

## Chapter 4



*Autumn on the Refuge: Erin Victory*

### **Environmental Consequences**

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## Introduction

This chapter describes the environmental consequences that we predict from implementing the three management alternatives presented in Chapter 2. Where detailed information is available, we present a scientific and analytic comparison between alternatives and their anticipated consequences, which we describe as “impacts” or “effects.” Where we are lacking detailed information, we make comparisons based on our professional judgment and experience. Specifically, we predict the effects of implementing the management actions and strategies for each of the three alternatives: Alternative A (Current Management), which serves as the baseline for comparing Alternative B (Enhanced Habitat Management and Visitor Services: the Service-preferred alternative), and Alternative C (Active Habitat Management and Enhanced Visitor Services).

We organized this chapter by major resource headings. Under each heading, we discuss the beneficial and adverse effects likely to occur over the 15-year life span of the plan. Beyond the 15-year planning horizon, we give a more speculative description of the direct, indirect, and cumulative effects. At the end of this chapter, Table 4.1 summarizes the effects predicted for each alternative and allows for a side-by-side comparison. Finally, this chapter identifies the irreversible and irretrievable commitment of resources from our proposed actions, as well as the relationship between short-term uses of the environment and long-term productivity, their cumulative effects, and the relationship to environmental justice.

As required by CEQ and Service regulations implementing NEPA, we assessed the importance of the effects of the CCP alternatives based on their context and intensity. The context of the impacts ranges from local and site-specific to regional.

This chapter does not describe the consequences of certain types of management activities in Chapter 2, “Alternatives,” because they would qualify for categorical exclusion under applicable regulations if independently proposed, and are both trivial in effect and common to all alternatives. These management activities are:

- environmental education and interpretive programs (unless major construction is involved or significant increase in visitation is expected)
- research, resource inventories, and other resource information collection
- operations and maintenance of existing infrastructure and facilities (unless major renovation is involved)
- routine, recurring management activities and improvements
- small construction and improvement projects (e.g., fences, kiosk, interpretive signs, trail improvements and additions, and angler parking area)
- native vegetation planting
- minor changes in amounts and types of public use
- issuance of new or revised management plans when only minor changes are planned
- law enforcement activities

In Chapter 2, “Alternatives,” we propose changes to priority public uses, specifically proposing to allow fishing (Alternatives B and C) and hunting (Alternative C) on the Refuge. We acknowledge that, in order to implement the addition of hunting as an allowed public use, we would need to conduct additional environmental and impact analysis and public involvement to comply with NEPA and Service policy, whereas fishing is fully analyzed here. These proposed activities would comply with New Hampshire state regulations. While we describe the impacts of the proposed fishing use in this chapter as it is a part of the preferred alternative, only some of the impacts of hunting are addressed in this chapter. We would

fully evaluate the impacts of a hunting program in a separate NEPA analysis that would be initiated after CCP approval should the use ever be proposed.

## Effects on Socio-Economic Resources

In analyzing the socioeconomic consequences of the actions under the three alternatives, we evaluated our refuge revenue sharing, refuge visitor expenditures in the local economy, and refuge staff and work-related expenditures in the local economy.

### Socio-Economic Impacts That Would Not Vary By Alternative

Under provisions of the Refuge Revenue Sharing Act local towns receive an annual payment for lands that have been purchased in full fee simple acquisition by the Service. Payments are based on the greater of 75 cents per acre or 0.75 percent of the market value of lands acquired by the Service. The exact amount of the annual payment depends on the Congressional appropriation, which in recent years have tended to be less than the amount to fully fund the authorized level of payments. In 2008, the payment to the Town of Newbury was \$11,609 or 41.9 percent of authorized levels. The Service is not proposing any new fee simple acquisition; therefore, the level of refuge revenue sharing will be the same for all three alternatives. We do not expect any major changes in the level of revenue sharing payments, unless Congress changes its annual appropriation for revenue sharing.

### Socio-Economic Effects of Alternative A (Current Management)

#### *Refuge visitor expenditures*

We have not conducted formal surveys of annual Refuge visitation. The Fells estimates that they receive 11,773 visitors per year (K. Zurheide, pers. comm.). Most people visiting the Refuge are likely there to see the estate and gardens, learn about John Hay and his family, or attend workshops and classes offered by The Fells. The historic John Hay Estate, now owned by The Fells, was part of the Refuge until 2008. With no Refuge staff on-site, we rely on a partnership with The Fells, whereby they provide some level of interpretation programs and outreach activities, and provide an immediate point of contact.

The only developed visitor service facility on the Refuge is the John Hay II Forest Ecology Trail. We do not have good estimates of the number of people that use the trail, nor do we know how many visitors walk through the Refuge off the trail. Based on visitor estimates from The Fells, in a 6-month period from October 2007 to March 2008, 1,805 visitors to The Fells likely used some portion of the Refuge for wildlife observation, nature photography, environmental education, or interpretation. We do not know how many of these visitors are local and how many are coming in from other regions. A Service study found that, in New Hampshire, resident and non-resident wildlife watchers respectively spent \$16 and \$69 per person, per day (US DOI and U.S. Department of Commerce (US DOC) 2008). Using the estimated 1,805 visitors to the Refuge over 6-months, that represents expenditures of \$28,880 (if all residents) and \$124,545 (if all non-residents). We assume that a portion of that is spent in the local community surrounding the Refuge.

#### *Impacts from Refuge Administration*

Administratively, the Refuge is an unstaffed satellite station of the Silvio O. Conte National Fish and Wildlife Refuge Complex, headquartered in Sunderland, Massachusetts. Currently the Refuge maintains Refuge boundary signs and the entrance sign; otherwise, the Refuge has no facilities or vehicles to maintain. As part of an agreement with The Fells, we jointly use the parking area located at the estate. Since there are no on-site staff and no active management activities, we contribute negligibly to the local

economy in terms of Refuge staff jobs, income, expenditures, and purchases of goods and services for Refuge activities.

### **Socio-Economic Effects of Alternative B (Enhanced Habitat Management and Visitor Services)**

#### ***Refuge visitor expenditures***

We expect visitation at the Refuge to increase in the coming years commensurate with statewide and regional trends, and with our planned improvements to the Ecology Trail, a kiosk and the new parking lot for The Fells, expanded outreach programs with the hiring of a seasonal visitor services staff, and the proposed addition of fishing as a priority public use on the Refuge. The New Hampshire State Comprehensive Outdoor Recreation Plan reported that visitation at New Hampshire state parks increased by 82 percent between 1998 and 2001 (NH Office of Energy and Planning 2003) and the “2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation” reports a 15 percent increase in the number of people watching wildlife near their homes in New England between 2001 and 2006 (US DOI and US DOC 2008).

We therefore predict an increase in visitation of up to 15 percent, to approximately 2,075 visitors, based on the national survey statistic, coupled with our proposed changes in outreach and expansion of allowed uses to include fishing. A majority of this increase in refuge visitation may come from existing visitation to The Fells; it is likely that the Refuge trail improvements will entice more of these people to venture onto the Refuge.

The national wildlife recreation survey found that in New Hampshire, resident and non-resident anglers respectively spent \$19 and \$53 per person, per day (US DOI and US DOC 2008). We do not know how many visitors will come to the Refuge just to fish, but we anticipate that a majority of these visitors will be in addition to those coming for wildlife watching, and therefore, expenditures in the local community as a result of fishing on the Refuge will be additive to the expenditures for wildlife watching.

#### ***Impacts from Refuge Administration***

Under all three alternatives the John Hay Refuge remains a satellite station of the Silvio O. Conte National Fish and Wildlife Refuge Complex, headquartered in Sunderland, Massachusetts, with limited on-site staffing. With the proposed addition of an on-site seasonal visitor services staff, we anticipate only modest increases in Refuge expenditures within the local community. These would include a slight increase in expenditures by the seasonal staff person for gas and other supplies, materials for improving the trail and constructing a kiosk and additional interpretive signs. These expenditures would contribute negligibly to the local economy in terms of the regional economy.

Though timber cutting or salvage operations on the Refuge would only occur as-needed in response to outbreaks of insects, disease or other salvage operations, they would provide some revenue to the town. Forest management activities that entail commercial forest cutting can provide an economic benefit to the town through the timber yield tax (NH Revised Statutes Annotated (RSA) 79:3). Through this tax, the local community receives 10 percent of the stumpage value at the time the trees are harvested. Further, this would provide some additional benefit to the local economy, at least temporarily, by the necessary hiring of local logging contractors.

## **Socio-Economic Effects of Alternative C (Active Habitat Management and Enhanced Visitor Services)**

### ***Refuge visitor expenditures***

We expect visitation at the Refuge to increase in the coming years commensurate with statewide and regional trends, and with our planned improvements to the Ecology Trail, a kiosk and the new parking lot for The Fells, expanded outreach programs with the hiring of a full-time visitor services staff, and the proposed addition of fishing and hunting as priority public uses on the Refuge. We estimate that annual visitation would be approximately 2,800 because the Ecology Trail would be upgraded to meet ADA guidance. We anticipate that these increases in visitation and corresponding increases in visitor expenditures are similar to Alternative B when considered in the context of the local and regional economy. Given the small size of the John Hay Refuge, it is unlikely that the addition of hunting will increase visitation in a measurable way, and may reduce some visitation by others during times of year that hunting is allowed on the Refuge. Resident and non-resident hunters in New Hampshire spend, respectively \$14 and \$46 per day (US DOI and US DOC 2008). Converting a portion of the Ecology Trail to be ADA-compliant will increase the number of people with disabilities that can visit the Refuge.

### ***Impacts from Refuge Administration***

Under all three alternatives the John Hay Refuge remains as a satellite station of the Silvio O. Conte National Fish and Wildlife Refuge Complex, headquartered in Sunderland, Massachusetts, with limited on-site staffing. With the proposed addition of an on-site full-time visitor services staff, we anticipate only modest increases in Refuge expenditures within the local community, compared to Alternative B. These would include a slight increase in expenditures by the full-time staff person for gas and other supplies, materials for improving the trail, constructing a kiosk and additional interpretive signs. These expenditures would contribute negligibly to the local economy in terms of the regional economy.

Forest management activities that entail commercial forest cutting can provide an economic benefit to the town through the timber yield tax (NH RSA 79:3). Through this tax, the local community receives 10 percent of the stumpage value at the time the trees are harvested. Though timber cutting or salvage operations on the Refuge would only be occasional, they would provide some revenue to the town. Further, active forest management would provide some additional benefit to the local economy, at least temporarily, by the periodic contracting with local loggers.

## **Effects on Water Quality**

### **Water Quality Impacts That Would Not Vary by Alternative**

Over the last 20 years, development around Lake Sunapee has increased by 24 percent, and impervious surfaces comprise 28 percent of the 250 foot buffer zone around the lake, which exceeds the 10 percent value considered to be the threshold at which water quality begins to decline (SAWC 2008). Overall, the water quality of Lake Sunapee is good, although some sampling sites around the lakeshore show elevated phosphorus levels. Beech Brook, which flows through the Refuge and into the lake, serves as a reference site because of its high water quality.

Under all three alternatives we would maintain the Refuge's role in protecting water quality by restricting uses that would contribute to sedimentation and runoff along the lakeshore and along the brook. We do not propose any impervious surfaces or any major land disturbing activities that would affect water quality. All vegetation management activities would incorporate best management practices to minimize potential impacts to water quality. All three alternatives rely on the Lake Sunapee Protective Association

for water quality monitoring of the brook. In addition, we would continue to prevent boat landing along the 3,100 feet of undisturbed lakeshore, and throughout the Refuge would prevent motorized vehicles, dog walking, camping, and horseback riding, which all could adversely impact water quality if allowed (Boyle and Samson 1985, Cole and Landres 1996, NH FGD 2005).

None of our proposed management activities would violate federal or state standards for contributing pollutants to water sources; all three alternatives would comply with the Clean Water Act.



*Outflow of Beech Brook: Erin Victory*

## **Water Quality Impacts of Alternative A (Current Management)**

### ***Benefits***

We anticipate that the greatest water quality benefits under this alternative would be by continuing to ensure the 3,100 feet of undisturbed shoreline along the lake. With no increases anticipated in visitation and no changes in priority public uses, the trail along the lakeshore would continue to receive only modest use, so water quality impacts would be minimal.

