
- Assure that water quality is supportive of northern red-bellied cooters in coordination with MADEP and other partners.

- Assess and control aquatic non-native invasive species, and other invasive species using mechanical methods, herbicide, or biocontrol in coordination with the MADCR, the town of Plymouth, and other conservation partners.
- Collaborate with the MassWildlife and other state agencies to define invasive species of greatest risk and to find funding for research and conservation action for species that pose the greatest threat native coastal pond biota.
- Support expanded collaborative research, including off-refuge surface water and groundwater withdrawal effects on refuge pond water quality, harmful algal bloom, and shoreline habitats, to determine the population and factors limiting survival and reproduction of northern red-bellied cooters and other coastal pond species of conservation concern on refuge lands.
- Seek grants and funding partnerships to support seasonal staff and coastal plain pond biota activities.

See also objective B3.1 for landscape scale, off-refuge strategies.

### **Inventory and Monitoring Elements**

*Continue to:*

- Collaborate with conservation partners to search nesting habitat along the Crooked Pond shoreline for nesting northern red-bellied cooter activity from late May through early August by walking through nesting areas at least once per week, and more often as time allows.
- Coordinate with conservation partners to install trail cameras at nesting sites to document nesting activity and trespass as time allows.
- Record location and monitor nest success (total eggs laid and hatched) if nests are found.

*Within 3 years of CCP implementation:*

- Collaborate with conservation partners to search nesting habitat refuge-wide for nesting northern red-bellied cooter activity from late May through early August by walking through nesting areas at least once per week, and more often as time allows.
- Record location and monitor nest success (total eggs laid and hatched) for all nests found refuge-wide.
- Monitor water quality by conducting baseline surveys in Crooked Pond (consistent with other sampling efforts in Plymouth, Massachusetts, including Secchi depth, pH, phosphorus, nitrogen, dissolved oxygen, and heavy metals). Monitor water quality every 10 years, or more frequently if baseline surveys results reveal factors of concern.
- Conduct baseline survey of aquatic plants, especially invasive species, on all refuge ponds beginning with Crooked Pond, and evaluate feasibility of control if detected. Document extent of aquatic invasive species every 5 years or more frequently if control is implemented.
- Survey refuge ponds to assess fish, invertebrate, and plant community structure.
- Monitor rare plant populations in and around refuge ponds to detect affects from human activities.

- Carry out monitoring and de novo sampling of freshwater mussel and odonate communities on refuge ponds in collaboration with MassWildlife, and track invasive invertebrate occurrence during native species surveys.

**Objective B1.2.**

**Manage up to 200 acres of mixed pine-oak forest habitats on Massasoit NWR with prescribed burning, mechanical methods and other methods to (1) reduce fuel loading and wildland fire risk and (2) improve habitat for migratory bird species of conservation concern, such as ovenbirds, eastern towhees, eastern wood-pewees, and prairie warblers, by providing a mosaic of forest ages and structure over the 15-year period.**

**Rationale**

The importance of reducing hazardous fuel loads and minimizing wildland fire risk was already discussed in the rationale for objective A1.2. Here we discuss the additional rationale for expanding prescribed burning and mechanical methods from a focus on fuel reduction, to non-native invasive species control for migratory bird and other species of conservation concern that may additionally benefit including New England cottontail, forest bat species, reptiles and amphibians, and invertebrates including pollinators. Because a large number of

SGCN identified in the Massachusetts SWAP (MassWildlife 2015) inhabit them, pitch pine-oak upland forest, open oak woodlands, and enduring shrublands are a high priority for both additional land protection and increased restoration and management in Massachusetts, using both prescribed fire and mechanical treatment.

Historically, fires in Massachusetts likely resulted in a “shifting mosaic” of grasses and forbs, shrubs, and trees, typically with canopy cover of less than 60 percent (savanna, shrubland, and open oak woodland).



USFWS

*Controlled burn on Massasoit National Wildlife Refuge*

These habitats are now considered very rare on the Massachusetts landscape (MassWildlife 2015). Historical return intervals for canopy-replacing wind and fire disturbance events vary across Massachusetts, and are generally shortest (40-150 years between severe fires and/or hurricanes) in the pitch pine-oak barrens of coastal and eastern Massachusetts, indicating that 10 to 31 percent of pitch pine-oak barrens naturally occurred in early successional (less than and up to 15 year-old) forest (Lorimer and White 2003). Historically, the largest individual wind and fire disturbance patch sizes appear to have exceeded 2,470 acres in pitch pine-oak barrens in the northeast (Lorimer and White 2003). Early



successional habitats are currently less common in southern New England than in pre-settlement times (Litvaitis 1993, DeGraaf and Miller 1996). The impact of fire and beaver flooding on the landscape was curtailed by European settlement and subsequent development (Askins 2001). Where these rare savanna, shrubland, and open oak woodland habitats do still occur, they support a number of Massachusetts SGCN, particularly migratory birds, moths and butterflies, and plants. Absent disturbance, the savanna, shrubland, and open oak woodland “thicket,” and other pitch pine-oak upland forest habitats eventually succeed to mature, closed-canopy forest.

Shrublands are relatively ephemeral, upland habitats that are dominated by low woody vegetation (generally less than 3 feet tall), with varying amounts of herbaceous vegetation and sparse tree cover according to the Massachusetts SWAP (MassWildlife 2015). Enduring shrubland habitats include young forest and pitch pine-scrub oak communities on relatively dry upland sites. Young forest (stand initiation stage) habitats are typically dominated by rapidly growing trees and shrubs, and generally occur when a mature forest canopy is disrupted, allowing sunlight to stimulate the growth of herbaceous and woody vegetation on the forest floor. During the stand initiation stage, the flush of woody and herbaceous vegetation on the forest floor provides food (e.g., berries, browse, and insects) and cover (e.g., shrubs, tree seedlings, and slash) resources for wildlife that is generally lacking in older forest. Overall, young forests support a great diversity of wildlife species and are a critical component of wildlife habitat at the landscape level (DeGraaf and Yamasaki 2001, 2003). Many wildlife species associated with young forests are habitat specialists with specific vegetation structure or area requirements, such as the New England cottontail and Chestnut-sided Warbler (DeGraaf and Yamasaki 2003). Relatively large (greater than 25 acre) patches of early successional habitat may be necessary to maintain viable populations of mammals associated with young forest (Litvaitis 2001).

The (young forest) stand initiation stage is characterized by high stem densities (e.g., 1,000 to greater than 10,000 stems per acre) and is relatively ephemeral, generally lasting about 10 years or until a young tree canopy forms, typically causing herbaceous and woody vegetation on the forest floor to die back. The competition for sunlight within a young forest canopy typically results in a rapid decline in stem density during the stem exclusion stage. Even-aged silvicultural practices can provide ecologically and economically sustainable early successional habitats for wildlife.

The 2015 Massachusetts SWAP states that the greatest management needs for open oak woodland and native grassland habitats in Massachusetts are prescribed fire (sometimes in combination with mechanical cutting) and control of invasive exotic vegetation. Landscape composition goals for state wildlife lands identified in the 2015 Massachusetts SWAP call for 15 to 20 percent young forest, as well as 10 to 15 percent late-successional forest, using modified even-aged silvicultural practices (aggregate retention cuts, and shelterwood retention cuts). In combination, these two management activities promote native grassland habitats (in terms of both species composition and structure), which in turn promote the persistence of animal species that depend on native grassland plants. Land-clearing machinery (mulching mowers, tree shears, or chippers) is often used to cut and mulch invading trees and large invasive shrubs within shrubland sites.

Control of invasive exotic plants is a vital component of shrubland management because invasive exotic species often thrive on disturbance, including disturbance caused by vegetation clearing. If left untreated, invasive exotic plants can quickly dominate sites and degrade natural communities. Invasive plant

control is accomplished through mechanical, manual, and/or chemical methods, depending on the abundance of invasive plants. Glossy buckthorn (*Frangula alnus*) is documented in Massasoit NWR, and is included among the invasive plants identified in the Massachusetts SWAP as particularly problematic in young forests (MassWildlife 2015) in the state. MassWildlife has developed Best Management Practices (BMPs) for their personnel and contractors for the control of invasive species to limit the spread of these plants.

Human-accelerated climate change impacts on upland forests, open oak woodlands, and grasslands in Massachusetts identified in the Massachusetts SWAP (MassWildlife 2015) include increased growing season length, more extreme summer temperatures, and increased periods of summer drought, as well as more frequent winter freeze-thaw cycles (<http://nsrforest.org/sites/default/files/uploads/templer09full.pdf>). Climate change also appears to be at least partially responsible for the recent and rapid spread of the southern pine beetle, a destructive insect pest, into more northern climes (Gan 2004). Southern pine beetles have been very abundant in the New Jersey pine barrens, and are now found in the Central Pine Barrens Preserve on Long Island, New York, where management efforts are being taken to control the beetle (New York State Department of Environmental Conservation, <http://www.dec.ny.gov/animals/99331.html> (accessed August 2016)). It is possible, and in fact likely, that the Southern pine beetle will reach southeastern Massachusetts. Due to inherent resiliency and dependence on disturbance, the Massachusetts SWAP (MassWildlife 2015) identified pitch pine-oak upland forest as being at moderate risk from climate change, which may expand and migrate northward. Healthy and diverse oak woodlands and native grasslands in Massachusetts may also be more resilient to drought and other severe weather events (MassWildlife 2015). Climate change may cause a shift in species composition in young forest and enduring shrubland habitats in Massachusetts, but these habitats will be able to be maintained on the landscape with active management. MassWildlife, the University of Massachusetts-Amherst, and the Department's Northeast Climate Science Center are jointly developing a Fish and Wildlife Climate Action Tool to help simplify decision-making and inspire action to maintain healthy, resilient natural resources and communities for use by local decision-makers, conservation practitioners, and community leaders. This tool may be used by the refuge to manage mixed pine-oak forest habitats on the refuge.

As previously discussed in chapter 1, Massachusetts has been collaborating with other northeastern state and Federal wildlife agencies and non-government conservation organizations to complete standardized surveys, assessments, and develop standardized monitoring protocols for species of conservation need and the habitats upon which they depend. The consistent and widespread use of common monitoring methodologies and survey protocols will help support regional assessments of the status and trends for SGCN and their habitats, such as the NEAFWA Monitoring and Performance Reporting Framework (NEAFWA 2008, see <http://rcngrants.org/content/regional-monitoring-and-performance-framework>.)

Some of the regional and statewide surveys and assessments and standardized monitoring protocols completed or now in process with funding from RCN Grant Program that are relevant for pitch pine-oak upland forests and associated savanna, shrubland, and open oak woodland habitat conservation include New England cottontail (Fuller and Tur 2012), shrubland birds (McDowell 2011), and detailed avian indicators for assessing the magnitude of threats and the effectiveness of conservation measures (Northeast Coordinated Bird Monitoring Partnership 2007). In addition, the NEAFWA also funded development of a database for regional invertebrate species of greatest conservation need through

a partnership with the Carnegie Museum of Natural History in Pittsburgh (Fetzner 2012). Service conservation partners continue constructing and using new results chain models (Margoluis and Salafsky 1998; Foundations of Success 2009) that can illuminate the complexities in effecting conservation for managers, policy makers, regulators, and concerned citizens.

Massasoit NWR is a relatively small refuge that cannot concurrently provide for multiple suites of forest songbirds by itself. However, management actions to reduce hazardous fuels would create and maintain a shifting mosaic of forest ages and structure likely to benefit many disturbance-dependent species of conservation concern over the 10 to 15-year CCP period.

*Native Plants:*

The unchecked spread of invasive plants threatens the biological diversity, integrity, and environmental health of all refuge habitats. In many cases, these plants have a competitive advantage over native plants and form dominant cover types, effectively reducing the availability of native plants as food and cover for wildlife. Prescribed burning and mechanical removal of invasive species would help in the control of glossy buckthorn and other invasive shrubs (see appendix A and chapter 2 for list of invasive plants).

*Migratory Birds:*

Within BCR 30, forested uplands provide habitat for the second highest number of priority bird species. Historically, the coastal communities within BCR 30 were dominated by a contiguous forest, but today these forests have become highly fragmented by 300 years of land clearing, agriculture, and human development (TNC 2006). Destruction and forest fragmentation in both breeding and wintering areas are factors in forest bird species declining abundance (Roth et. al 1996). Within Massasoit NWR and the surrounding region, a number of migratory birds depend on mixed pine-oak communities and associated shrublands. For this objective we focus on several songbird species that are of conservation concern, already present on the refuge, and that represent the habitat needs of other species of concern.

*Ovenbird*



Tom Benson

Ovenbirds are among the list of surrogate species (see chapter 2) in the North Atlantic LCC southeastern subregion. Despite their sensitivity to patch size, 16 percent of all landbirds recorded on the refuge during surveys conducted from 2001 to 2010 were ovenbirds, making this the most common bird species recorded. Ovenbirds nest in deciduous or mixed deciduous-conifer forests where deciduous trees predominate. These birds may be area sensitive and require a closed canopy structure and a relatively open understory (Neimi and Hanowski 1984). Preferred vegetative structure includes canopy heights of 52.5 to 72.2 feet with 60 to 90 percent canopy closure (Robbins et al. 1989). Patches characterized by few shrubs and small trees and an open forest floor provide nesting opportunities, although dense herbaceous vegetation may also be used. Some studies suggest that the minimum required acreage for breeding ovenbirds ranges from 247 to 2,186 acres (Robbins 1979, Robbins et al. 1989). However, a recent study conducted in an urban region outside of Boston, Massachusetts analyzed the presence of ovenbirds in patch sizes from 24 to

770 acres and found pairing success was high in all sites but was not significantly higher (statistically) in large versus small reserves. There was also no significant statistical difference in predation or parasitism. Density was significantly higher and territories for male ovenbirds were significantly smaller (statistically) in the large reserves (Morimoto et al. 2012), which may partly explain the high frequency with which ovenbirds were encountered during surveys at the refuge and the surrounding landscape. The models from this study suggest that northeastern U.S. habitats can support viable ovenbird populations with forest cover exceeding 40 percent and maintaining reserves that are approximately 300 acres and larger (Morimoto et al. 2012). Although these studies suggest the importance of open understory for nesting success among adults, some studies also indicate that juvenile ovenbirds use regenerating cleared areas that have a denser understory for foraging and predator protection (Pagen et al. 2000, Marshall et al. 2003).

The eastern towhee is a species of priority conservation concern due to regional declines (PIF 09), and it also has a High Priority ranking within BCR 30. It is also a surrogate species in the North Atlantic LCC northeastern subregion. Breeding bird survey data since the mid-1960s show eastern towhee population declines throughout southern New England, averaging -7.1 percent per year (Dettmers and Rosenberg 2000). The 2000 PIF report for this region indicates a level III management priority, i.e., management is needed to reverse or stabilize the population. One study in Plymouth, Massachusetts showed that suburban development within pine barren habitat had decreased eastern towhee populations by 50 percent (TNC 2009). The most likely explanation for this long-term, chronic decline is early successional habitat reversion to more mature forests in southern New England (Hagan 1993). During surveys conducted from 2001 to 2010, 9 percent of all landbirds recorded on the refuge were eastern towhees, making it the second most common landbird recorded. Eastern towhees rely on dense shrubland with small tree cover near the ground (Greenlaw 1996). This species thrives in native deciduous shrubs and vine tangles in mid- to late-secondary successional stages, with stems at least 6.6 feet tall, a well-developed litter layer and dense low cover extending to the leaf litter. The low cover may be continuous or discontinuous with patches of more open ground. Overstory trees may or may not be present, and if present, open-canopy (woodland) situations are favored. In general, eastern towhee densities are greatest in old field thickets and later stages of second growth, but are sometimes present in climax forest where the understory is well developed as well. Minimum territory size can be as large as 5 acres, but in high density nesting areas in Massachusetts as many as 1.5 pairs per acre have been documented (Greenlaw 1996). Management efforts for this species should seek to maintain habitat diversity, specifically to include an array of woody plant communities in mid-seral successional stages. Eastern towhees benefit from controlled burning, but burn frequency must be carefully considered. Regular disturbance in the form of fire, controlled logging, or heavy weather is necessary to maintain optimal eastern towhee habitat (Blake and Karr 1984).

Eastern wood-pewee, another species of concern present on the refuge is identified as a surrogate species in the Mid-Atlantic subregion of the LCC and breeds in every type of wooded community in the East (McCarty 1996). Breeding bird surveys show an overall -35.6 percent population decline for the period 1966 to 1993, with a -13.4 percent decrease from 1984 to 1993 (Price et al. 1995). Eastern wood-pewee comprised four percent of the total birds identified at the refuge during the 2001-2010 surveys. With warming temperatures due to climate change, it is expected that eastern species found more abundantly in southern regions, such as the eastern wood-pewee, could migrate further north with time. In general, forestry practices that maintain large tracts of intermediate aged



forest with closed canopy and limited size clear cuts (greater than or equal to 24.7 acres), along with thinning to remove mature trees and woody growth less than 3 inches in diameter at breast height (dbh), should provide adequate habitat for eastern wood-pewees. In eastern deciduous habitats, eastern wood-pewee can be found in more open sites with low density canopy cover. Size of forest fragments does not appear to be an important factor in habitat selection (Blake and Karr 1987). The eastern wood pewee uses both edge and suburban habitats. Although they are able to breed in every forest type in the East (McCarty 1996), they prefer large tracts of intermediate age forest with more closed canopy and limited clearing (Price et al 1995). They have also been known to consistently select open park-like areas on xeric (dry) sites with limited canopy and low shrub density (McCarty 1996; Robbins et al. 1989). Because this species is common in both forest interiors and edges they are not sensitive to patch size (McCarty 1996; Robbins et al. 1989), and a mosaic type management effort with varying levels of succession would likely support eastern wood-pewee.