### ***Adverse Impacts***

The existing Refuge self-guided trail follows Beech Brook for approximately 200 feet and crosses over twice. Under this alternative we would leave the trail in its current location. Although current use of the trail does not appear to be substantially impacting the brook, retaining the current brook crossing(s) could eventually result in increased erosion, stream bank sloughing, and sedimentation, thereby negatively affecting water quality in both the brook and Lake Sunapee (Boyle and Samson 1985, Cole and Landres 1996, NH FGD 2005). With no on-site staff, our ability to conduct outreach and monitor trail use is more limited than under Alternatives B and C, so the potential for impacts to the brook and shoreline are higher under Alternative A. We are also not able to monitor any potential water quality impacts (e.g., Kuntz and McBride 1993, Paschka et al. 1999, Kaushal et al. 2005) to Beech Brook from winter road treatments on Route 103A, which forms the eastern boundary of the Refuge.

## **Water Quality Impacts of Alternative B (Enhanced Habitat Management and Visitor Services)**

### ***Benefits***

Under Alternative B we would relocate sections of the self-guided Ecology Trail away from Beech Brook and/or install a footbridge(s), if we find that the trail is negatively affecting stream health, through erosion, soil compaction, and/or sedimentation. The footbridge(s) would be constructed with pressure-treated lumber, and would be approximately 3 feet wide and approximately 30 feet long, depending on the location. The walking surface would be attached to pressure-treated posts set in the ground at both ends. Handrails would be approximately 3 feet high. Construction of this footbridge(s) would cause temporary disruption to the site; however, any sloughing or sedimentation as a result of construction would be minor, and would be offset by the utility of the footbridge(s) in preventing future impacts.

This brook, upstream from the Refuge boundary, is used as a reference for water quality monitoring in the Lake Sunapee basin due to its excellent water quality. Trail improvements would be designed to protect and maintain the integrity of this brook while still allowing visitors to observe and explore it. Hiring a seasonal visitor services staff person would enhance our capacity to monitor public uses, ensure greater compliance of allowed and prohibited uses, and provide more public outreach on the value and sensitivity of the lakeshore and brook. These proposed activities would provide greater water quality protection than under Alternative A. In addition, we would work with the Lake Sunapee Protective Association to assess the potential effects of Route 103A winter road treatments on the water quality of Beech Brook; we would work with them and the local road authority to take mitigating steps, if necessary.

### ***Adverse Impacts***

We predict that the increased outreach and education programs by seasonal staff would lead to increased visitation on the Refuge. This could lead to an increase in trail impacts such as soil compaction and erosion, which could adversely affect water quality and site productivity (Boyle and Samson 1985, Cole and Landres 1996, NH FGD 2005), although the proposed trail improvements should mitigate impacts from additional visitor use. The proposed addition of an access trail for fishing could also lead to greater adverse impacts to water quality along the lakeshore, and an increase in soil compaction on the access trail, especially if anglers concentrate use in a particular area. Good fishing locations, if there are any, will get repeated use over time, and this could result in habitat degradation in the form of unplanned trails, stream bank sloughing, disturbance to shoreline vegetation, and increased sedimentation (Boyle and Samson 1985, Cole and Landres 1996). Water quality could also be effected by litter and debris left behind by anglers, although this is more of a problem along marine shorelines than freshwater shorelines (e.g., Earll et al. 2000, NH FGD 2005). However, the addition of an angler access trail would be intended to supplant any desire for unplanned trails and our capacity to monitor and respond to the above impacts, if they occur, would be enhanced by having on-site staff during the summer.

The expansion of the meadow through the selective removal of seedlings, saplings and poles would be conducted by hand without the use of mechanized vehicles or equipment access; therefore no adverse impacts to water quality would be expected to occur from this activity. If mechanized equipment and access roads become necessary to clear felled or snagged trees resulting from catastrophic weather events, or in order to remove pathogens, water quality could be adversely impacted by a temporary increase in soil erosion and runoff (Moffat 1993, Ares et al. 2005, Eisenbies et al. 2005). These impacts would be short-term, as the access routes and the presence of heavy equipment would be temporary, and the use of forestry BMPs would minimize their extent and duration (Smith 2006, Sun 2006).

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## **Water Quality Impacts of Alternative C (Active Habitat Management and Enhanced Visitor Services)**

### ***Benefits***

As in Alternative B, we would relocate sections of the Refuge self-guided trail away from Beech Brook and/or install a footbridge(s), if we find that the trail is negatively affecting stream health, through erosion, soil compaction, and/or sedimentation. Construction materials and impacts would be the same as mentioned in Alternative B. This would protect and maintain the water quality of the brook, which serves as a reference site in the Lake Sunapee basin due to its high water quality. Hiring a full-time visitor services staff person would further enhance our capacity to monitor public uses, ensure greater compliance of allowed and prohibited uses, and provide more public outreach on the value and sensitivity of the lakeshore and brook. These proposed activities would provide greater water quality protection than under Alternative A or B since the full-time staff person could monitor uses year-round. The assessment of the potential effects of Route 103A winter road treatments on the water quality of Beech Brook would include establishing a water quality monitoring site on the brook downstream of the road. This would provide better information and enable more direct response to impacts and mitigating them to protect water quality, if needed.

### ***Adverse Impacts***

We predict that the increased outreach and education programs by full-time staff would lead to increased visitation on the Refuge. This could lead to an increase in trail impacts such as soil compaction and erosion, which could adversely affect water quality (Boyle and Samson 1985, Cole and Landres 1996). Under this alternative we propose to widen the Refuge trail and install a footbridge(s) to ensure ADA compliance and to build a wildlife viewing/fishing platform on the lakeshore. This could lead to greater erosion, runoff, sedimentation, and water quality impacts during trail reconstruction and installation of the bridge(s) and platform (Reid et al. 2002); however, once completed the effects would be minimal. An ADA-compliant trail (e.g., modest, aesthetically pleasing boardwalks, and possibly rails) would also serve to focus use on the trail and most likely reduce off-trail activities.

The proposed addition of an access trail for fishing on the Refuge could also lead to greater adverse impacts to water quality along the lakeshore and the brook, if use is concentrated, and an increase in soil compaction on the new access trail. Good fishing locations, if there are any, will get repeated use over time, and this could result in habitat degradation in the form of unplanned trails, stream bank sloughing, disturbance to shoreline vegetation, and increased sedimentation (Boyle and Samson 1985, Cole and Landres 1996). Water quality could also be effected by litter and debris left behind by anglers, although this is more of a problem along marine shorelines than freshwater shorelines (e.g., Earll et al. 2000, NH FGD 2005). However, the addition of an angler access trail would be intended to supplant any desire for unplanned trails, and our capacity to monitor and respond to water quality impacts, if they occur, would be enhanced by having on-site staff.

The expansion of the existing meadow and the creation of a new meadow would be conducted through the selective removal of seedlings, saplings and poles by hand without the use of mechanized vehicles or equipment access; therefore no adverse impacts to water quality would be expected to occur from this activity. If mechanized equipment and access roads become necessary to clear felled or snagged trees resulting from catastrophic weather events, to remove pathogens, or to more actively manage the existing forest, water quality could be adversely impacted by a temporary increase in soil erosion and runoff (Moffat 1993, Ares et al. 2005, Eisenbies et al. 2005). These impacts would be short-term, as the access routes and the presence of heavy equipment would be temporary, and the use of forestry BMPs would minimize their extent and duration (Smith 2006, Sun 2006).

## Effects on Air Quality

### Air Quality Impacts That Would Not Vary By Alternative

The air quality for New Hampshire is considered relatively good. Levels of carbon monoxide and sulfur dioxide have decreased steadily since the 1980s and, along with nitrogen dioxide, have remained well below national standards set by the US EPA. However, the state does have on an average 10 days per year, with air quality officially classified as unhealthy due in large part to high ozone and fine particulate matter levels (Underhill 2004). These areas affected by high ozone days include the Refuge and surrounding region. Most of the pollution that causes unhealthy air quality days comes from sources outside New Hampshire. Therefore, we conclude that regional air quality should not be adversely affected by refuge management activities regardless of which management activity is selected. None of the alternatives would violate US EPA standards; all three would be in compliance with the Clean Air Act.

### Air Quality Effects of Alternative A (Current Management)

#### *Air Quality Benefits*

Since no new activities would occur under Alternative A, there would be no substantial benefits or adverse effects on local and regional air quality. The Refuge would be managed, largely through natural processes, maintaining the existing acreage of mature upland forest that plays a role in sequestering carbon.

#### *Adverse Air Quality Impacts*

Alternative A involves no ground disturbing activities and other activities that would introduce additional emission sources, nor any changes to the extent of existing mature upland forest. Minimal emissions would be released during maintenance of the viewing corridor.

### Air Quality Effects of Alternative B (Enhanced Habitat Management and Visitor Services)

#### *Air Quality Benefits*

The effects of Alternative B would be similar to Alternative A. There would be negligible changes in air quality, and no violations of air quality standards. Under this alternative, the Refuge would still be largely managed through natural processes and though a proposed increase in meadow habitat would reduce the acreage of upland forest by a few acres of small diameter, sub-canopy trees, the role of the mature upland forest in sequestering carbon would be nearly the same.

#### *Adverse Air Quality Impacts*

A minimal impact on air quality is the anticipated increase in visitors, and thus, an increase in vehicles, as a result of improved Service and Refuge outreach. It is anticipated that most of the increase in visitation to the Refuge would come from people already visiting The Fells. Additive visitation would likely be due to anglers, when the Refuge is opened to fishing. Still, those car emissions would contribute only a negligible amount compared to those of the urban and industrial centers within 100 miles of the Refuge and sources outside New Hampshire. Minimal emissions would be released from equipment during meadow enhancement and maintenance of the viewing corridor.

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## **Air Quality Effects of Alternative C (Active Habitat Management and Enhanced Visitor Services)**

### ***Air Quality Benefits***

The effects of Alternative C would be similar to Alternative B. There would be negligible changes in air quality, and no violations of air quality standards. Although under this alternative the upland forest would be more actively managed, and a proposed increase in meadow habitat would reduce the acreage of mature upland forest by a few acres, the role of the mature upland forest in sequestering carbon would be nearly the same.

### ***Adverse Air Quality Impacts***

The adverse impacts to air quality resulting from Alternative C would be similar to Alternative B, but somewhat greater in magnitude due to increases in meadow enhancement and the size of the viewing corridor, and initiation of active forest management.

## **Effects on Soils**

### **Soil Impacts That Would Not Vary By Alternative**

Soils on the Refuge uplands are mostly shallow and stony with slopes of 3 to 15 percent. Under all three alternatives we would use best management practices in all management activities that might affect Refuge soils to ensure that we maintain soil productivity and minimize erosion. We are not proposing major construction or demolition projects that require the disturbance of significant areas of soil under any of the alternatives. In addition, we would continue to prevent boat landing along the 3,100 feet of undisturbed lakeshore and throughout the Refuge prevent motorized vehicles, camping, and horseback riding, which all could adversely impact Refuge soils.

### **Soil Impacts of Alternative A (Current Management)**

#### ***Soil Benefits***

The only management activity on the Refuge with the potential to affect soils is maintaining the trails. With small increases anticipated in visitation over time, and no changes in priority public uses, the trail along the lakeshore and brook would continue to receive only modest use. Soil impacts may increase slightly over time as a result, but would be minimal overall. Under Alternative A we propose no active forest management, virtually eliminating any potential for localized soil damage from tree-cutting, skid roads, or woods roads and landings.

#### ***Adverse Soil Impacts***

The existing self-guided Ecology Trail follows Beech Brook for approximately 200 feet and crosses over twice. Under this alternative we would leave the trail in its current location. Although current use of the trail does not appear to be substantially impacting the brook, retaining the current alignment on the banks of Beech Brook could eventually result in increased erosion, stream bank sloughing, and sedimentation, thereby negatively affecting water quality in both the brook and Lake Sunapee. With no on-site staff, our ability to conduct outreach and monitor uses that could cause erosion and off-trail soil compaction along the brook is more limited than under Alternatives B and C, so the potential for impacts to go unnoticed is higher and the risk to soil productivity is therefore potentially higher under Alternative A.

## **Soil Impacts of Alternative B (Enhanced Habitat Management and Visitor Services)**

### ***Soil Benefits***

Under Alternative B we would relocate sections of the self-guided Ecology Trail away from Beech Brook and/or install a footbridge(s) where needed, if we find that the trail is negatively affecting stream health through erosion, soil compaction, and/or sedimentation. Construction of this footbridge(s) would utilize pressure treated lumber, and entail a walking surface with handrails affixed to posts set in the ground on either end. The dimensions would be approximately 3 feet wide by 30 feet long, depending on the location. Construction would likely cause temporary impacts, particularly displacement of soil for the post holes, and likely some sloughing during construction. These impacts would be offset by the benefit of the footbridge(s) that would protect and maintain soil productivity in the riparian area along the brook by preventing further impacts in the future.