Prairie warblers are a highest priority species for BCR 30 and are a representative species for pitch pine-scrub oak habitats in the Service's northeast region. The prairie warbler is listed under the PIF 09 Plan (Dettmers and Rosenberg 2000) as a level III priority species with populations declining in this region. Prairie warblers do not occur in large numbers on Massasoit NWR, but do consistently nest along opening edges on the refuge. Prairie warblers utilize various shrubby plant associations lacking closed canopies for breeding, with trees scattered and a dense shrub layer present (Nolan Jr. et al. 2014). Fire-maintained habitats, such as pine barren, host this surrogate species. A study conducted in the pine barrens of New York (Beachy and Robinson 2008) showed that shrubland birds such as prairie warbler were twice as frequent and three times as abundant at sites that were not invaded by woody invasive plants. Prescribed burning and mechanical removal of invasive species would help control glossy buckthorn and other invasive shrubs (see appendix A and chapter 2 for a list of invasive plants). In a study by King et al. (2011), bird surveys were conducted pre- and post-thinning using prescribed burns for management. The surveys showed that early successional species such as prairie warbler and field sparrow were most abundant in scrub oak and thinned pitch pine conditions.

*Whip-poor-will*



William Majoros

Although not specifically listed in our objective, whip-poor-wills are also likely to benefit from increased management. Whip-poor-wills are a high priority species of conservation concern associated with forested upland habitats within BCR 30 (Steinkamp 2008). They are widely distributed in Massachusetts, but are declining. They occur most commonly in the woodlands of the southeastern coastal plain in Plymouth County and on the Cape and Islands, including Massasoit NWR. Declines in breeding populations are difficult to quantify because whip-poor-wills are under-sampled by existing breeding bird survey methodologies due to their nocturnal calling and cryptic behavior. Both long-term (1966 to 1988) and short-term (1978 to 1988) indices for breeding bird censuses (Sauer and Droege 1992) suggest small, annual

declines (-0.01 percent long-term and -2.26 percent short-term) for U.S. central woodland regions and for eastern woodland regions (-0.70 percent long-term and -1.36 percent short-term). They favor dry deciduous or mixed forests with little or no underbrush. The degree of openness in forest understory appears more

important than forest composition (Wilson 1985). Shade, proximity to open areas for foraging, and fairly sparse ground cover are key habitat elements (Eastman 1991). In Massachusetts, the whip-poor-will is found in lower elevations in dry oak and pine woodlands with occasional clearings. It nests on the ground in leaf litter, and feeds on moths and other flying insects. Causes for decline in some areas include habitat loss to agriculture and closing of forest openings due to forest succession.

*Mammals:*

New England cottontails may also benefit from forest management under this objective. Although not currently found on Massasoit NWR, they do occur on the adjoining MSSF, and providing potential habitat may increase the likelihood of future refuge occupancy. Litvaitis and Tash (2006) estimated the species only occupied 14 percent of its historical range as of 2004. Given the relative ease in which habitat management can provide suitable habitat for New England cottontail and the species' fecundity, habitat restoration can provide immediate conservation benefits.



Tom Barnes/USFWS

*New England cottontail*

New England cottontails are considered habitat specialists insofar as they depend on early-successional "thicket" habitats (Litvaitis 2001). These habitats can be found in association with abandoned agricultural lands, wetlands, clear cuts, coastal shrublands, scrub oak barrens, utility rights-of way, or other areas where disturbance has stimulated the growth of shrubs and other early-successional plants (Litvaitis 1993, Tash and Litvaitis 2007). New England cottontails are reluctant to venture from the cover these dense stands provide, demonstrating a close affinity for microhabitats with over 20,000 stems per acre (Barbour and Litvaitis 1993). New England cottontail populations decline rapidly as understory vegetation thins with maturing forests (Litvaitis 2001). Along with the vegetation structure within a habitat patch, the patch size must be considered when assessing its value as New England cottontail habitat. In smaller habitats, cottontails tend to deplete food resources during the winter, and as a result rabbits on smaller patches (less than 7 acres) tend to be in poorer body condition than rabbits on larger

patches (greater than 12 acres) (Villafuerte et al. 1997). According to Barbour and Litvaitis (1993) small patches have higher mortality rates, acting as a sink for dispersing juveniles, and that for the continued existence of New England cottontails, larger patches of suitable habitat must be maintained.

The primary threat to the New England cottontail is habitat loss through succession. During the process of forest maturation stem density declines, and eventually the stems self-thin to such an extent that it becomes unsuitable. Fragmentation serves to further degrade habitat on a larger scale. Isolation of occupied patches by surrounding areas of unsuitable habitat, coupled with high predation rates, are causing local extirpation of New England cottontail from small patches (USFWS 2011). Maintaining and regenerating early successional habitat with a high density of shrub and thicket vegetation benefits New England cottontail recovery.

Management of the mixed pine-oak forests of Massasoit NWR may also benefit forest dwelling bats. Acoustic surveys are currently being conducted to determine which species are present on the refuge. The eastern red bat and northern long-eared bat are surrogate species within the southern New England subregion of the NALCC, and other bats under consideration for management due to declining numbers include big brown bat and silver-haired bat. In a

study by Loeb and O’Keefe (2006), bats were more likely to be recorded in areas with sparse vegetation, farther from roads, and in early successional stands. Vegetation density was also the best predictor of habitat use by big brown and red bats, with both species recorded at points with sparse vegetation. Silver-haired bats forage in fairly open habitat in mixed wood forest areas near ponds. They roost in hollow trees and cavities under loose bark or bark folds (Barclay et al. 1988). Fires that cause overstory mortality and create canopy gaps may allow bats such as eastern red bat and big brown bat to forage more effectively (Edwards et al. 2000). Prescribed burns increase herbaceous and shrub growth that can increase abundance and diversity of insect prey. Care must be taken to prevent the loss of snags and green-reserve (wildlife) trees left as roosting habitat. Bats may benefit from fire creating new roost trees through direct or indirect fire mortality (via disease, insect or fungal attack). Fire can also decrease forest tree density and increase openings, thereby improving foraging space and travel corridors, allowing more light to reach and warm roost trees, and increasing insect prey diversity and abundance by increasing herbaceous and shrub growth.

*Invertebrates, including pollinators:*

Overall, shrublands are the most important natural community type for rare and endangered Lepidoptera in Massachusetts (Wagner et al. 2003). Rare species associated with shrublands in the northeastern U.S. tend to occur in enduring shrub habitats as opposed to ephemeral shrub habitats (Latham 2003), and this may be especially true for Lepidoptera (Wagner et al. 2003). Recent work in Massachusetts indicates that shrublands along power line corridors and at reclaimed abandoned field sites support a diverse assemblage of Lepidoptera, but do not typically support rare species of butterflies and moths (King and Collins 2005). Many invertebrates such as rare moths and butterflies in Massachusetts depend on pitch pine-scrub oak habitats. Each moth and butterfly species is often a specialist on a microhabitat such as frost barrens, river corridors, or late-successional stands and not found in all pitch pine-scrub oak types. In addition, many of the caterpillars of these species eat only pitch pine, scrub oak, or other specific larval host plants found only or mostly in pitch pine-scrub oak communities. Thus, to maintain these species metapopulations over time (long-term persistence), it is necessary to maintain pitch pine-oak in various stages of recovery from various kinds and severity of disturbances across large landscape areas.

Pollinators play a crucial role in flowering plant reproduction. A recent study of the status of pollinators in North America by the National Academy of Sciences found that populations of some native pollinators are declining, which may in part result from habitat loss, degradation, fragmentation, non-target effects of pesticides, competition from invasive species, and introduced diseases (National Academy of Sciences 2007). Although no moth or butterfly surveys have been conducted on the refuge, many rare species are known to be present within the neighboring conservation lands of the MSSF (see chapter 2). The persius duskywing (State-listed endangered) and frosted elfin (species of special conservation concern) can be found within the pine barren habitats of this region. Pine barrens buckmoth and Gerard’s underwing moth are also species of concern in Massachusetts that may be found in this region. The water willow stem borer (State-threatened) is a moth species associated with the pondshore wetlands.

A two-year study currently underway will result in a significantly better understanding of the distribution and microhabitat needs of the Barrens tiger beetle and the purple tiger beetle in pitch pine-oak upland forest habitat in the MSSF adjoining Massasoit NWR. For insects, determining population trends and their causes is generally time and cost-prohibitive. Therefore, most

surveys for Massachusetts insect SGCN (MassWildlife 2015) consist of presence-absence data by habitat. Future monitoring of these species, to the extent possible, should investigate correlations with habitat management and/or natural disturbance events. The life history and habitat requirements of some state-listed Massachusetts SWAP species that occur in pitch pine-scrub oak habitat (for example, the Barrens Metarranthis) are completely unknown. In order to better inform habitat management and other conservation efforts, research to elucidate the natural history of lesser known species is a priority under the 2015 Massachusetts SWAP. Research on the natural history of rare orchids associated with pitch pine-oak upland forest habitat is also a priority in the 2015 Massachusetts SWAP.

**Strategies:**

*Continue to:*

- Evaluate the entire refuge in the context of wildland urban interface risks and along in coordination with Service partners, facilitate planning of additional hazardous fuel reductions to protect neighboring communities.
- Utilize prescribed fire and mechanical clearing including mowing, cutting, and masticating in accordance with the approved FMP and Annual Burn Plans every 3 to 5 years initially to maintain approximately 75- to 100-foot wide shaded fuel breaks between the refuge and residential areas, and 10- to 25-foot fire breaks between burn units (see map 3-1). Transition to a 5- to 10- year interval on the northeastern portion of the Crooked Pond parcel over time. The target shaded fuel break effective width is 100 feet, and the target fire break effective width between burn units is 12 feet.

**In addition:**

*Within 5 years of CCP implementation:*

- Utilize prescribed fire in combination with mechanical mowing, cutting, and/or mastication (chipping/mulching) in accordance with the approved FMP and Annual Burn Plans to open forest and shrub canopies to increase sunlight reaching the forest floor, or to control invasive plant species.
- Implement prescribed fire on a 5- to 7-year cycle within all burn units on the Crooked Pond parcel.
- Mechanically maintain all fire breaks on all refuge parcels as needed.
- Refine existing cover type map via ground verification. Evaluate available data on forest structure and composition and determine if finer scale information is needed to evaluate baseline characteristics of forest habitat refuge-wide.
- Ensure management plans (such as the HMP) incorporate mechanical, prescribed fire and other techniques, and contain strategies to collaborate with utility ROW managers to achieve habitat objectives.
- Reduce invasive plants such that they are dominant on less than 10 percent (less than or equal to 21 acres) of upland acres.
- Facilitate and participate in relevant research that has conservation implications for priority species and habitat types and will inform management priorities.
- Consult regional and/or state conservation plans including (but not limited to) those existing for pitch pine-scrub oak and shrubland habitats, New England cottontail, bats, northern red-bellied cooters, and lepidopteran species during



refuge habitat project planning, including prescribed burning. Coordinate refuge habitat project implementation with the MassWildlife, MADCR, and other local and regional conservation partners.

- Seek grants and funding partnerships to support seasonal staff and forest management projects.

**Inventory and Monitoring Elements**

*Continue to:*

- Document all management actions using GIS.
- Fulfill monitoring elements as outlined in annual burn plans to evaluate how well burn objectives are met.

*Within 5 years of CCP implementation:*

- Update the refuge-wide cover type map every 10 years.
- Collect existing historic information (including spatial information) about wildlife and habitat resources from partners and the community to inform priorities.
- Conduct breeding landbird surveys to document breeding bird response to management.
- Implement baseline nocturnal surveys for whip-poor-will to better understand refuge importance and determine if management should incorporate this species.
- Implement baseline surveys for invertebrate species (including rare species found on neighboring MSSF) to better understand species presence and abundance, and determine if management and long-term monitoring is warranted.
- Develop and implement surveys to track vegetation response to habitat management.
- Conduct forest composition surveys (species composition, structure, density, diameter at breast height) and additional surveys as warranted by protocols and guidelines.
- Work with partners or volunteers to develop a comprehensive list of plants with emphasis on rare species and non-native species (including spatial information) to help prioritize management actions.
- Conduct invasive species surveys (presence and infestation size).

**GOAL 2:**

**Promote awareness and support for the protection of sensitive resources on Massasoit NWR through community outreach and opportunities for connecting the public to the refuge’s natural resources.**

**Objective B2.1.**

**Within 5 years, work with partners and volunteers to expand opportunities to provide quality environmental education and interpretation programs, and enhance community outreach.**

**Rationale:**

Under alternative B, we would rely primarily on refuge partners, local conservation groups such as Friends of MSSF, the Southeastern Massachusetts

Pine Barrens Alliance, and volunteers, as well as some refuge staff involvement, to provide interpretive programming or public information delivery on or associated with the refuge. The primary area this would occur is within the Crooked Pond parcel.

We want local residents and visitors to understand, appreciate, and support the Refuge System mission and the refuge's unique purpose. To accomplish this, we would update the refuge Website and use social media and the press to describe management actions and upcoming initiatives. We would also participate in at least one community event every four years and develop display materials to reach non-traditional audiences. Our standard practice of informing the public of prescribed burns would continue under alternative B.

Given current limitations with staff and funding, it is of utmost importance for us to reach out and collaborate with other conservation agencies and organizations in the region. These could include MADCR, MassWildlife, the town of Plymouth, Massachusetts Audubon Society, TNC, the Southeastern Massachusetts Pine Barrens Alliance, and others. It is through these partners that we would strive to develop an effective outreach program targeted at local communities and residents who may be unaware a national wildlife refuge is nearby. In addition, these partnerships are important to our biological program and we would continue to strengthen and develop collaborative initiatives with them to accomplish our objectives.

Further educating both the public and other regulatory agencies about the value of pitch pine-oak upland forest and coastal pond habitats and the issues related to their conservation are state priorities (MassWildlife 2015) through publications and other forms of public outreach (e.g. the Wildlife Management Institute Website dedicated to New England cottontail conservation). An ongoing Working

Lands for Wildlife partnership between MassWildlife and the NRCS provides additional opportunity to make direct contact with private landowners focused on the importance of restoring and managing pitch pine-oak upland forest habitat. The Southeastern Massachusetts Pine Barrens Alliance is also locally active in public outreach and education about the unique values of and threats to pitch pine-oak upland forest (<http://www.pinebarrensalliance.org/>, accessed November 2015). Posters and booklets focusing on coastal pond conservation and management similar to one produced in 1999 by MassWildlife and the Wildlands Trust of Southeastern Massachusetts could be put on the refuge Website for public access. The Massachusetts SWAP (MassWildlife 2015) identifies several outreach actions focused on coastal plain pond conservation that the MassWildlife will undertake, that present opportunities for refuge staff to partner with, including: encouraging local conservation commissions to enforce the Massachusetts Wetlands Protection Act and town and regional bylaws restricting work in coastal plain ponds and the 100-foot buffer zones surrounding them; regulating and limiting the impacts of development, nutrients, and water withdrawals on coastal plain ponds, and; educating and informing the public about the values of coastal plain ponds and the issues related to their conservation, through state agency publications and other forms of public outreach, to instill public appreciation and understanding.

*Eastern hognosed snake*



Ohio DNR

Interpretation is one of the most important ways to increase visitor awareness of the Service's presence and role in the Plymouth area. Interpretation can help visitors understand refuge habitats, including the pitch pine-scrub oak and pond habitats, the importance of endangered species such as the northern red-bellied cooter, and the Refuge System mission. Interpretation programs can provide visitors with an understanding and appreciation of fish and wildlife ecology and help them understand their own role in the environment. Interpretation is one of the most important ways to increase visitor awareness of the Service's role in the protection and recovery efforts for the northern red-bellied cooter and habitat management for neotropical migratory bird species, bats, New England cottontail, rare invertebrates and plants, other species of conservation concern, and the uniqueness of pine barren communities.

Environmental education programs promote understanding and appreciation of natural and cultural resources and their conservation on all lands and waters in the national wildlife refuge system. Generally, conducting environmental education involves more than facilitating field trips. Formal environmental education requires that the programming meets national curriculum-based academic standards. Educating people about the significance of the refuge for birds and other wildlife will foster an appreciation of conservation and encourage them to make environmentally responsible decisions.

Expanding environmental education, interpretation, and community outreach as proposed under alternative B, requires additional seasonal staff, volunteers, enhanced partnerships, and other resources to fully implement.

**Strategies:**

*Continue to:*

- Allow occasional guided interpretative field trips on the refuge hosted by partners under a SUP.
- Use the refuge Website to provide information about the northern red bellied cooter and other important species in the coastal plain pond habitat and pine-oak forests.
- Disseminate the Refuge Complex brochure to provide information on refuge and wildlife management.
- Notify the public of large scale management activities (e.g., prescribed burns), their purposes, and possible impacts through press releases and the refuge Website.
- Manage the refuge volunteer program.
- Coordinate with local organizations to promote awareness about the refuge and its resources.

**In addition to objective A2.1,**

*Within 5 years:*

- Provide information about refuge resources and management at the library, partner facilities, and the Chamber of Commerce.
- On request, work with local educators to provide environmental education for local schools.
- Work with partners to develop and display traveling exhibits for libraries and community buildings to reach non-traditional audiences.

- Conduct Service-directed interpretive programs as requested along with partners, utilizing existing roads and trails on the refuge through Special Use Permits.
- At a minimum, participate in one local community event every 4 years.
- Develop an interpretative endangered species and species of greatest conservation concern education trunk to be used by teachers in local schools.
- Work with partners to conduct “Teach the Teacher” classes to provide information about the refuge, the northern red-bellied cooter and other species of conservation concern, and management of pine barren and coastal pond habitats.
- Seek grants and funding partnerships to support additional seasonal staff, environmental education programs, and community outreach activities.
- Hire a summer Visitor Services intern with refuge resources or through partnerships to focus on supporting these efforts.

#### **Inventory and Monitoring Elements**

- Record the number of SUPs issued for environmental education and interpretive guides.
- Record the number of participants in each program.
- Record number of events and number of attendees at the event.
- Record volunteer hours.
- Record number of times travelling display is utilized and record number of people that interact with exhibit.