Hiring a seasonal visitor services staff person would enhance our capacity to monitor public uses, ensure greater compliance of allowed and prohibited uses, and provide more public outreach on the value and sensitivity of the lakeshore and brook. These proposed activities would provide greater protection of soils than under Alternative A. Forest management activities would be limited to expansion of the existing meadow and removal of hazard trees which are discussed in more detail below. The meadow expansion would have negligible impacts on soil productivity because the trees, primarily seedlings, saplings, and poles would be cut and left in place to contribute to soil fertility (Eisenbies et al. 2005, Belleau et al. 2006).

### ***Adverse Soil Impacts***

We predict that the increased outreach and education programs by seasonal staff and the addition of fishing as a priority public use would lead to increased visitation on the Refuge. This could lead to an increase in trail impacts such as soil compaction and erosion, which could adversely affect Refuge soils (Boyle and Samson 1985, Cole and Landres 1996). Anglers could create new off-trail pathways to favored fishing spots, which could spread trail impacts to new areas that were previously undisturbed. Our capacity to monitor and respond to such impacts, if they occur, would be enhanced by having on-site staff, and the addition of an angler access trail would be intended to supplant the desire for such unplanned trails. Soil compaction would result from the new angler trail, new extension of the Ecology Trail to a fen and the new trail section that avoids crossing onto The Fells property. These trails would be native surface trails, and any adverse effects would be limited to the width of the trail (about two feet). The installation of more interpretive signs and a kiosk would have minimal localized impacts on soils. Clearing for a meadow expansion could cause short-term localized impacts to soils, although no vehicles or mechanized equipment would be used. In the event that felled, snagged or damaged trees need to be cleared or removed as a result of a catastrophic weather event or a pathogen infestation, mechanized equipment and access routes may become necessary. Best management practices would be used to minimize and mitigate any soil disturbances to prevent erosion and maintain soil productivity from these activities (Smith 2006). The use of forestry BMPs can avoid and minimize impacts to both water quality and soils (Smith 2006, Sun 2006).

## **Soil Impacts of Alternative C (Active Habitat Management and Enhanced Visitor Services)**

### ***Soil Benefits***

As in Alternative B, we would relocate sections of the Refuge self-guided trail away from Beech Brook and/or install a footbridge(s) where needed, if we find that the trail is negatively affecting stream health through erosion, soil compaction, and sedimentation. Construction materials and impacts would be as described in Alternative B. This would protect and maintain soil productivity in the riparian areas along the brook. Hiring a full-time visitor services staff person would further enhance our capacity to monitor

public uses, ensure greater compliance of allowed and prohibited uses, and provide more public outreach on allowed uses and sensitivity and value of the lakeshore and brook. These proposed activities would provide greater protection of Refuge soils than under Alternative A or B since this would be year-round monitoring.

### ***Adverse Soil Impacts***

We predict that the increased outreach and education programs by full-time staff and the addition of fishing as a priority public use would lead to increased visitation on the Refuge. This could lead to an increase in trail impacts such as soil compaction and erosion, which could adversely affect Refuge soils. Under this alternative we propose to widen the Ecology Trail to ensure ADA compliance, install a footbridge(s) to cross the brook where needed, and to build a wildlife viewing/fishing platform on the lakeshore. This could lead to greater erosion during trail reconstruction; however, once completed the effects would be minimal. An ADA-compliant trail (e.g., modest, aesthetically pleasing boardwalks, and possibly rails) would also serve to focus use on the trail and most likely reduce off-trail activities. The proposed addition of fishing as a priority public use on the Refuge could also lead to greater adverse impacts to soils along the lakeshore and the brook through increased soil compaction (Boyle and Samson 1985, Cole and Landres 1996). As described in Alternative B, there would be soil compaction resulting from establishment of the trail additions.

Compared to Alternative B, the clearing of another meadow and greater use of forest management practices under Alternative C would have a modest increase in short-term localized soil impacts from tree cutting, skids roads, woods roads, etc. (Moffat 1993, Ares et al. 2005, Eisenbies et al. 2005). This would be minimized by dropping and leaving the harvested trees which would be limited to seedlings, saplings, and poles which have little commercial value and/or conducting the work on frozen ground during the winter. Best management practices would be used to prevent erosion and minimize other adverse soil impacts. Forestry best management practices have been shown to minimize and mitigate adverse impacts to habitat and wildlife (Smith 2006, Sun 2006). Our capacity to monitor and respond to soil impacts, if they occur, would be enhanced by having on-site staff.

## **Effects on Forest Habitat and Wildlife**

### **Forest Habitat and Wildlife Impacts That Would Not Vary by Alternative**

The John Hay Refuge is mostly forested upland (about 77.6 of its 80 acres). Under all three alternatives the majority of the Refuge would remain as mature forested habitat to benefit migratory birds. The alternatives vary in the reliance on natural processes versus active forest management to create and maintain habitat conditions. We would remove fallen and dead and dying trees from the trail for safety reasons and treat pathogens as needed under all three alternatives. Under all three alternatives the one acre viewshed would be maintained by The Fells, and we would endeavor to work with them to create a treatment schedule that incorporates wildlife habitat objectives.

The presence of hikers and other visitors on the Ecology Trail has the potential to disturb wildlife in the forest. Frid and Dill (2002) argue that non-lethal human disturbance (including wildlife photography) may affect the behavior and reproductive success of wildlife, chiefly through their response to the disturbance stimuli as though they were responding to a predator; animals “divert time and energy from other fitness-enhancing activities such as feeding, prenatal care, or mating displays” (Frid and Dill 2002). Recreational trails may also affect breeding bird communities in forest habitats, with generalist species found more abundant near trails while specialist species were less abundant; the predation of nests was higher near trails, but brood parasitism by brown-headed cowbirds (*Molothrus ater*) was not affected by

the presence of trails (Miller et al. 1998). While the potential for these types of impacts to occur at the Refuge exists, the Ecology Trail is only 0.9 miles long and thus has a small footprint relative to the size of the surrounding forest habitat. Impacts to forest wildlife from public use of the trail, therefore, is expected to be minimal and temporary because visitor use is low and disturbance is intermittent with the presence of humans along the trail.

### **Forest Habitat and Wildlife Impacts of Alternative A (Current Management)**

Under Alternative A we would rely on natural processes (e.g., succession and disturbance), rather than any active forest management, to maintain the current extent of mature forest habitat (77.6 of 80 acres). Natural tree falls and other blow downs within the otherwise maturing forest would create habitat conditions that benefit many migratory birds and other wildlife that rely on a diverse forest structure and contribute to soil productivity (Peterson and Pickett 1995, Burris and Haney 2005, Walter and Maguire 2005, Pauli et al. 2006). Because we would not actively manage the forest under Alternative A, there would be no impacts from tree cutting or construction of skid trails or log landings. Removal of dead and dying trees and fallen trees for safety reasons could reduce habitat for cavity nesting birds and other wildlife that utilize dead trees (Aitken et al. 2002, Walter and Maguire 2005, Aitken and Martin 2008), although this removal would occur primarily along the trail and possibly in certain parts of the viewshed, rather than throughout the forest.

As stated previously, the presence of hikers and other visitors on the Ecology Trail has the potential to disturb wildlife in the forest. At present, the Refuge experiences only moderate use, and based on observations by Fells and Conte staff, the current low levels of Refuge visitation cause minimal disturbance of upland forest habitat or disturbance of forest wildlife. This is not anticipated to change under this alternative.

### **Forest Habitat and Wildlife Impacts of Alternative B (Enhanced and Forest Management and Visitor Services)**

Similar to Alternative A, we would rely primarily on natural processes (e.g., succession and disturbance), rather than any active forest management, to maintain the current extent of mature forest habitat (approximately 77.6 of 80 acres). Natural tree falls and other blow downs within the otherwise maturing forest would create habitat conditions that benefit many migratory birds that rely on a diverse forest structure. Under this alternative, we would evaluate the forest every 10 to 15 years or following a substantial disturbance event, and using adaptive management, retain the option of more active forest management to create habitat conditions to benefit migratory birds, if forest conditions warrant. An increase in the size of the meadow from 1.4 acres to approximately 3.0 acres would be primarily accomplished by cutting younger aged trees (i.e., seedlings, saplings, and poles), causing a negligible effect to mature forest habitat. The increase in meadow acreage could benefit some forest species by providing sources of insects and fruits that many birds rely on during the breeding season (Burris and Haney 2005). An increase in forest edge habitat formed by the meadow expansion could benefit forest generalist species as well as shrubland and/or grassland bird species, but may negatively impact forest specialists or other species such as New England cottontail (*Sylvilagus transitionalis*) as forest blocks become more fragmented (Jobes et al. 2004, Litvaitis et al. 2006, Rodewald and Brittingham 2007, Hallworth et al. 2008, Schlossberg and King 2009). Any negative impacts to forest specialist species are likely to be minimal, however, since the reduction in forest area is limited to approximately 1.6 acres.

Removal of dead and dying trees and fallen trees for safety reasons could reduce habitat for cavity nesting birds and other wildlife that utilize dead trees (Aitken et al. 2002, Walter and Maguire 2005, Aitken and Martin 2008), although this removal would occur primarily along the trail and possibly in certain parts of

the viewshed, rather than throughout the forest. Removal of pathogen infestations, should they occur, may result in the short-term loss of trees and their associated habitat for wildlife. The removal of dead, dying or infested trees that contain active bird nests could lead to wildlife mortality if eggs or unfledged young are present at the time of removal. However, it would benefit the long-term health of the forest by limiting the spread and damage of the infestation.



*Downed tree: Erin Victory*

Given our predictions of only modest increases in Refuge visitation we anticipate only minimal disturbance of upland forest habitat or disturbance of forest wildlife. Most public use in the forest would be concentrated along the developed Ecology Trail, new spur loops to the fen and trailhead, and angler access trail to the lakeshore. These trail additions would be native surface trails that would likely require little to no construction, so any impacts to forest habitat would be minimal. Increased public use in areas where there were previously little to none would potentially cause some localized impacts to wildlife. However, given our predictions of only modest increases in Refuge visitation we anticipate any disturbances to upland forest habitat or forest wildlife to be minimal. Our capacity to monitor and respond to forest impacts, if they occur, would be enhanced by having seasonal on-site staff.

### **Forest Habitat and Wildlife Impacts of Alternative C (Active Habitat Management and Enhanced Visitor Services)**

Under Alternative C we would have a greater emphasis on active forest management to encourage regeneration, create early successional habitat, and increase meadow habitat. In addition to the expansion of the existing meadow to approximately 3.0 acres, we would create another one- to three-acre meadow on the Refuge. This would cause a corresponding decrease in the extent of forest habitat to about 73 acres. We would locate the meadow based on soils, historical, and biological factors, and would endeavor to minimize any fragmentation of the mature forest habitat. Forest fragmentation from logging harvest can adversely affect species such as New England cottontail, northern goshawk, and marten, while other species are not impacted (e.g., eastern chipmunk) or may even benefit for some period of time (e.g., red-tailed hawks) (Thompson 1994, Mahan and Yahner 1998, LaSorte et al. 2004, Litvaitis et al. 2007).

After evaluating forest conditions, silvicultural prescriptions would be developed in a Habitat Management Plan to enhance forest regeneration, if warranted, and avoid or minimize potential impacts to wildlife. Sensitive areas such as bogs, fens and other wetlands would be avoided; the use of buffers such as those recommended by Faccio (2003) for salamanders could further avoid and minimize potential disturbance impacts from forest management activities. Similar to Alternative B, we would evaluate the forest every 10 to 15 years, and under this alternative, we would monitor forest responses to silvicultural prescriptions. Logging operations have been shown to disturb some large mammals such as elk and grizzly bear (*Ursus arctos*), which avoided areas during active logging operations or the young, logged forests the operations created (Edge and Marcum 1985, Apps et al. 2004). Although elk and grizzly bear do not occur in New Hampshire or the Refuge, similar large mammals such as moose and black bear may occur and are species of conservation concern identified in this CCP (Appendix A). Using adaptive management, we would adjust forest management actions to avoid and minimize impacts to forest habitat and wildlife accordingly as new information becomes available.

Similar to Alternatives A and B, removal of dead and dying trees and fallen trees for safety reasons could reduce habitat for cavity nesting birds and other wildlife that utilize dead trees (Aitken et al. 2002, Walter and Maguire 2005, Aitken and Martin 2008), although this removal would occur primarily along the trail and possibly in certain parts of the viewshed, rather than throughout the forest. Removal of pathogen infestations, should they occur, may result in the short-term loss of trees and their associated habitat for wildlife. The removal of dead, dying or infested trees that contain active bird nests could lead to wildlife mortality if eggs or unfledged young are present at the time of removal. However, it would benefit the long-term health of the forest by limiting the spread and damage of the infestation.