#### **Objective B2.2**

**Provide opportunities on the Crooked Pond parcel for visitors to engage in wildlife observation and photography on the refuge in a manner that minimizes disturbance to refuge habitats and wildlife.**

#### **Rationale:**

Wildlife observation and photography are identified in the Improvement Act as priority public uses. Priority public uses are to receive enhanced consideration when developing goals and objectives for refuges. We like to partner with other agencies and organizations to connect adults and children with nature, thereby reducing “nature-deficit disorder.” A growing body of research suggests that a lack of direct involvement with the outside world may be contributing to a variety of maladies affecting children in today’s society (Louv 2005). By offering places and programs where children and their parents can observe wildlife in natural settings, and learn to appreciate wildlife, we will contribute to the growing national initiative to reconnect children with nature.

High quality wildlife observation and photography involves: (1) observation that occurs in a primitive setting and provides an opportunity to view wildlife and its habitats in a natural setting; (2) observation facilities that are safe and maximize opportunities to view the spectrum of species and habitats on the refuge; (3) observation opportunities that promote public understanding of and increased public appreciation for America’s natural resources; (4) viewing opportunities that can inspire increased stewardship of our refuge resources; (5) facilities, when

provided, that blend with the natural setting and provide viewing opportunities for all visitors, including persons with disabilities; (6) observers who understand and follow procedures that encourage the highest standards of ethical behavior in natural; (7) viewing opportunities that exist for a broad variety of visitors; and (8) observers who have minimal conflict with other priority wildlife-dependent recreational uses or refuge operations.

People enjoy being outdoors in natural areas. The National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, published every five years by the Service, found that more than 90 million Americans, or 41 percent of the U.S. population age 16 and older, pursued outdoor recreation in 2011. They spent almost \$145 billion that year pursuing those activities. About 72 million people observed wildlife, while 33 million fished and nearly 14 million hunted (USFWS and U.S. Census Bureau, 2014). About 82 percent of total expenditures came from non-consumptive recreation (recreation other than hunting and fishing) on national wildlife refuges. Fishing accounted for 12 percent of total expenditures, while hunting accounted for 6 percent.

Under Alternative B, visitors would be able to observe and photograph wildlife on special occasions when led by refuge staff or partners working under an SUP. Wildlife observation and photography might be the focus of a specially guided trip, or could occur when environmental education and interpretation is conducted. Dogs, horses, bicycles, and motorized vehicles would never be allowed on the refuge.

**Strategies:**

*Within 1 year:*

- Provide wildlife observation and photography staff or partner-led trips on the refuge.

**Inventory and Monitoring Elements**

- Number of visitors engaged in wildlife observation and photography annually.
- Number of participants in trips to the refuge.

**Objective B2.3.**

**Determine whether to open the Crooked Pond parcel to hunting, particularly deer and turkey hunting, within 5 years of CCP approval.**

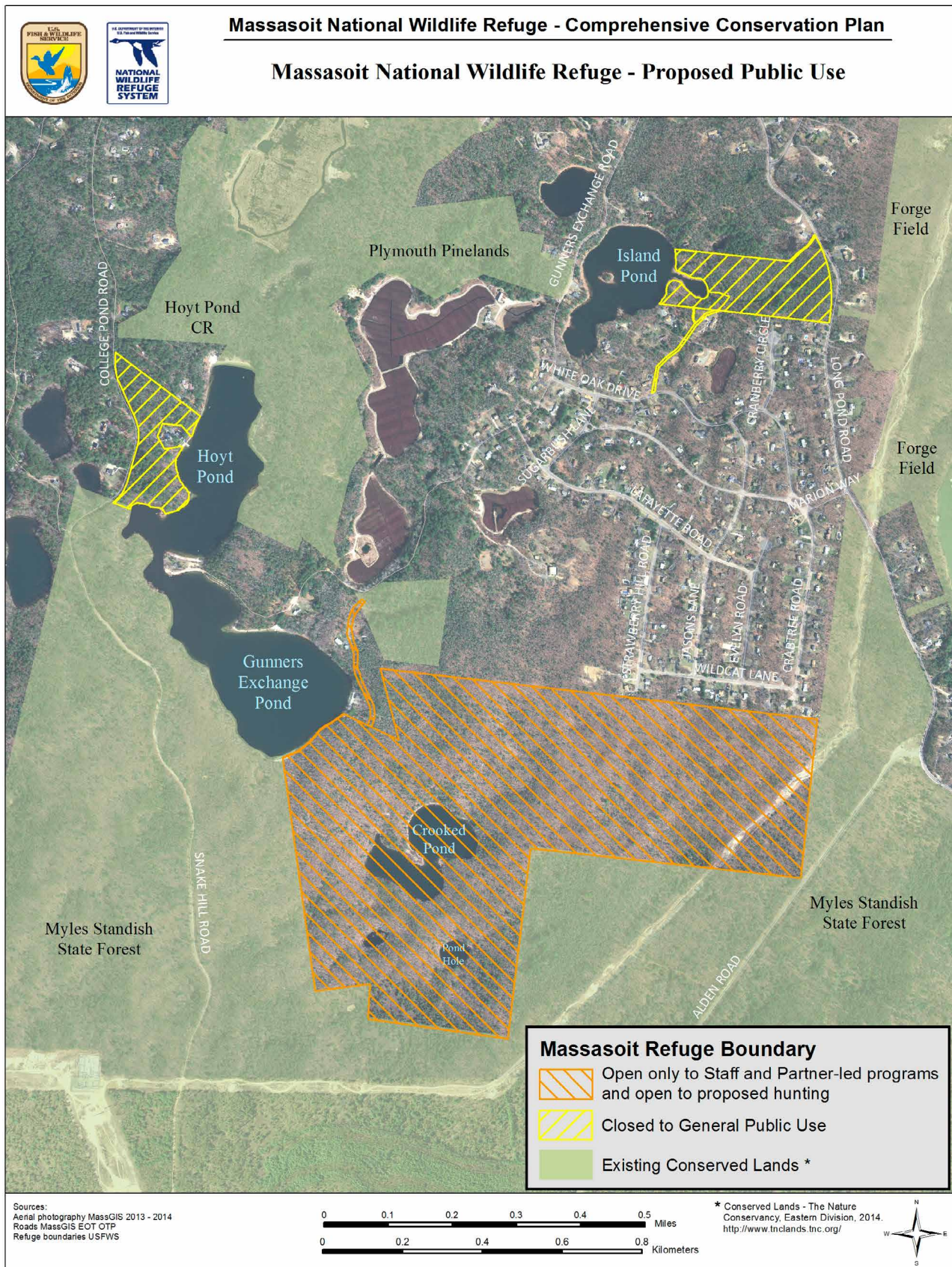
**Rationale**

Based on the primary purpose for establishment of the refuge for the protection of an endangered species, and budgetary and staff constraints, Massasoit NWR has never previously been opened for any public use including hunting. Hunting is permitted in accordance with State regulations on lands adjoining the refuge, particularly on the MSSF where deer and turkey are the most common species hunted.

High density deer populations can result in increased incidences of Lyme disease, increased collisions with automobiles, and unhealthy deer populations (MassWildlife 2014) and wildlife habitat conditions. Since deer populations can exceed 30 deer per square mile annually in Massachusetts, hunting is a valuable means for MassWildlife to manage the populations while simultaneously providing opportunities for wildlife-dependent recreation. A study (MassWildlife 2014) of deer survivorship in MSSF indicated that deer density was 15 to 20 deer per square mile (Epsilon 2001 as referenced in MADCR 2011). This suggests refuge deer abundance currently is well above the 2014 Wildlife Management Zone 11 “target” of 6 to 8 deer per square mile average density. Opening the



Map 3-2. Alternative B Proposed Public Use.



refuge to deer hunting would assist MassWildlife's efforts to address deer overabundance in the immediate refuge vicinity, while providing additional opportunity for wildlife-dependent recreation in the area.

Under this alternative, the refuge would consider opening most of the Crooked Pond parcel to hunting; no other parcels would be opened to hunting. In order to open the refuge to hunting, refuge staff would be required to develop a separate, opening package including NEPA compliance, which requires a public comment period. All hunt seasons would be evaluated as part of this process. Hunting would occur in accordance with State regulations. In addition to safety zones, other buffer zones could be established to protect the northern red-bellied cooter. At a minimum, we anticipate that the refuge would open for archery deer, shotgun deer, muzzleloader deer, and wild turkey. The refuge would not construct any parking areas to support hunting on the refuge. Hunters would access the refuge from existing parking areas on abutting State lands. We do not anticipate requiring special permits issued by or on behalf of the Service in order to hunt on the refuge.

### Strategies

*Within 5 years:*

- Evaluate all State hunt seasons and prepare a hunt opening package, including NEPA analysis and public review, to open the refuge to hunting, including deer and turkey hunting.
- If approved, prepare a refuge hunt plan and open for hunting for the selected seasons.

### Inventory and Monitoring Elements

- Develop monitoring strategies to measure change, achievement of objective, and evaluate the hunt program, modify or restrict access, or adapt hunt management strategies as warranted.
- Coordinate with MassWildlife, MADCR and other State agencies to obtain any available harvest data for the refuge.