Given our predictions of only modest increases in Refuge visitation we anticipate only minimal disturbance of upland forest habitat or disturbance of forest wildlife. Most public use in the forest would continue to be concentrated along the developed Ecology Trail. The presence of hunters, however, could adversely impact the forest understory and disturb wildlife as hunters traverse off-trail areas (Boyle and Samson 1985, Cole and Landres 1996); a small number of trees could be damaged by the installation of tree stands. The use of archery as a hunting method would avoid potential impacts to the forest from spent shell casings from firearms and minimize disturbance to wildlife by avoiding sudden, loud noises from firearm use.

However, hunting can have a beneficial impact on an ecosystem when overbrowsing by white-tailed deer is an issue. In Pennsylvania, low levels of sapling species density and diversity were correlated with increased deer abundance (Powers and Nagel 2009), and tree regeneration and forb and shrub abundance was negatively impacted by deer overbrowse (Carson et al. 2005). Because excessive damage to vegetation by deer browse has been documented to have negative impacts on the abilities of forest species to regenerate, it can therefore influence stand composition. In the Refuge forest, where its value to the landscape lies in its unique character, these impacts are especially important. Though overbrowse is not yet a concern on the Refuge at present, we cannot rule out the possibility of problems in the future. Conducting a forest inventory every 10 to 15 years would allow us to monitor for signs of overbrowse, along with general forest health and stand composition. One of the reasons to consider hunting on the Refuge would be to ensure the maintenance of a deer population within the Refuge's carrying capacity to prevent excessive vegetation damage. Any hunting would be extremely limited and all potential impacts would be further evaluated in a separate environmental analysis before a hunt plan would be considered.

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## Effects on Meadow Habitat

### Meadow Habitat Impacts That Would Not Vary by Alternative

Under all three alternatives we would maintain the existing 1.4 acre meadow habitat to benefit migratory birds, including American woodcock that require open habitat. The meadow would continue to be mowed once every other year, after September 15<sup>th</sup>, to prevent disturbance to ground nesting birds, brood-rearing and other foraging wildlife, and allow pollinators to utilize late summer nectar and pollen. The differences between the alternatives relates to the amount, if any, additional meadow habitat that is created on the Refuge.

Recreational trails may also affect breeding bird communities in grassland habitats, with birds found to be less likely to nest near trails and the predation of nests higher near trails (Miller et al. 1998). Neither the existing Ecology Trail nor the proposed trail relocations and additions would traverse meadow habitats, however, so any potential impacts to breeding bird communities resulting from recreational trails would be nonexistent.

### Meadow Habitat Impacts of Alternative A (Current Management)

Under Alternative A we would maintain the existing 1.4 acre meadow habitat to benefit migratory birds that require open habitat. The meadow would continue to be mowed at least once every other year, after September 15<sup>th</sup>, to prevent disturbance to ground nesting birds, brood-rearing and other foraging wildlife, and allow pollinators to utilize late summer nectar and pollen.

### Meadow Habitat Impacts of Alternative B (Enhanced Habitat Management and Visitor Services)

Under Alternative B we propose to expand the existing meadow by up to 1.6 acres, creating a larger meadow habitat approximating 3.0 acres, the exact size dependent upon habitat and historical factors. This would enhance the habitat for meadow-dependent species, while having a negligible effect on forest species, given the overall extent of the surrounding forest. No mature, overstory trees would be removed to expand the meadow habitat. We would continue to maintain the larger 3.0 (+/-) acre meadow by mowing once every other year, after September 15<sup>th</sup>, to prevent disturbance to ground nesting birds, brood-rearing and other foraging wildlife, and allow pollinators to utilize late summer nectar and pollen.

### Meadow Habitat Impacts of Alternative C (Active Habitat Management and Enhanced Visitor Services)

Similar to Alternative B, we would expand the existing meadow to a total of approximately 3.0 acres, depending on habitat and historical factors, and manage it with similar benefits, as described above under Alternative B. Under this alternative, we would also create a second one- to three-acre meadow elsewhere on the Refuge to further benefit meadow-dependent migratory birds. We would use soils, historical records, maps, existing forest conditions, and other documents to help determine the appropriate size and location of a second meadow. Historical documents offer clues to areas that were most recently cleared, and therefore, those areas would likely be the easiest to re-create as meadow. We would endeavor to ensure that the creation of a new meadow would not fragment the upland mature forest in order to avoid any negative effects of habitat fragmentation (e.g., LaSorte et al. 2004, Litvaitis et al. 2006).

## **Effects on Shoreline/Minute Island**

### **Shoreline/Minute Island Impacts That Would Not Vary by Alternative**

Under all three alternatives we would protect the 3,100 feet of undeveloped shoreline along Lake Sunapee and the 0.1 acre Minute Island by preventing public uses that could pose risks to the habitat and associated species. We would continue to rely on the Lake Sunapee Protective Association in monitoring water quality of the lake in the vicinity of the Refuge.

In addition, we would continue to prevent boat landing along the 3,100 feet of shoreline and prevent motorized vehicles, dog walking, camping, and horseback riding that could adversely affect shoreline conditions.

Stalmaster and Kaiser (1998) found that wintering bald eagle were disturbed by fishing boats as well as eagle-viewing boats, but were most disturbed by foot traffic. Individuals flushed and feeding was interrupted by the presence of human recreational activity; the eagles resumed feeding fairly quickly following disturbance, but the higher the number of disturbance events in a given day, the longer the time for the eagles to resume feeding (Stalmaster and Kaiser 1998). Watercraft were also found to disrupt nesting (Grubb et al. 2002) and postfledging bald eagles (Wood et al. 1998). Although the Refuge currently does not support bald eagles, except occasionally during migration, potential habitat is present and bald eagles may use the Refuge in the future.

Staging waterfowl have also shown to be sensitive to human disturbance, with disturbances such as boats potentially causing a flight response (with associated disruptions to feeding) from entire flocks during spring and fall migration periods (Knapton et al. 2000). Colonies of breeding waterbirds are sensitive to human disturbance, as well, with displacement from preferred habitat, reproductive failure and population declines all possible impacts (Skagen et al. 2001). To the extent that human use of the shoreline tramples or damages the understory vegetation, bird, frog and insect populations may be affected – the more intact the understory vegetation, the higher the species richness and abundance of these taxonomic groups along a lakeshore (Henning and Remsburg 2009). The existing closure of the Refuge shoreline to beaching watercraft would persist under all three alternatives. We would continue to post Refuge signs along the shoreline indicating uses, including the beaching of boats, which are not allowed. As a result, impacts to waterfowl, waterbirds, piscivorous birds such as bald eagle, and other shoreline wildlife should be minimal and limited to disturbances generated by occasional foot traffic.

### **Shoreline/Minute Island Impacts of Alternative A (Current Management)**

With limited increases anticipated in visitation and no changes in priority public uses, the trail along the lakeshore would continue to receive only modest use, so shoreline impacts would be minimal. With no on-site staff, our ability to conduct outreach and monitor unauthorized uses that could cause erosion and other adverse impacts to the lakeshore (e.g., Cole and Landres 1996, NH FGD 2005) is more limited than under Alternatives B and C, so the potential for such uses occurring is higher and the risk to the shoreline is therefore potentially higher under Alternative A. We would rely primarily on The Fells and New Hampshire Marine Patrol to help monitor the lakeshore and inform us of any concerns.

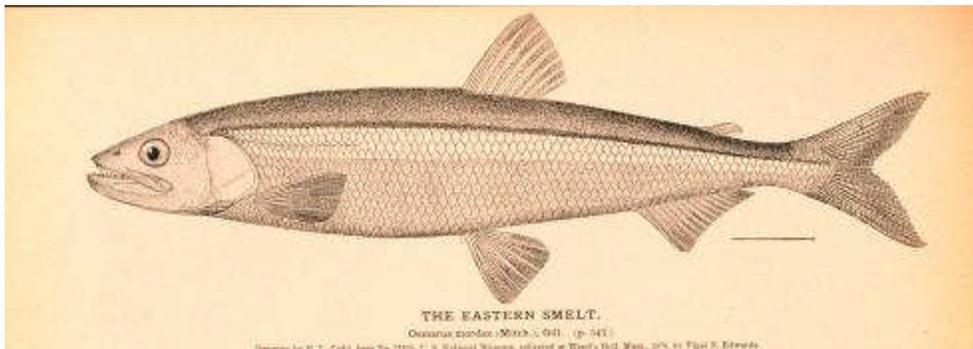
### **Shoreline/Minute Island Impacts of Alternative B (Enhanced Habitat Management and Visitor Services)**

Under Alternative B hiring a seasonal visitor services staff person would enhance our capacity to monitor public uses during peak periods, ensure greater compliance of allowed and prohibited uses, and provide

more public outreach on allowed uses and sensitivity and value of the lakeshore. These proposed activities would provide greater protection to shoreline habitat than under Alternative A. Similar to Alternative A, we would continue to rely on The Fells and New Hampshire Marine Patrol to help monitor the shoreline and inform us of any concerns.

We predict that the increased outreach and education programs by seasonal staff would lead to modest increases in visitation on the Refuge. This could lead to an increase in trail impacts such as soil compaction and erosion where the trail follows the shore, which could adversely affect shoreline habitat (Cole and Landres 1996, Henning and Remsburg 2009). However, as long as visitors continue to stay on the trail, these impacts should be minimal. The proposed addition of fishing as a priority public use on the Refuge could also lead to greater adverse impacts along the lakeshore, including disturbance to wildlife (e.g., Knapton et al. 2000, Grubb et al. 2002).

Under this alternative, angler access would be restricted to the southeast corner where the Woods Road meets Route 103A. Two to three vehicles would be allowed to park on a short section of the Woods Road. If necessary, the present gate would be moved to accommodate the vehicles, but vehicle access beyond the parking area would be restricted. A new primitive foot trail would connect this parking area with the Lake Sunapee shoreline, which would create a minimal increase in disturbance to the surrounding habitat and wildlife. Anglers would not be allowed to park in the parking lot adjacent to The Fells gatehouse. These access restrictions should minimize disturbance to the shoreline and associated wildlife by limiting the number of anglers present at any one time. In addition, the shoreline itself is heavily vegetated in most areas without a beach; therefore most fishing is anticipated to be from lake waters and not the Refuge shoreline.



*Rainbow smelt*: NOAA

Potential adverse impacts along the lakeshore from fishing include an increase in litter, offal and abandoned or lost fishing gear. Lost or discarded fishing tackle can injure and kill birds and ingestion of lead fishing weights raises blood lead levels (Franson et al. 2003, Kelly and Kelly 2004). Waterbirds can ingest lead fishing weights and other fishing tackle as well as become entangled in fishing tackle, and have been found in New Hampshire (Franson et al. 2003). The largest known cause of adult loon mortality in New Hampshire, in fact, is lead poisoning resulting from ingestion of lead fishing sinkers and jigs (NH FGD 2005). Abandoned trout-fishing lures may also entangle and kill insectivorous birds such as the eastern phoebe (*Sayornis phoebe*; Eaton and Hernández 2005). The incidental take of non-game species is another risk to aquatic resources from fishing (NH FGD 2005).

Compliance with state fishing rules as annually published in the New Hampshire Fresh Water Fishing Digest (e.g., seasonal and gear restrictions, creel limits) and controlling access would minimize these potential adverse impacts. For example, fishing would be prohibited from Minute Island in order to

protect this sensitive habitat. Lead sinkers less than 1 ounce in weight and jigs less than 1 inch on the longest axis would be prohibited in compliance with state rules, minimizing potential injury to wildlife. The use of live bait while on the Refuge would be prohibited in order to prevent the introduction of non-native or invasive species which could alter the freshwater ecosystem (Claudi and Leach 2000, as described by Moyle 2000). Anglers would not be permitted to dig for bait within the Refuge, avoiding disruption of soils, vegetation and wildlife. Moreover, our capacity to monitor and respond to such impacts, if they occur, would be enhanced by having on-site staff. The addition of signs closing the Refuge shoreline and Minute Island to all watercraft rafting, beaching of boats and public access from the lake would further minimize adverse impacts to the undeveloped shoreline and nearshore habitats.

### **Shoreline/Minute Island Impacts of Alternative C (Active Habitat Management and Enhanced Visitor Services)**

Under Alternative C hiring a full-time visitor services staff person would further enhance our capacity to monitor public uses, ensure greater compliance of allowed and prohibited uses, and provide more public outreach on allowed uses, sensitivity, and value of the lakeshore. These proposed activities would provide greater protection to the lakeshore than under Alternative A or B since this would be year-round outreach and monitoring. We predict that the increased outreach and education programs by full-time staff would lead to modest increases in visitation on the Refuge. This could result in increased trail impacts such as soil compaction and erosion, which could adversely affect the shoreline.

Under this alternative, widening the existing Ecology Trail, and adding a viewing platform at the lakeshore would expand recreational opportunities, including fishing, for visitors with mobility limitations. Complete trail improvements would be ADA-compliant, and would increase public safety by including a packed surface, a wider walkway, possibly handrails, and better markings that would lead to a platform at the lake shore. The platform itself would be constructed from pressure-treated lumber, and it would be built to be aesthetically pleasing, and to blend into the lakeshore environment. These improvements could lead to greater erosion and soil compaction during trail reconstruction; however, once completed the effects from construction would be minimal and there would be long-term benefits from a hardened trail. An ADA-compliant trail (e.g., modest, aesthetically pleasing boardwalks, and possibly rails) would also serve to focus use on the trail and most likely reduce off-trail activities along the shoreline.

The proposed addition of fishing as a priority public use on the Refuge could also lead to greater adverse impacts to the lakeshore, as described above under Alternative B. The greater use of the lakeshore environment by an increased number of visitors, including anglers, could lead to greater disturbance of wildlife using the lakeshore (e.g., Knapton et al. 2000, Grubb et al. 2002). A new primitive foot trail would connect the proposed angler parking area with the Lake Sunapee shoreline, which would create a minimal increase in disturbance to the surrounding habitat and wildlife. Anglers would not be allowed to park in the parking lot adjacent to The Fells gatehouse. These access restrictions should minimize disturbance to the shoreline and associated wildlife by limiting the number of anglers present at any one time.

The lakeshore platform may serve the dual purpose of concentrating use by anglers as well as other recreationists, thereby reducing the anticipated increase in shoreline use to some extent. Overall, shoreline use by anglers is anticipated to be relatively low given that the heavy vegetation along most of the Refuge shoreline would restrict casting ability. Most fishing would likely take place not from the shoreline, but from the lake waters or from the platform. Our capacity to monitor and respond to shoreline impacts, if they occur, would be enhanced by having on-site staff.

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## Effects on Riparian and In-Stream Habitat

### Riparian and In-Stream Habitat Impacts That Would Not Vary by Alternative

Beech Brook, which flows approximately 1,750 feet through the Refuge and then into the lake, serves as a reference site for the Lake Sunapee basin because of its high water quality. All three alternatives recognize the role of the Lake Sunapee Protective Association in monitoring the water quality of the brook. Under all three alternatives, we would continue to prevent motorized vehicles, dog walking, camping, and horseback riding, which all could adversely impact riparian and in-stream habitat, if allowed.

### Riparian and In-Stream Habitat Impacts of Alternative A (Current Management)

Under Alternative A we would maintain the current extent of mature forest habitat, retaining a closed canopy forest above the stream corridor, which is an important thermal regulator for fish species of conservation concern; open canopies can lead to fluctuations in water temperature that are harmful for some aquatic species (Kelly et al. 2003, NH FGD 2005, Petty et al. 2005, Wilzback et al. 2005). The existing self-guided Ecology Trail follows Beech Brook for approximately 200 feet and crosses over twice. Under this alternative we would leave the trail in its current location, which is currently resulting in erosion and sedimentation, increasing the risk to in-stream and riparian habitat and function. With no on-site staff, our ability to conduct outreach and monitor unauthorized uses that could cause erosion, runoff, and sedimentation is more limited than under Alternatives B and C, so the potential for such uses occurring is higher and the risk to the stream is therefore potentially higher under Alternative A. We are also not able to monitor any potential adverse impacts to Beech Brook from winter road treatments on Route 103A, which forms the eastern boundary of the Refuge.

### Riparian and In-Stream Habitat Impacts of Alternative B (Enhanced Habitat Management and Visitor Services)

Under Alternative B we would relocate sections of the self-guided Ecology Trail away from Beech Brook and/or install a footbridge(s) at stream crossings, which would minimize adverse impacts that the trail may be having on stream health through erosion, soil compaction, runoff, and/or sedimentation. This footbridge(s) would be constructed with pressure treated lumber, and would entail a walking surface with handrails affixed to a set of posts on either side. The dimensions would be approximately 3 feet wide by 30 feet long, depending on the location. Though construction of the footbridge(s) itself would likely cause some minor erosion and sedimentation during construction, these impacts would be offset by the benefits provided by the footbridge(s) to help protect and maintain in-stream habitat quality and prevent future adverse impacts.

Hiring a seasonal visitor services staff person would enhance our capacity to monitor public uses, ensure greater compliance with allowed and prohibited uses, and provide more public outreach on allowed uses and sensitivity of the brook and associated riparian habitat. These proposed activities would provide greater protection to these habitats than under Alternative A. In addition, we would endeavor to assess the potential effects of Route 103A winter road treatments on Beech Brook, and take mitigating steps, if possible. Under Alternative B, we develop a partnership with New Hampshire Fish and Game Department to assess in-stream habitats and associated fish populations. In the event that forestry management actions become necessary, motorized equipment would not be allowed to work in the fens and Beech Brook riparian corridor, unless it could be accomplished with minimal impact to these productive, fragile habitats.

We predict that the increased outreach and education programs by seasonal staff would lead to a modest increase in visitation on the Refuge. This could lead to an increase in trail impacts such as soil compaction and erosion, which could adversely affect the brook. In this case, sections of the trail may be relocated away from the brook to protect in-stream habitat quality. This relocation would entail no construction, and is not anticipated to have any adverse impacts. The proposed addition of fishing as a priority public use on the Refuge could also lead to greater adverse impacts to the brook, as described under the Shoreline/Minute Island section above. However, the proposed angler parking area would only accommodate several cars at a time. This in conjunction with the prohibition of angler parking at The Fells gatehouse would limit the number of anglers present at any one time. In addition, our capacity to monitor and respond to such impacts, if they occur, would be enhanced by having on-site staff.

### **Riparian and In-Stream Habitat Impacts of Alternative C (Active Habitat Management and Enhanced Visitor Services)**

As in Alternative B, we would relocate sections of the self-guided Ecology Trail away from Beech Brook and/or install a footbridge(s) at stream crossings, which would minimize adverse impacts that the trail may be having on stream health through erosion, soil compaction, and sedimentation. Improving the trail to be ADA-compliant would reduce erosion and sedimentation into the brook from the trail, although it would have a temporary increase during construction. This would help protect and maintain in-stream habitat. The expanded area of the trail surface would be at the expense of about 600 square feet of existing riparian habitat. Hiring a full-time visitor services staff person would further enhance our capacity to monitor public uses, ensure greater compliance with allowed and prohibited uses, and provide more public outreach on allowed uses and sensitivity of the brook and associated riparian area. These proposed activities would provide greater protection for these habitats than under Alternatives A or B, since this would be year-round monitoring. The assessment of the potential effects of Route 103A winter road treatments on Beech Brook and establishing a water quality monitoring site on the brook downstream of the road would provide insight into the protection of the stream habitat and associated fish species. This would enable more direct response to impacts and mitigation to protect the brook, if needed. Under Alternative C, we would also undertake at least one stream enhancement project, if warranted, to restore stream riparian habitat to benefit fish species of conservation concern.

Similar to Alternative B, we predict that the increased outreach and education programs by permanent staff would lead to a modest increase in visitation on the Refuge. This could lead to an increase in trail impacts such as soil compaction and erosion, which could adversely affect the brook. The proposed addition of fishing as a priority public use on the Refuge could also lead to greater adverse impacts to the brook as described under the Shoreline/Minute Island section above. However, our capacity to monitor and respond to such impacts, if they occur, would be enhanced by having on-site staff. In the event that forestry management actions become necessary, motorized equipment will not be allowed to work in the fens and Beech Brook riparian corridor, unless it can be accomplished without impacting these productive, fragile habitats.

## **Effects on Wetlands Habitat**

### **Wetlands Habitat Impacts That Would Not Vary by Alternative**

The Refuge has two known fens (a type of peatland) that total approximately 1.0 acre, and one known vernal pool; the latter may have been human created. Given the Refuge soils and slopes, wetland habitat is probably limited on the Refuge (LaPointe 2008), although a formal inventory has not been conducted. Under all three alternatives we will continue to protect these habitats as breeding habitats for wetland-

dependent species and as a part of the Refuge's biological diversity. Any changes in trail location or clearing for other management activities would avoid adverse impacts to wetland habitats under all three alternatives.

### **Wetlands Habitat Impacts of Alternative A (Current Management)**

Under Alternative A we would continue to allow natural processes to influence wetland habitats. We would record and georeference any new wetlands as we encounter them on the Refuge. We would conduct a vernal pool inventory prior to any management activities that involve earth moving or filling.

### **Wetlands Habitat Impacts of Alternative B (Enhanced Habitat Management and Visitor Services)**

Under Alternative B we would proactively inventory and record locations of all vernal pools and other wetlands on the Refuge. This would ensure greater protection of wetland habitats. We would record any observations of vernal pool-obligate species, and conduct at least one formal vernal pool breeding species survey. These surveys may cause some temporary trampling of vegetation and disturbance to wildlife; however, this would last only as long as it took to complete the survey or to georeference the location. Because only one survey is scheduled to be completed over the life of this CCP, and the location of a vernal pool need only be georeferenced once, these actions would have only minor, short-term impacts. In the event that forestry management actions become necessary, motorized equipment would not be allowed to work in the fens and Beech Brook riparian corridor, unless it can be accomplished with minimal impact to these productive, fragile habitats.

The creation of a trail from the Ecology Trail to the nearest fen and back would provide additional opportunities for interpretation and wildlife observation and photography. This trail would be a native surface trail with minimal to no construction required, and would be marked by directional trail signs. The trail would end at some distance to one of the fens where a short post and rail fence would keep visitors away from the fen, and where interpretive signage would provide information about fens. The process of establishing this trail and fence, and the presence of visitors to this habitat on the Refuge would likely cause some disturbance to wildlife. We would conduct monitoring to ensure that management activities or trail re-location do not adversely impact the fens. All vernal pools would be inventoried and georeferenced prior to any trail enhancement or habitat management activities in order to avoid these impacts to sensitive habitats.

### **Wetlands Habitat Impacts of Alternative C (Active Habitat Management and Enhanced Visitor Services)**

In addition to Alternative B, we would explore opportunities to create new vernal pools or to enhance the existing vernal pool (or others if found on the Refuge). We would also create a trail to one of the fens as described in Alternative B. In the event that active forestry management actions become necessary, motorized equipment will not be allowed to work in the fens and Beech Brook riparian corridor, unless it can be accomplished with minimal impact to these productive, fragile habitats.

## Effects on Migratory Birds

### Migratory Birds Impacts That Would Not Vary by Alternative

All three alternatives maintain the primary purpose of the Refuge as a sanctuary for migratory birds, with management guided, in part, by the species of conservation concern included in the New Hampshire Wildlife Action Plan (NH FGD 2005) and the BCR 14 bird conservation plan (Dettmers [revised 2006]). The alternatives differ modestly in the role of natural process management versus active management and the amount of meadow and other early successional habitat in proportion to mature forest habitat. Given the small size of the Refuge, the results of Refuge habitat management activities will create modest or negligible changes to the composition and numbers of migratory birds that use the Refuge when considered in a landscape context. Other activities, such as removal of dead, dying, and down trees from trails under all three alternatives, would reduce habitat components for some migratory birds. Removal of these trees for safety reasons could reduce habitat components that are important to some species, although this removal would occur primarily along the trail and possibly in certain parts of the viewshed, rather than throughout the forest or meadow.



*Wood thrush:* Steve Maslowski/USFWS

### Migratory Birds Impacts of Alternative A (Current Management)

Under Alternative A we would rely on natural processes (e.g., succession and disturbance), rather than any active forest management, to maintain the current extent of mature forest habitat (77.6 of 80 acres) for forest-dependent migratory birds such as Canada warbler and wood thrush. Natural tree falls and other blow downs within the otherwise maturing forest would create habitat conditions that benefit many migratory birds that rely on a diverse forest structure (Burris and Haney 2005, Walter and Maguire 2005). The resultant gaps in the forest canopy can improve conditions for tree seedling regeneration (Peterson and Pickett 1995). We would maintain the existing 1.4 acre meadow habitat to benefit migratory birds that require open habitat, such as American woodcock. The meadow would continue to be mowed at least once every other year, after September 15<sup>th</sup>, to prevent disturbance to ground nesting birds and during brood-rearing.