## GOAL 3:

**Enhance collaborations with Federal and State agencies, conservation organizations, and local communities to promote species and habitat conservation across the pitch pine-oak landscape in southeastern Massachusetts, and to support Massasoit NWR's purpose, and the Refuge System and Service missions.**

### Objective B3.1.

**Work with the northern red-bellied cooter recovery team and species experts to refine our understanding of species habitat requirements, methods for assessing habitat quality rangewide, and the factors limiting survival and reproduction. Also, work with these experts to determine high priority areas for habitat management across its range and determine suitable management actions.**

### Rationale

The Service entered into a cooperative agreement during the writing of this CCP as discussed under objective A3.1. Alternative B expands these objectives and our participation in off-refuge work. Finalized protocols developed under the cooperative agreement referenced in objective A3.1 will allow us and our conservation partners to inventory, monitor, and evaluate more sites rangewide, and pilot habitat management techniques beyond 2016. In the near term, this information will help us evaluate how well we are meeting Recovery Plan goals, and whether current population levels satisfy down-listing or delisting criteria. It will also help us monitor future population changes and strategically direct our efforts on the ground.





USFWS

*Northern red-bellied cooter and white-tailed deer at Crooked Pond*

Successful northern red-bellied cooter recovery depends on hatchling survival and recruitment into the breeding population. The Revised Recovery Plan (USFWS 1994) and 5-Year Review (USFWS 2007) recommend studies to determine primary sources of mortality, hatchling predator issues, and other factors affecting turtle reproduction and survival. The plan also recommends continued natural history studies that include determination of habitat requirements, nest site selection preferences, the proportion of adult female turtles that nest annually or twice annually, and the age and size of turtles at reproductive maturity. Research on long-term survival of turtles indicates that successful management and conservation programs for long-lived organisms, such as turtles, will be those that recognize that protection of all life stages is necessary (Congdon et al. 1993). These and other studies continue to provide data needed to implement sound management. These studies should evolve as the data and knowledge base improves and new research goals are developed.

Additionally, there is a need for data on possible effects of pesticides, heavy metals, and other environmental contaminants on northern red-bellied cooters. Since many of the ponds are found in close proximity to commercial agriculture, the potential impact of insecticides and other chemicals used in agriculture or mosquito abatement should be investigated. Habitat alteration as a result of agricultural development and practices may also bear on the northern red-bellied cooter population status. Manipulation of aquatic vegetation, including herbicide use, may impact northern red-bellied cooter food resource quality and quantity. Unanswered questions about the effects of more recent chemical treatment that are less toxic to wildlife remain. The cranberry industry is the single largest water user in southeastern Massachusetts (Barbour et al. 1998) for irrigation and harvesting and many northern red-bellied cooter populations are dependent on the same water used by growers. The cranberry industry had a negative impact to the habitat of the northern red-bellied cooter through large water withdrawals and the use of herbicides and pesticides. However,

the cranberry industry in Plymouth County has been very supportive of the recovery effort, and is now an important partner in the program (USFWS 2004). Our State partner, MassWildlife, has established cooperative relationships with cranberry companies and it is important to maintain these relationships and establish new ones.

**Strategies**

*Continue to:*

- Work with MassWildlife, Massachusetts Cooperative Fish and Wildlife Research Unit, and other partners to fulfill priority research objectives.
- Support efforts and research toward rangewide recovery of the northern red-bellied cooters.

*Within 3 years of CCP implementation:*

- Facilitate and as appropriate, participate in additional rangewide research relevant to northern red-bellied cooters when research has conservation implications and will inform future refuge management. Focus may include, but is not limited to:
  - \* Post-emergence survival of hatchlings.
  - \* Principal sources of mortality.
  - \* Impacts of predators.
  - \* Other natural and anthropogenic factors affecting northern red-bellied cooter survival, reproduction, and population growth.
- Work through MassWildlife to engage cranberry industry owners and other appropriate enterprises to avoid activities that may be harmful to northern red-bellied cooters and their habitats range-wide, as well as support recovery efforts.
- Pursue incentive programs for private landowner management of habitats for northern red-bellied cooters range-wide.
- Work with partners, to utilize the most current information on the Critical Habitat Area for the northern red-bellied cooter, and identify potential areas for land protection to benefit the species.

**Inventory and Monitoring Elements**

*Continue to:*

- Annually record the number of research projects funded and research objectives met.

*Within 3 years:*

- Facilitate implementing inventory, monitor, and evaluation of non-refuge sites identified as high priority by the Service and conservation partners.

**Objective B3.2.**

**Work with local and regional wildland and structural fire management professionals to continue to protect communities at risk from wildfire.**

**Rationale**

The rationale is the same as that previously discussed for objective A3.2.

**Strategies:**

*Continue to*

- Coordinate with abutters, private landowners, and conservation partners to ensure protection of communities at risk as well as natural resources.
- Work with the MADCR to implement ‘Fire Wise’ (<http://www.firewise.org>) educational programs in neighboring communities.
- Support other land management agencies with their fuel reduction projects by providing assistance through training, equipment, staff time, and technical expertise.

**Inventory and Monitoring Elements**

- Annually record the number of partnership hazardous fuel reduction projects the Service participates in.
- Annually record the number of Fire Wise programs implemented and number of attendees.
- Annually record the number of acres treated.

**Objective B3.3.**

**Work with adjacent landowners, the MSSF, and other conservation organizations in the area to coordinate responsible use and enjoyment of the Massasoit NWR and surrounding public lands.**

**Rationale**

Opening the refuge to limited public access and use, would allow Massasoit NWR to play a key role in supporting conservation efforts in the surrounding area on town, State, private and partner lands. Staff would coordinate with others to ensure the management actions occurring on the refuge complement larger, landscape efforts while maintaining our focus on protecting the federally endangered northern red-bellied cooter and other species of conservation concern.

*Measuring the size of a red bellied-cooter*



Jared Green



**Summary of Alternatives**

**Strategies**

*Within 1 year of CCP implementation:*

- Refuge law enforcement will communicate threats to public safety and species protection with abutters and other conservation organizations.
- Coordinate with abutters, private landowners, and conservation partners to ensure protection of resources.
- Work with MSSF to post information on their Alden Road kiosk about the refuge, its species, and management practices, including prescribed burns.
- Increase law enforcement outreach to surrounding landowners.
- Identify other opportunities to provide refuge information at partner facilities.

**Inventory and Monitoring Elements**

None applicable

Table 3-1 below compares and contrasts what distinguishes the two management alternatives evaluated in detail in this draft CCP/EA. It highlights the management actions that are detailed in chapter 3. We recommend readers consult chapter 3, including the sections titled “Actions Common to All Alternatives” to understand the full range of what is proposed, and our rationale, under each alternative.

**Table 3-1. Summary of Alternatives Matrix**

<b>Actions Common to All</b>
Implementing adaptive management.
Monitoring and abating wildlife and plant diseases.
Conducting biological and ecological research and investigations.
Conducting non-lethal predator control.
Reducing hazardous fuels.
Providing limited environmental education or interpretation opportunities through refuge partners.
Fostering volunteers and partnerships.
Providing refuge staffing and administration.
Protecting resources and ensuring visitor safety.
Managing access or rights-of-way.
Prohibit Fishing.
Distributing refuge revenue sharing payments.
Completing stepdown management plans.
Protecting cultural resources.
Conducting additional NEPA analysis.

Table 3-1. Summary of Alternatives Matrix

Refuge Resource or Program	Alternative A Current Management	Alternative B (Service-preferred) Expanded Management
<p><b>Goal 1:</b> Perpetuate the biological integrity, diversity, and environmental health of the pitch pine-oak forest habitat type and associated coastal plain ponds and wetlands on Massasoit National Wildlife Refuge to sustain native wildlife, especially species of conservation concern such as the federally listed northern red-bellied cooter.</p>		
<p><b>Responds to Issues:</b> How will we effectively manage the habitat for the cooter while considering the management for a diversity of wildlife and plant species, including State-listed endangered and threatened species including rare moths and plants? What opportunities are there for protecting the New England cottontail? What role will prescribed burns play in habitat management?</p>		
<p><b>Objective 1.1. Northern red-bellied cooter management</b></p>	<p><b>Objective A1.1.</b> On the Crooked Pond parcel, contribute to rangewide northern red-bellied cooter population recovery by: (1) protecting 10 acres of existing pond habitat and associated shoreline from human disturbance; (2) creating and maintaining 1/4 acre of high quality nesting habitat for the northern red-bellied cooter; and (3) increasing nest success and hatchling survival.</p> <p><b>Strategies</b> <i>Continue to:</i></p> <ul style="list-style-type: none"> <li>• Use mechanical and hand tools (such as rototiller, rakes, shovels, axes, and chainsaws) to reduce encroaching shrubby vegetation, remove herbaceous vegetation, girdle large canopy trees, and loosen soil at two sites on the Crooked Pond shoreline by late May at least every third year.</li> <li>• Protect northern red-bellied cooter nests with predator enclosures (nest enclosures) to protect eggs and emerging hatchlings at Crooked Pond.</li> <li>• Coordinate with conservation partners and participate in the State headstarting program when northern red-bellied cooters successfully nest on the refuge.</li> <li>• Support collaborative research to determine the population and factors limiting survival and reproduction of northern red-bellied cooters on refuge lands, and establish short-term population objectives.</li> <li>• Use temporary signs to establish a physical closure at northern red-bellied cooter nesting sites along the Crooked Pond shoreline annually from mid-May through mid-September, and address trespass issues as they occur.</li> <li>• Make appropriate changes in management for northern red-bellied cooters within 6 months of completion of any 5-year reviews or recovery plan updates to accommodate updated recovery criteria, research needs, or any additional needs identified.</li> </ul>	<p><b>Objective B1.1.</b> Contribute to rangewide northern red-bellied cooter population recovery and long-term persistence of other native coastal plain biota by: (1) protecting 10 acres of existing pond habitat and associated shoreline at Crooked Pond and all refuge-owned shoreline from human disturbance; (2) creating and maintaining 1 acre of high quality nesting habitat on the shorelines of Crooked, Island, Gunners Exchange, and Hoyt Ponds on Massasoit NWR; and, (3) increasing northern red-bellied cooter nest success to at least 60 percent by protecting nests from mammalian predators and increasing hatchling survival through headstarting.</p> <p><b>Strategies:</b> <i>In addition to objective A1.1, within 3 years of CCP implementation:</i></p> <ul style="list-style-type: none"> <li>• Prioritize refuge-owned shoreline of Gunners Exchange, Hoyts, and Island Ponds for opportunities to create and expand nesting habitat for northern red-bellied cooters. Develop and implement appropriate strategies including mechanical and hand methods to reduce encroaching shrubby vegetation, remove herbaceous vegetation, girdle large canopy trees to increase sun exposure, and (if appropriate) loosen soil.</li> <li>• Provide basking logs for northern red-bellied cooters refuge-wide by placing large downed trees along pond shorelines.</li> <li>• Protect northern red-bellied cooter nests with predator enclosures (nest enclosures) to protect eggs and emerging hatchlings refuge-wide. Implement additional non-lethal predator management techniques, such as electric fencing, if necessary to meet nest success objectives.</li> <li>• Use temporary signs to establish physical closures at northern red-bellied cooter nesting sites refugewide, and particularly along the refugewide shoreline of Island Pond, Gunners Exchange Pond, and Hoyts Pond annually from mid-May through mid-September. Address trespass issues as they occur.</li> <li>• Assure that water quality is supportive of northern red-bellied cooters in coordination with MADEP and other partners.</li> <li>• Assess and control aquatic non-native invasive species, and other invasive species using mechanical methods, herbicide, or biocontrol in coordination with the MADCR, the Town of Plymouth, and other conservation partners.</li> </ul>

Table 3-1. Summary of Alternatives Matrix

Refuge Resource or Program	Alternative A Current Management	Alternative B (Service-preferred) Expanded Management
<p><b>Goal 1 (cont.):</b> Perpetuate the biological integrity, diversity, and environmental health of the pitch pine-oak forest habitat type and associated coastal plain ponds and wetlands on Massasoit National Wildlife Refuge to sustain native wildlife, especially species of conservation concern such as the federally listed northern red-bellied cooter.</p>		
<p><b>Responds to Issues:</b> How will we effectively manage the habitat for the cooter while considering the management for a diversity of wildlife and plant species, including State-listed endangered and threatened species including rare moths and plants? What opportunities are there for protecting the New England cottontail? What role will prescribed burns play in habitat management?</p>		
<p><b>Objective 1.1. Northern red-bellied cooter management (cont.)</b></p>		<ul style="list-style-type: none"> <li>• Collaborate with MassWildlife and other State agencies to define invasive species of greatest risk and find funding for research and conservation action for species that pose the greatest threat to native coastal pond biota.</li> <li>• Support expanded collaborative research, including off-refuge surface water and groundwater withdrawal effects on refuge pond water quality, harmful algal bloom, and shoreline habitats, to determine the population and factors limiting survival and reproduction of northern red-bellied cooters and other coastal pond species of conservation concern on refuge lands.</li> <li>• Seek grants and funding partnerships to additional seasonal staff.</li> </ul>
<p><b>Objective 1.2. Pine barren and shrubland habitat management</b></p>	<p><b>Objective A1.2.</b> Manage 50 acres of mixed pine-oak forest and other upland habitats on the refuge to reduce hazardous fuel loading through mechanical and prescribed fire.</p> <p><b>Strategies</b> <i>Continue to:</i></p> <ul style="list-style-type: none"> <li>• Evaluate the entire refuge in the context of wildland urban interface risks and along with Service partners, facilitate planning of additional hazardous fuel reductions to protect neighboring communities.</li> <li>• Utilize prescribed fire and mechanical clearing including mowing, cutting, and masticating in accordance with the approved FMP and Annual Burn Plans every 3 to 5 years initially to maintain approximately 75- to 100-foot wide shaded fuel breaks between the refuge and residential areas, and 10- to 25-foot fire breaks between burn units. Transition to a 5- to 10-year interval on the northeastern portion of the Crooked Pond parcel over time. The target shaded fuel break effective width is 100 feet, and the target fire break effective width between burn units is 12 feet.</li> </ul>	<p><b>Objective B1.2.</b> Manage up to 200 acres of mixed pine-oak forest habitats on Massasoit NWR with prescribed burning, mechanical methods, and other methods to (1) reduce fuel loading and wildland fire risk; and, (2) improve habitat for migratory bird species of conservation concern, such as ovenbirds, eastern towhees, eastern wood-peewees, and prairie warblers, by providing a mosaic of forest ages and structure over the 15-year period.</p> <p><b>Strategies</b> <i>In addition to objective A1.2, within 5 years of CCP implementation:</i></p> <ul style="list-style-type: none"> <li>• Utilize prescribed fire in combination with mechanical mowing, cutting, and/or mastication (chipping/mulching) in accordance with the approved FMP and Annual Burn Plans, to open forest and shrub canopies to increase sunlight reaching the forest floor, or to control invasive plant species.</li> <li>• Implement prescribed fire on a 5- to 7-year cycle within all burn units on the Crooked Pond parcel.</li> <li>• Mechanically maintain all fire breaks on all refuge parcels as needed.</li> <li>• Refine existing cover type map via ground verification. Evaluate available data on forest structure and composition and determine if finer scale information is needed to evaluate baseline characteristics of forest habitat refugewide.</li> <li>• Ensure management plans (such as the HMP) incorporate mechanical, prescribed fire, and other techniques, and contain strategies to collaborate with utility ROW managers to achieve habitat objectives.</li> <li>• Reduce invasive plants such that they are dominant on less than 10 percent (less than or equal to 21 acres) of upland acres.</li> </ul>

Table 3-1. Summary of Alternatives Matrix

Refuge Resource or Program	Alternative A Current Management	Alternative B (Service-preferred) Expanded Management
<p><b>Goal 1 (cont.):</b> Perpetuate the biological integrity, diversity, and environmental health of the pitch pine-oak forest habitat type and associated coastal plain ponds and wetlands on Massasoit National Wildlife Refuge to sustain native wildlife, especially species of conservation concern such as the federally listed northern red-bellied cooter.</p>		
<p><b>Responds to Issues:</b> How will we effectively manage the habitat for the cooter while considering the management for a diversity of wildlife and plant species, including State-listed endangered and threatened species including rare moths and plants? What opportunities are there for protecting the New England cottontail? What role will prescribed burns play in habitat management?</p>		
<p><b>Objective 1.2. Pine barren and shrubland habitat management (cont.)</b></p>		<ul style="list-style-type: none"> <li>• Facilitate and participate in relevant research that has conservation implications for priority species and habitat types and will inform management priorities.</li> <li>• Consult regional and/or state conservation plans including (but not limited to) those existing for pitch pine–scrub oak and shrubland habitats, New England cottontail, bats, northern red-bellied cooters, and lepidopteran species during refuge habitat project planning, including prescribed burning. Coordinate refuge habitat project implementation with the MassWildlife, MADCR, and other local and regional conservation partners.</li> <li>• Seek grants and funding partnerships to support seasonal staff and forest management projects.</li> </ul>
<p><b>Goal 2:</b> Promote awareness and support for the protection of sensitive resources on Massasoit NWR through community outreach and opportunities for connecting the public to the refuge’s natural resources.</p>		
<p><b>Responds to Issues:</b> What, if any, public access will be provided? What kinds of signage and interpretation can be used to increase the public’s understanding of the resources, especially for the protection of the cooter, the consequences of misuse of sensitive areas on the refuge, and limitations on public access? How do we improve outreach for the refuge to the public and potential partners and stakeholders?</p>		
<p><b>Objective 2.1. Environmental education and interpretation</b></p>	<p><b>Objective A2.1.</b> Provide environmental education and interpretation programming via permit or staff-led events, and conduct community outreach working through partnerships to inform the public about the refuge and its resources.</p> <p><b>Strategies:</b> <i>Continue to:</i></p> <ul style="list-style-type: none"> <li>• Allow occasional guided interpretative field trips on the refuge hosted by partners under a SUP.</li> <li>• Use the refuge Website to provide information about the northern red-bellied cooter and explain refuge management.</li> <li>• Disseminate the Refuge Complex brochure to provide information on refuge and wildlife management.</li> <li>• Notify the public of large scale management activities (e.g., prescribed burns), their purposes, and possible impacts through press releases and the refuge Website.</li> <li>• Manage the refuge volunteer program.</li> <li>• Coordinate with local organizations to promote awareness about the refuge and its resources.</li> </ul>	<p><b>Objective B2.1.</b> Within 5 years, work with partners and volunteers to expand opportunities to provide quality environmental education and interpretation programs, and expand public information dissemination and community outreach.</p> <p><b>Strategies:</b> In addition to objective A2.1, within 5 years:</p> <ul style="list-style-type: none"> <li>• Provide information about refuge resources and management at the library, partner facilities, and the Chamber of Commerce.</li> <li>• On request, work with local educators to provide environmental education for local schools.</li> <li>• Work with partners to develop and display traveling exhibits for libraries and community buildings to reach non-traditional audiences.</li> <li>• Conduct Service-directed interpretive programs as requested along with partners, utilizing existing roads and trails on the refuge through SUPs.</li> <li>• At a minimum, participate in one local community event every 4 years.</li> <li>• Develop an interpretative endangered species-species of conservation concern education trunk to be used by teachers in local schools.</li> </ul>