Although recreational trails may adversely impact breeding bird communities (Miller et al. 1998), the current low levels of Refuge visitation causes minimal habitat disturbance to migratory birds.

### **Migratory Birds Impacts of Alternative B (Enhanced Habitat Management and Visitor Services)**

Similar to Alternative A, we would rely primarily on natural processes (e.g., succession and disturbance), rather than any active forest management, to maintain the extent of mature forest habitat (approximately 76 of 80 acres) for forest-dependent migratory birds such as Canada warbler and wood thrush. Natural tree falls and other blow downs within the otherwise maturing forest would create habitat conditions that benefit many migratory birds that rely on a diverse forest structure (Burris and Haney 2005, Walter and Maguire 2005). The resultant gaps in the forest canopy can improve conditions for tree seedling regeneration (Peterson and Pickett 1995). Under this alternative, we would evaluate the forest every 10 to 15 years, and using adaptive management, retain the option of more active forest management to create and benefit habitat conditions to benefit migratory birds (Jobes et al. 2004, Hallworth et al. 2008), if forest conditions warrant.

An increase in the size of the meadow from 1.4 acres to approximately 3.0 acres would cause a corresponding decrease in the amount of forest habitat, though this is a negligible impact to forest habitat given the extent of forest in the surrounding landscape. Tree removal would focus on seedlings, saplings, and poles and would not remove any mature trees. The increase in meadow acreage could benefit forest species by providing sources of insects and fruits that many birds rely on during the breeding season and increase habitat for migratory birds that depend on open habitat, including the American woodcock (Rodewald and Brittingham 2007).

Given our predictions of only modest increases in Refuge visitation we only anticipate a minimal rise in disturbance to migratory birds. The greatest disturbance would likely occur to migratory birds using the lakeshore and those near the Ecology Trail, since those areas receive the greatest public use.

### **Migratory Birds Impacts of Alternative C (Active Habitat Management and Enhanced Visitor Services)**

Under Alternative C we would have a greater emphasis on active forest management to encourage regeneration, create early successional habitat, and increase meadow habitat. In addition to the expansion of the existing meadow to about 3.0 acres, we would create another one- to three-acre meadow on the Refuge. This would cause a corresponding decrease in the extent of forest habitat to 73 acres. We would locate the meadow to minimize any fragmentation of the mature forest habitat. Since this is a relatively modest change in habitat conditions, these modifications would likely have little effect on forest-dependent migratory birds, with perhaps a modest benefit to species that depend on meadow or open land habitat.

After evaluating current levels of forest regeneration, silvicultural prescriptions would be developed to create and enhance habitat conditions that benefit migratory birds if forest conditions warrant (Jobes et al. 2004, Hallworth et al. 2008). Similar to Alternative B, we would evaluate the forest every 10 to 15 years, and under this alternative, we would monitor forest responses to silvicultural prescriptions. Using adaptive management, we would adjust forest management actions accordingly as new information becomes available. The increase in visitor numbers projected for Alternative C would have incrementally higher likelihood for impacts to birds. This is not anticipated to be substantial when considered in the context of the Refuge because public use will be concentrated along developed trails.

## Effects on Public Use and Access

### Public Use and Access Impacts That Would Not Vary by Alternative

Four of the six priority public uses (wildlife observation, photography, environmental education, and interpretation) are allowed on the Refuge and would continue under all three alternatives. We would retain the 0.9 mile self-guided Ecology Trail, with changes to the trail varying by alternative. Under all alternatives, we would continue to prohibit boat landing along the 3,100 feet of undisturbed lakeshore, and would prohibit throughout the Refuge: motorized vehicles, bicycling, jogging, dog walking, camping and backpacking with the intention to camp, geocaching, picnicking, and horseback riding to protect Refuge resources. We would continue to rely on The Fells as an important partner in our outreach programs for Refuge visitors and the surrounding community.

Papouchis et al. (2001) found that desert bighorn sheep (*Ovis canadensis nelsoni*) were more impacted by hikers than by vehicles or mountain bikers, “apparently because hikers were more likely to be in unpredictable locations and often directly approached” the animals. Similarly, Stalmaster and Kaiser (1998) found that wintering bald eagle were most disturbed by foot traffic, with individuals flushed and feeding interrupted by the presence of human recreational activity; the eagles resumed feeding fairly quickly following disturbance, but the higher the number of disturbance events in a given day, the longer the time for the eagles to resume feeding. To the extent that watchable wildlife are disturbed and displaced by visitors to the Refuge, wildlife viewing and photography opportunities may be adversely impacted by becoming scarcer. The relatively low visitor use of the Refuge should minimize this impact, however, and avoid wildlife becoming habituated to visitors.



*Beech Brook stream crossing: Barry Parrish/USFWS*

### Public Use and Access Impacts of Alternative A (Current Management)

Under Alternative A we would continue to promote the four priority public uses mentioned above and fishing and hunting would continue to be prohibited on the Refuge. The small size of the Refuge, visitation occurring at the Refuge and The Fells during hunting season, and current levels of Refuge staffing and funding restrict our ability to provide, monitor, and enforce a quality hunting program. It is therefore not feasible under this alternative. Similarly, we would continue to maintain a no-fishing policy given current staffing and funding levels and lack of ability to monitor and enforce a quality fishing program. Hunting and fishing are both allowed on other lands in the area.

Environmental education and interpretive programs are limited under Alternative A due to a lack of any Refuge staff on-site. Any education and outreach on the Refuge is provided by partners, including The Fells, LSPA and Forest Society, and we would continue to make the Refuge available to partners for these priority public uses. We would maintain the self-guided Ecology Trail in its current location and the existing interpretive signs. Given the current location of the trail along the brook, we would anticipate some impacts to Refuge resources from public use of this section of the trail. With no on-site staff, our ability to conduct outreach and monitor unauthorized uses such as boat landing and picnicking is limited under Alternative A.

People and vehicles can be vectors for invasive plants when seeds or other propagules are moved from one area to another (Von Der Lippe and Kowarik 2007). Once established, invasives can out-compete native plants, thereby altering habitats and indirectly impacting wildlife (Weston et al. 2005, Lecerf et al. 2007). Fortunately, at this time, invasive plants are a minor problem at the Hay Refuge. Invasive plants known on the Refuge include Japanese barberry. The threat of invasive plant establishment will always be an issue requiring annual monitoring, and when necessary, treatment; however, invasives seem to be manageable at the Refuge, thanks to the control efforts of The Fells and their volunteers. Any decline in the visitor use experience caused by the presence of invasive species, therefore, is minimal.

### **Public Use and Access Impacts of Alternative B (Enhanced Habitat Management and Visitor Services)**

Similar to Alternative A, we would continue to promote the four priority public uses mentioned above, and hunting would continue to be prohibited on the Refuge for the same reasons mentioned under Alternative A. Under Alternative B we would open the Refuge to fishing, one of the six priority public uses not currently allowed on the Refuge. This would expand the public uses of the Refuge and potentially attract a new group of visitors (i.e., anglers) to the Refuge; parking for anglers would be limited to a new two- or three-vehicle parking area off of Woods Road in the southeast corner of the Refuge.

The addition of fishing as a public use on the Refuge would likely increase Refuge visitation to some degree. However, it is not expected to become a fishing hotspot because there are no unique gamefish resources on the Refuge. The Refuge's small size and the provision of a limited angler parking area that would accommodate only a few cars would restrict the number of anglers at any one time. Because fishing is a quiet pastime that often requires some amount of solitude for success, it is anticipated that anglers may choose times of the day and locations on the Refuge that would minimize interactions with other Refuge recreationists, although peak periods of use would undoubtedly be weekends and holidays. Most visitors will be concentrated on the Ecology Trail, which is on the northern portion of the Refuge and disjunct from the proposed angler access. We do not anticipate substantial user conflicts between anglers and other Refuge visitors because they will tend to be spatially separated. In addition, fishing is a generally accepted pastime, and the inclusion of this activity as a public use is not anticipated to result in negative responses by other Refuge users.

Under Alternative B we would hire a seasonal visitor services staff person that would expand opportunities for the four current priority public uses with more brochures, public programs, and community outreach. Stand-alone interpretive signs along the trail and a kiosk at the trailhead would increase interpretation on Refuge resources. We would continue to rely on our partnership with The Fells to provide year-round outreach and education. The seasonal staff would also provide greater outreach and monitoring to Refuge visitors and the local community about uses that are not allowed on the Refuge. All of these education and outreach measures would improve the visitor use experience at the Refuge.

Under Alternative B, we would relocate the Ecology Trail away from the brook, as needed, to minimize the impacts of public use on Refuge resources and provide improved wildlife viewing opportunities. The addition of a footbridge(s) or similar crossing structure across Beech Brook would improve visitor safety along the Ecology Trail. The addition of a spur trail to the closest fen, the trail extension back to trailhead within Refuge bounds, and a new trail for anglers to the lakeshore would expand opportunities for visitors to learn about the natural resources of the Refuge.

Weather-related events, while not common, can be disruptive to refuge operations, particularly visitation. Windthrow and widow makers (i.e., trees or limbs caught in the overhead canopy) may make it necessary to close Refuge trail(s) or if the damage is widespread, the entire Refuge. In either case, it will be necessary to eliminate hazards to public and employee safety. Once the hazards are removed, visitor access would be restored; therefore the impacts of the proposed forestry management activities would be short-term, but moderate if closure of the Refuge is required.

### **Public Use and Access Impacts of Alternative C (Active Habitat Management and Enhanced Visitor Services)**

Similar to Alternatives A and B, we would continue to promote the four priority public uses mentioned above. Under Alternative C we would open the Refuge to fishing and complete a Hunt Plan and develop Refuge-specific regulations for a limited, archery-only deer season. These priority public uses are not currently allowed on the Refuge. As mentioned earlier in this chapter, the Refuge acknowledges the need to conduct additional environmental review and administrative procedures before hunting can be an approved use; this review would include looking at potential impacts to the other public uses.

As in Alternative B, the addition of fishing as a public use on the Refuge would likely increase Refuge visitation to some degree. However, it is not expected to become a fishing hotspot because there are no unique gamefish resources on the Refuge. The Refuge's small size and the provision of a limited angler parking area that would accommodate only a few cars would restrict the number of anglers at any one time. Because fishing is a quiet pastime that often requires some amount of solitude for success, it is anticipated that anglers may choose times of the day and locations on the Refuge that would minimize interactions with other Refuge recreationists, although peak periods of use would undoubtedly be weekends and holidays. Most visitors will be concentrated on the John Hay Ecology Trail, which is on the northern portion of the Refuge and disjunct from the proposed angler access. We do not anticipate substantial user conflicts between anglers and other Refuge visitors because they will tend to be spatially separated. In addition, fishing is a generally accepted pastime, and the inclusion of this activity as a public use is not anticipated to result in negative responses by other Refuge users.

The proposed deer hunting under Alternative C would open the Refuge to a new user group, but could also adversely impact non-hunting use of the Refuge and The Fells. It is possible that non-hunting recreationists would have negative feelings regarding hunting in general, or would not feel comfortable using the Refuge during the hunting season. This could also cause an associated reduction in visitation for The Fells, an important source of revenue for them, due to the shared parking area and interconnected trail system. These impacts would potentially be moderate but short-term as they would only occur during the hunting season. The impacts could become long-term, however, if conflicts amongst the user groups persist over time and affect long-time, frequent users of the Refuge or The Fells. Outreach and education would be important components of this Refuge hunt program to avoid these conflicts and increase awareness. Hunting has been allowed on Forest Society property across Route 103A from the Refuge, and this has not lead to serious adverse impacts in terms of public use or user conflicts. Before any hunt plan would be approved, these impacts would be further evaluated in a separate EA.

Under Alternative C we would hire a full-time visitor services staff person that would expand opportunities for the four priority public uses with more materials for school programs, brochures, public programs, and community outreach. Stand-alone interpretive signs along the trail and a kiosk at the trailhead would increase interpretation for Refuge resources. We would continue to partner with The Fells outreach and education. The full-time staff would also provide greater outreach and monitoring to Refuge visitors and the local community about uses that are not allowed on the Refuge.

As in Alternative B, we would relocate the trail away from the brook and/or install a footbridge(s), as needed, to minimize the impacts of public use on Refuge resources and provide improved wildlife viewing opportunities. Under Alternative C we would explore the opportunity to enhance the Ecology Trail so that it is ADA compliant; this would likely include a widening of the trail, a change in the surface materials, and the construction of a viewing platform at the lakeshore that could also serve as a fishing pier. ADA-compliance would open the Refuge to a broader audience, potentially increasing visitation on the Refuge. This would result in the Refuge reaching a greater number and diversity of people to increase awareness of the Refuge, its resources, the role it plays in the local landscape and in the Refuge System, and ultimately to demonstrate the value and importance of natural resources stewardship.

Weather-related events, while not common, can be disruptive to refuge operations, particularly visitation. Windthrow and widow makers (i.e., trees or limbs caught in the overhead canopy) may make it necessary to close a Refuge trail or, if the damage is widespread, the entire Refuge. In either case, it will be necessary to eliminate hazards to public and employee safety. Once the hazards are removed and the Refuge is safe, visitor access would be restored; therefore the impacts of the proposed forestry management activities would be short-term, but moderate if closure of the Refuge is required. More active forest management under this alternative would also potentially require temporary closures of certain sections of the Refuge at any given time; impacts in this case would also be short-term, and closure of the entire Refuge would be unlikely.

## Effects on Cultural Resources

### Cultural Resources Impacts That Would Not Vary by Alternative

The Refuge was originally part of the John Hay estate and as such was maintained by the Hays as open meadows and pastures with expansive views to the lake. This cultural heritage is important to the local community and guides the management of the The Fells, which abuts the Refuge. The Hay estate itself is listed on the National Historic Register. None of our proposed actions have the potential to impact these cultural resources as they are no longer part of the Refuge.

Under all three alternatives, we would initiate an archaeological survey prior to any ground-disturbing activities, and would consult with the NH SHPO. We would especially be thorough in areas along Beech Brook and the shoreline where there is a higher probability of locating a site. We do not anticipate any differences in cultural impacts among the three alternatives.

## Cumulative Impacts

According to the CEQ NEPA implementing regulations at 40 CFR 1508.7, “Cumulative impact” is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-

Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

This cumulative impacts assessment includes other agencies' or organizations' actions if they are inter-related and influence the same environment. Thus, this analysis considers the interaction of activities at the Refuge with other actions occurring over a larger spatial and temporal frame of reference.

### **Air Quality**

Air quality is generally good in the region, with some periods during the year with high ozone levels. We would expect short-term, negligible, localized effects on air quality from the emissions of motor vehicles used by staff and Refuge visitors. However, we expect none of the activities on the Refuge to contribute to any measurable incremental increase in ozone levels or other negative air quality parameters. We expect none of the alternatives to cause any greater than negligible cumulative adverse impacts on air quality locally or regionally.

With our partners, we would continue to contribute to improving air quality by maintaining the natural vegetation of the Refuge, which ensures that those areas will continue to filter out many air pollutants harmful to humans and the environment.

### **Water Quality and Soils**

There would be no significant cumulative adverse effects to water quality or soils under any of the alternatives. Best management practices and actions to minimize or prevent erosion, soil compaction, runoff, and sedimentation would be used in any management activities and changes to infrastructure to ensure impacts are minimized or removed. Under Alternatives B and C there would be cumulative benefits to water quality and soils from greater assessments of existing conditions, improving site conditions as needed, and greater on-site monitoring and outreach on sensitivity of these resources.

### **Biological Resources**

All alternatives would maintain or improve biological resources on the Refuge. We would work closely with our partners locally and in the state to collaborate on resource management, assessment and enhancement of Refuge biological resources, and monitoring of impacts to biological resources. There would be no significant cumulative adverse effects to biological resources under any of the alternatives because our management would use a mix of natural processes and active management, based on adaptive management, to maintain habitat conditions for migratory birds. Biological resources, such as invasive plant species, that we would manage to prevent introduction, limit, or eliminate, are not natural components of the Refuge; their losses where they occur would not be considered adverse.

Alternatives B and C propose new public uses on the Refuge; fishing and both fishing and hunting, respectively. These activities would result in the direct loss of individual wildlife, but would not impact populations. Although there are global concerns about overfishing inland waters (Allan et al. 2005), the NH FGD provides annual rules that minimize the cumulative effects of inland fishing in the state and this new public use in the Refuge would comply with all state regulations. As noted previously, the direct, indirect, and cumulative impacts of any new hunting program would be detailed in separate environmental assessments if and when that activity was proposed.

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## **Socio-Economic Environment**

We expect none of the three proposed alternatives to have a significant adverse cumulative impact on the economy of the town or county in which the Refuge lies. We would expect none of the alternatives to alter the demographic or economic characteristics of the local community. The actions we propose would neither disproportionately affect any communities nor damage or undermine any businesses or community organizations. Implementing Alternatives B or C would result in several minor beneficial impacts on the social communities near the Refuge and in the region as a whole. We would expect public use of the Refuge to increase modestly, thereby increasing the number of days visitors spend in the area and, correspondingly, the level of visitor spending in the local community. Funding a seasonal staff (Alternative B) or a full-time staff (Alternative C) would also make a small, incremental contribution to the employment and income in the local community. Purchasing materials locally for trail relocation (Alternative B) or enhancement (Alternative B or C) would have a minimal but positive effect on the local economy.

More emphasis on education and outreach in Alternatives B and C should foster more understanding and appreciation of resource issues and needs, and could lead to increased political support and funding, which could positively affect fish and wildlife resources in the Refuge and around Lake Sunapee. The increased outreach of these alternatives could also positively affect land use decisions outside the Refuge by local governments and private landowners, and thus, lead to improved fish and wildlife habitat over a broader area.

## **Cultural Resources**

We expect none of the alternatives to have significant adverse cumulative impacts on cultural resources in the region. We would work with our partners in the state and federal agencies to identify and protect any discovered sites.

## **Cumulative Impacts of Global Climate Change**

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

The Wildlife Society (TWS) published an informative technical review report in 2004 titled “Global Climate Change and Wildlife in North America” (TWS 2004). It interprets results and details from such publications as the Intergovernmental Panel on Climate Change (IPCC) reports (1996-2002) and describes the potential impacts and implications on wildlife and habitats. It mentions that projecting the impacts of climate change is hugely complex because not only is it important to predict changing precipitation and temperature patterns, but more importantly, to predict their rate of change, as well as the exacerbated effects of other stressors on the ecosystems. Those stressors include loss of wildlife habitat to urban sprawl and other developed land uses, pollution, ozone depletion, exotic species, disease, and other factors.

The effects of climate change on populations and range distributions of wildlife are expected to be species specific and highly variable, with some effects considered negative and others considered positive. Generally, the prediction in North America is that the ranges of habitats and wildlife will generally move upwards in elevation and northward as temperature rises (TWS 2004). The TWS report, however,

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

Our review of proposed actions in this CCP suggest that only three activities may contribute negligibly, but incrementally, to stressors affecting regional climate change: our meadow mowing program, our use of vehicles and equipment to administer the Refuge, and the removal of trees to expand the existing, and/or to create a new, meadow. We discuss the direct and indirect impacts of those activities elsewhere in Chapter 4. We also discuss measures to minimize the impacts of both. With regards to our equipment and facilities, we are trying to reduce our carbon footprint wherever possible by using alternative energy sources and energy saving appliances, driving hybrid vehicles, and using recycled or recyclable materials, along with reduced travel and other conservation measures. With regards to mowing, we mow only once every two years in the fall to keep the fields free of woody growth. The removal of seedling, sapling and pole trees would occur in a limited area, would not detract from the mature canopy, and would not be irreversible.

In our professional judgment, most of the management actions we propose would not exacerbate climate change in the region or project area, and in fact, some might incrementally prevent or slow down local impacts (e.g., proposed stream enhancements). The TWS report provides 18 recommendations to assist land and resource managers in meeting the challenges of climate change when working to conserve wildlife resources (TWS 2004). Their position is that if land and resource managers collectively implement these recommendations, then cumulatively there would be a positive impact of addressing climate change. We discuss our actions relative to addressing recommendations relevant to this CCP:

- *Recognize climate change as a factor in wildlife conservation*  
The Service is taking a major role among federal agencies in distributing and interpreting information on climate change. There is a dedicated webpage to this issue at [www.fws.gov/home/climatechange/](http://www.fws.gov/home/climatechange/). The Service's Northeast Region co-hosted a workshop in June 2008 titled "Climate Change in the Northeast: Preparing for the Future."
- *Manage for diverse conditions*  
Our proposed habitat management actions described in Chapter 2 are intended to promote healthy, functioning native forests and meadows, and protect the integrity of lake shore and riparian areas. Our proposed management actions take into account the Refuge's role in the larger landscape. We will implement an adaptive management approach as new information becomes available.
- *Expect surprises, including extreme events*  
Refuge managers have flexibility within their operations funds to deal with emergencies. Other Regional operations funds could also be re-directed as needed to deal with an emergency. The proposed forest management activities in the case of catastrophic weather events or pathogen occurrences allow us the flexibility to respond to unexpected extreme events.

## **Relationship between Short-term Uses of the Human Environment and Enhancement of Long-term Productivity**

All of the alternatives strive to maintain or enhance the long-term productivity and sustainability of natural resources on the Refuge, in the Lake Sunapee region, and migratory birds across all landscape

scales. The alternatives strive to conserve our Federal trust species and the habitats they depend on. Outreach and environmental education are a priority in each alternative to encourage visitors to be better stewards of our environment. The dedication of certain areas for information kiosks and trails represents a potential loss of long-term productivity on localized areas, but is not considered significant given the small footprint of these activities. In summary, we predict that all alternatives would contribute positively to maintaining or enhancing the long-term productivity of the environment.

## Unavoidable Adverse Effects

Unavoidable adverse effects are the effects of those actions that could cause significant harm to the human environment and that cannot be avoided, even with mitigation measures. There would be some minor, localized unavoidable adverse effects under all the alternatives. For example, there would be minor, localized adverse effects of mowing fields and controlling invasive plants. Under Alternatives B and C there would be increased visitation that could have unavoidable effects. However, none of these effects rises to the level of significance. All would be mitigated, so there would in fact be no significant unavoidable adverse impacts under any of the alternatives.

## Potential Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those which cannot be reversed, except perhaps in the extreme long term or under unpredictable circumstances. An example of an irreversible commitment is an action which contributes to a species' extinction. Once extinct, it can never be replaced. We would anticipate no irreversible commitments of resources under any of the alternatives.

In comparison, irretrievable commitments of resources are those which can be reversed, given sufficient time and resources, but represent a loss in production or use for a period of time. An example of an irretrievable commitment is the maintenance of meadows for woodcock. If for some reason woodcock management were no longer an objective, these would gradually revert to mature forest, or the process could be expedited with plantings.

We could consider small visitor facilities, such as kiosks and educational signs, irretrievable commitment of resources. However, we can dismantle those facilities and restore the sites if resource damage is occurring.

## Environmental Justice

Executive Order 12898 "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" (February 11, 1994), requires that Federal Agencies consider as part of their action, any disproportionately high and adverse human health or environmental effects to minority and low income populations. Agencies are required to ensure that these potential effects are identified and addressed.

The EPA defines environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies" (<http://www.epa.gov/oecaerth/environmentaljustice/index.html>). In this context, fair treatment means that no group of people should bear a disproportionate share of negative environmental consequences resulting from the action.

The community surrounding the Refuge is relatively homogenous; minority groups do not represent a substantial portion of the affected community. Overall, we expect none of the alternatives to place disproportionately high, adverse environmental, economic, social, or health effects on minority or low-income persons. Our programs and facilities are open to all who are willing to adhere to the established Refuge rules and regulations, we acquire land only from willing sellers, and we do not discriminate in our responses for technical assistance in managing private lands.