Table 3-1. Summary of Alternatives Matrix

Refuge Resource or Program	Alternative A Current Management	Alternative B (Service-preferred) Expanded Management
<p><b>Goal 2 (cont.):</b> Promote awareness and support for the protection of sensitive resources on Massasoit NWR through community outreach and opportunities for connecting the public to the refuge’s natural resources.</p>		
<p><b>Responds to Issues:</b> What, if any, public access will be provided? What kinds of signage and interpretation can be used to increase the public’s understanding of the resources, especially for the protection of the cooter, the consequences of misuse of sensitive areas on the refuge, and limitations on public access? How do we improve outreach for the refuge to the public and potential partners and stakeholders?</p>		
<p><b>Objective 2.1. Environmental education and interpretation (cont.)</b></p>		<ul style="list-style-type: none"> <li>• Work with partners to conduct “Teach the Teacher” classes to provide information about the refuge, the northern red-bellied cooter, and other species of conservation concern, and management of pine barren and coastal pond habitat.</li> <li>• Seek grants and funding partnerships to support additional seasonal staff, environmental education programs, and community outreach activities.</li> <li>• Hire a summer Visitor Services intern with refuge resources or through partnerships to focus on supporting these efforts.</li> </ul>
<p><b>Objective 2.2. Wildlife Observation and Photography</b></p>		<p><b>Objective B2.2.</b> Provide opportunities on the Crooked Pond parcel for visitors to engage in wildlife observation and photography on the refuge in a manner that minimizes disturbance to refuge habitats and wildlife.</p> <p><b>Strategies:</b> <i>Within 1 year:</i></p> <ul style="list-style-type: none"> <li>• Offer at least one wildlife observation and photography staff- or partner-led trip on the refuge.</li> </ul>
<p><b>Objective 2.3 Hunting</b></p>		<p><b>Objective B2.3.</b> Determine whether to open the Crooked Pond parcel to hunting, particularly deer and turkey hunting, within 5 years of CCP approval.</p> <p><b>Strategies:</b> <i>Within 5 years:</i></p> <ul style="list-style-type: none"> <li>• Evaluate all State hunt seasons and prepare a hunt opening package, including NEPA analysis and public review, to open the refuge to hunting, including deer and turkey hunting.</li> <li>• If approved, prepare a refuge hunt plan and open for hunting for the selected seasons.</li> </ul>



Table 3-1. Summary of Alternatives Matrix

Refuge Resource or Program	Alternative A Current Management	Alternative B (Service-preferred) Expanded Management
<p><b>Goal 3:</b> Enhance collaborations with Federal and State agencies, conservation organizations, and local communities to promote species and habitat conservation across the pitch pine-oak landscape in southeastern Massachusetts, and to support Massasoit NWR's purposes and Refuge System and Service missions.</p>		
<p><b>Response to Issues:</b> What strategic approach will the Service take in landscape level land protection and conservation actions to expand the efforts toward the northern red-bellied cooter and New England cottontail recovery, and other shrubland-dependent species conservation?</p>		
<p><b>Objective 3.1. Landscape-scale Land Protection and Conservation Collaboration.</b></p>	<p><b>Objective A3.1.</b> Work with the northern red-bellied cooter recovery team and species experts to refine our understanding of species habitat requirements, methods for assessing the quality of habitat rangewide, and the factors limiting survival and reproduction. Also, work with these experts to determine high priority areas for habitat management across its range and determine suitable management actions.</p> <p><b>Strategies:</b> <i>Continue to:</i></p> <ul style="list-style-type: none"> <li>• Work with MassWildlife, Massachusetts Cooperative Fish and Wildlife Research Unit, and other partners to fulfill priority research objectives.</li> <li>• Support efforts and research toward rangewide recovery of the northern red-bellied cooter.</li> </ul>	<p><b>Objective B3.1.</b> Work with the northern red-bellied cooter recovery team and species experts to refine our understanding of species habitat requirements, methods for assessing the quality of habitat rangewide, and the factors limiting survival and reproduction. Also, work with these experts to determine high priority areas for habitat management across its range, and determine suitable management actions.</p> <p><b>Strategies:</b> In addition to Objective A3.1: <i>Within 3 years of CCP implementation:</i></p> <ul style="list-style-type: none"> <li>• Facilitate and as appropriate, participate in additional rangewide research relevant to northern red-bellied cooters when research has conservation implications and will inform future refuge management. Focus may include, but is not limited to: <ul style="list-style-type: none"> <li>♦ Post-emergence survival of hatchlings.</li> <li>♦ Primary sources of mortality.</li> <li>♦ Impacts of predators.</li> <li>♦ Other natural and anthropogenic factors affecting northern red-bellied cooter survival, reproduction, and population growth.</li> </ul> </li> <li>• Work through MassWildlife to engage cranberry industry owners and other appropriate enterprises to avoid activities that may be harmful to northern red-bellied cooters and their habitats rangewide.</li> <li>• Pursue incentive programs for private landowner management of habitats for northern red-bellied cooters rangewide.</li> <li>• Work with partners to utilize the most current information on the Critical Habitat Area for the northern red-bellied cooter, and identify potential areas for land protection to benefit the species.</li> </ul>

Table 3-1. Summary of Alternatives Matrix

Refuge Resource or Program	Alternative A Current Management	Alternative B (Service-preferred) Expanded Management
<p><b>Goal 3 (cont.):</b> Enhance collaborations with Federal and State agencies, conservation organizations, and local communities to promote species and habitat conservation across the pitch pine-oak landscape in southeastern Massachusetts, and to support Massasoit NWR's purposes and Refuge System and Service missions.</p>		
<p><b>Response to Issues:</b> What strategic approach will the Service take in landscape level land protection and conservation actions to expand the efforts toward the northern red-bellied cooter and New England cottontail recovery, and other shrubland-dependent species conservation?</p>		
<p><b>Objective 3.2. Protect communities at risk from wildfire.</b></p>	<p><b>Objective A3.2.</b> Work with local and regional wildland and structural fire management professionals to continue to protect communities at risk in southeastern Massachusetts to wildfire.</p> <p><b>Strategies:</b> <i>Continue to:</i></p> <ul style="list-style-type: none"> <li>• Coordinate with abutters, private landowners, and conservation partners to ensure protection of communities at risk as well as natural resources.</li> <li>• Work with the MADCR to implement "Fire Wise" educational programs in neighboring communities.</li> <li>• Support other land management agencies with their fuel reduction projects by providing assistance through training, equipment, staff time, and technical expertise.</li> </ul>	<p><b>Objective B3.2.</b> Work with local and regional wildland and structural fire management professionals to continue to protect communities at risk from wildfire.</p> <p><b>Strategies</b> Same as objective A3.2.</p>
<p><b>Objective 3.3. Community Outreach and Partnerships</b></p>		<p><b>Objective B3.3.</b> Work with adjacent landowners, the MSSF, and other conservation organizations in the area to coordinate responsible use and enjoyment of the Massasoit NWR and surrounding public lands.</p> <p><b>Strategies</b> <i>Within 1 year of CCP implementation:</i></p> <ul style="list-style-type: none"> <li>• Refuge law enforcement will communicate threats to public safety and species protection with abutters and other conservation organizations.</li> <li>• Coordinate with abutters, private landowners, and conservation partners to ensure protection of resources.</li> <li>• Work with the MSSF to post information on their Alden Road kiosk about the refuge, its species, and management practices, including prescribed burns.</li> <li>• Increase law enforcement outreach to surrounding landowners.</li> <li>• Identify other opportunities to provide refuge information at partner facilities.</li> </ul>