**Table 4.1. Matrix of Environmental Consequences.**

John Hay NWR Resources	Alternative A Continue Current Management	Alternative B Enhanced Habitat Management and Visitor Services <b>Service-preferred alternative</b>	Alternative C Active Habitat Management and Enhanced Visitor Services
<b>Socioeconomic</b>	<p>Minimal contribution to the local economy from refuge visitors each year and their expenditures in the community.</p> <p>We contribute minimally to the local economy, in terms of refuge staff jobs, income, expenditures, and purchases of goods and services for refuge activities, since there are no on-site staff</p>	<p>Enhancing refuge programs, seasonally, would increase public use an estimated 15 percent to approximately 2,075 visitors each year, thereby increasing their expenditures in the local economy. That increase would be negligible in the context of the community and region in which the refuge lands lie.</p> <p>Adding one seasonal refuge staff position to be stationed at The Fells would minimally increase benefits for the local economy in jobs, income, and expenditures. Construction of a kiosk and trail improvements would also add minimal expenditures in the local economy for labor, materials, and services.</p>	<p>Adding one full-time visitor services staff person stationed at the Fells and enhancing refuge programs year-round would increase public use to approximately 2,800 visitors each year. Otherwise, effects similar to alternative B; a slight increase in expenditures from visitors, but still negligible in relation to the local and regional economy.</p> <p>Refuge activities including increased forest management would add to the local economy through the occasional contracting with local loggers to complete the work, and would provide revenue to the local community through the Timber Yield Tax. On public lands, the town is entitled to 10 percent of the stumpage value at the time of harvest. Though this would likely be for sporadic salvage or small scale cuts only, it would provide some additional revenue to the town.</p>
Service land ownership would remain the same under all three alternatives; refuge revenue sharing payments			

	and impacts on property taxes are not affected.		
<p><b>Water Quality</b></p>	<p>In Alternative A, we rely on water quality sampling of Beech Brook by Lake Sunapee Protective Association; the brook consistently has one of the lowest levels of phosphorus and conductivity on the lake, serving as a reference site for other tributaries.</p> <p>Minimal impact to water quality by leaving the existing trail in its present location, paralleling and crossing a stretch of the brook. Unknown effects of runoff and sedimentation on water quality from Route 103A, which forms eastern boundary of the refuge.</p> <p>Continuing to protect the 3,100 feet of undisturbed lake shoreline, 0.1 acre Minute Island, and 1,750 feet of Beech Brook by preventing certain public uses such as boat landing and fishing will help protect water quality.</p> <p>Continuing to prevent motorized vehicles, dog walking, camping, and horseback riding under all three alternatives protects and maintains water quality.</p>	<p>As in alternative A, continued LSPA monitoring of the brook will serve as water quality indicator.</p> <p>Relocating the trail away from sensitive riparian areas and/or installing a footbridge(s), will further improve water quality of the brook. Two new trails (a spur loop trail to the nearest fen and a trail from the new parking area along Wood Road to the lakeshore) will be primitive trails with no stream crossings and will focus visitor use on developed trails.</p> <p>An assessment of the potential effects of Route 103A winter road treatments on Beech Brook from runoff and sedimentation and taking mitigating steps will benefit water quality.</p> <p>Hiring of a seasonal visitor services person will benefit water quality by having someone onsite to monitor public uses, ensure compliance, and provide more public outreach about the sensitivity of the undisturbed shoreline.</p> <p>Though increases in visitor use of</p>	<p>As in alternative A and B, continued LSPA monitoring of the brook will serve as the water quality indicator.</p> <p>As in B, relocating the trail away from sensitive riparian areas and/or installing a footbridge(s), will further improve water quality of the brook and the two new trails will focus visitor use along designated trails. Establishing a water quality monitoring site on Beech Brook downstream of Route 103A to measure potential impacts of runoff and sedimentation from road, would further protect water quality.</p> <p>Hiring of a full-time visitor services person will benefit water quality by having someone on-site to monitor public uses, ensure compliance, and provide more public outreach about the sensitivity of the undisturbed shoreline.</p> <p>As in B, any benefits in water quality from increased outreach and monitoring could be off-set by an increase in visitor use of the trail and shoreline and the addition of a trail for angler use.</p>

		<p>the trails and shoreline, especially with fishing as an allowed use, could pose some risk to water quality, the combination of outreach, monitoring, and trail improvements are thought to counteract any potential adverse impacts associated with higher visitorship. There will likely be soil compaction on the designated access route for anglers; however, this trail will be aligned to minimize resource impacts. The majority of visitors stay on designated trails, and even if anglers, for example, were to venture off trail to fish, this impact is perceived to be low because fishing pressure will likely be low due to access limitations. We propose to monitor these sites closely and address any changes that may negatively impact the resource.</p> <p>In the event that mechanized equipment and access roads become necessary to conduct forestry management actions (i.e., catastrophic weather events, pathogen infestations), impacts to water quality will be short-term and mitigated by the use of forestry BMPs.</p>	<p>Additionally, this alternative proposes to widen the trail and add a wildlife viewing/fishing platform, which could affect water quality in the short term during construction. Overall, these improvements would likely reduce impacts to water quality by providing a buffer between the relocated trail and stream, encouraging people to stay on a more clearly defined trail, and by providing a platform so that people are not directly impacting the shoreline. We propose to monitor these sites closely and address any changes that may negatively impact the resource.</p> <p>As in B, any impacts to water quality by forest management activities will be mitigated by the use of forestry BMPs.</p>
<p>None of our proposed management activities would violate federal or state standards for contributing pollutants to water sources; all three would comply with the Clean Water Act.</p>			

<b>Air Quality</b>	Current management activities neither substantially benefit nor adversely affect local and regional air quality.	Small increase, but negligible adverse effects from increased vehicle emissions, a result of modest increase in visitation.	Similar to B, but somewhat greater in magnitude due to larger area managed as meadow, a wider viewing corridor, and initiation of active forest management.
	None of our proposed management activities should adversely affect regional air quality. None would violate EPA standards for criteria air pollutants; each would comply with the Clean Air Act		
<b>Soils</b>	<p>Posting signs to prohibit boat landing will have minimal, localized impacts, off-set by benefits of preventing compaction and erosion from unauthorized uses.</p> <p>Keeping trail in existing location along and across brook may cause some soil compaction and erosion near the brook</p>	<p>Enhanced monitoring of trails and shoreline to identify and mitigate erosion will help protect soil productivity.</p> <p>Relocating the trail away from the brook, installing foot bridge(s) and minimizing crossings will have short-term impacts from a crew relocating the trail; this will be off-set by long-term benefits of moving the trail. There also would be soil compaction on the trail extension to the fen and the new route back to the parking area that avoids crossing onto The Fells. These impacts would be limited to the trail surface.</p> <p>Installation of additional interpretive signs along the trail and a kiosk at the trailhead will have minimal localized impacts.</p> <p>Increased visitation, including addition of fishing, could increase soil compaction and increase potential for erosion, though this would depend on fishing pressure,</p>	<p>In addition to the benefits and adverse impacts described for alternative B, under alternative C widening of the trail and installation of a viewing platform on the lakeshore will have modest increase in adverse impacts along the trail and at the lakeshore from increased soil compaction and increased potential for erosion in the short term during construction. We would employ Best Management Practices to minimize these impacts. The improvements, once completed, would concentrate visitor use on the designated trail, and would decrease the occurrence of off-trail use of the Refuge. We would design the trail, including use of boardwalks, outreach and education programs to reduce this risk.</p> <p>Compared to alternative B, the clearing of another meadow and greater use of forest management practices under alternative C would have a modest increase in</p>

		<p>which is likely to remain low, and also trail improvements which would minimize impacts. We would design monitoring, outreach, and education programs to reduce risk.</p> <p>Short-term, localized soil impacts from clearing of more meadow and slight increase in forest management would be minimized using best management practices.</p>	<p>short-term localized soil impacts. Best management practices would be used to minimize adverse effects.</p>
<p><b>Forest Habitat and Wildlife</b></p>	<p>Relies on natural processes, succession and disturbance, to maintain forest characteristics, benefiting forest-dependent focal species, and maintaining a mature forest habitat condition.</p> <p>Removal of fallen trees and dead and dying trees for safety reasons and to maintain a viewshed could reduce a habitat component for some species that rely on dead, dying, and downed trees. However, hazard trees would be cut &amp; left in place, so there would not be a reduction of coarse woody debris.</p> <p>Use of the Ecology Trail may disturb breeding birds and other wildlife, but the relatively low visitor use is offset by the comparably high acreage of mature forest available for wildlife</p>	<p>Relies mostly on natural processes to maintain mature forest habitat and some active management to maintain viewshed and create early successional habitat (including larger meadow).</p> <p>Where feasible, saplings, seedlings and pole trees would be cut to increase meadow extent from 1.4 to 3.0 acres. Any losses in a small amount of forest acreage would be offset by a modest increase in diversity of habitat structure that could benefit forest focal species.</p> <p>Conduct forest inventory every 10- to 15-years and, using adaptive management, conduct active forest management as conditions dictate. Use of forestry BMPs would mitigate any potential impacts to forest habitat</p>	<p>A greater emphasis on active forest management to encourage regeneration, create early successional habitat, and create additional meadow, may cause modest reduction in habitat for mature forest focal species; impacts depend on type and extent of forest management occurring in surrounding forested landscape. Where feasible, we would minimize cutting mature trees and concentrate instead of younger stands of saplings, seedlings and pole trees. Any losses in a small amount of forest acreage would be offset by a modest increase in diversity of habitat structure that could benefit forest focal species.</p> <p>Conduct forest inventory every 10- to 15-years and, using adaptive management, conduct active forest management as</p>

	<p>versus the short trail length.</p>	<p>and wildlife.</p> <p>As in alternative A, removal of fallen trees and dead and dying trees for safety and access reasons could reduce a habitat component for some species that rely on dead, dying, and downed trees. However, hazard trees would be cut and left in place, so there would be not be a reduction of coarse woody debris.</p> <p>As in A, human use of existing and new forest trails may disturb some wildlife but this is offset by relatively low visitor use, short trail lengths, and the new opportunities to use developed trails instead of hiking off-trail. We propose to monitor these sites and address any changes that may negatively impact the resource.</p>	<p>conditions dictate. Use of forestry BMPs would mitigate any potential impacts to forest habitat and wildlife.</p> <p>As in alternatives A and B, removal of fallen trees and dead and dying trees for safety, aesthetic, and access reasons and to maintain a viewshed could reduce a habitat component for some species that rely on dead, dying, and downed trees. However, hazard trees would be cut and left in place, so there would be not be a reduction of coarse woody debris.</p> <p>As in A and B, human use of existing and new forest trails may disturb some wildlife but this is offset by relatively low visitor use, short trail lengths and the new opportunities to use developed trails instead of hiking off-trail. We propose to monitor these sites and address any changes that may negatively impact the resource.</p> <p>The addition of hunting as an allowed use would negatively impact forest understory vegetation as hunters hike off-trail, a small number of trees if tree stands are used, and disturb forest wildlife; impacts would be</p>
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			limited to the hunting season and would be mitigated by controlling the number of hunters.
<b>Meadow Habitat</b>	No change in impacts as existing 1.4 acre meadow would continue to be mowed every other year, or as needed, after September 15 <sup>th</sup> .	<p>Expansion of the meadow up to 3.0 +/- acres would reduce young forest habitat by a negligible amount, while creating additional and more suitable habitat for meadow focal species.</p> <p>An increase in meadow habitat would require a modest expansion of active management (mowing, cutting, clearing) to maintain the habitat condition. Meadow maintenance would be the same as Alternative A.</p>	<p>In addition to B, this alternative proposes another 1-3 acre meadow that would further reduce mature forest habitat by a similar amount, but would minimize cutting mature trees, and instead would seek younger stands of saplings, seedlings and pole trees.</p> <p>The additional meadow would benefit focal species dependent on this habitat type, and would require additional active management to maintain meadow habitat above levels in Alternative B. Meadow maintenance would be the same as Alternative A.</p>
<b>Shoreline/Minute Island</b>	Posting signs along the lakeshore and working with NH Marine Patrol to monitor and enforce posted signs would continue to protect 3,100 feet of undisturbed shoreline and 0.1 acre Minute Island by preventing public uses that pose risk.	<p>In addition to A, hiring a seasonal visitor services staff person as proposed in Alternative B, will further protect the shoreline through increased monitoring, outreach, and assessment of baseline conditions.</p> <p>Increases in visitation, including the addition of fishing, would cause a higher risk to the undisturbed shoreline and wildlife. However, the addition of on-site seasonal staff to monitor public uses, ensure compliance, and provide more public outreach</p>	<p>In addition to A, hiring a full-time visitor services staff person as proposed in Alternative C, will provide enhanced protections to the shoreline through even greater monitoring, outreach, and deployment of refuge law enforcement on busy days.</p> <p>Increases in visitation, including the addition of fishing, and a proposed widening of the trail and viewing platform/fishing pier at the lakeshore would have adverse impacts on the undisturbed shoreline habitat and wildlife in</p>

		<p>about the sensitivity of the undisturbed shoreline may help minimize these impacts.</p>	<p>the short term during construction. We would employ BMPs to minimize these impacts. The improvements, once completed, would concentrate visitor use on a more clearly defined trail, which would decrease the occurrence of off-trail use of the Refuge, and would provide a platform so that people are not directly impacting the shoreline. Year-round on-site staff would be able to monitor public uses, ensure compliance and provide more public outreach about the sensitivity of shoreline habitat. In addition, the trail enhancement and platform proposed may concentrate use in these designated areas, minimizing disturbance to other areas of the Refuge and shoreline.</p>
<p><b>Riparian and In-Stream Habitat</b></p>	<p>Relying on water quality sampling of Beech Brook by the LSPA would help monitor for potential water quality issues that may impact in-stream habitat conditions and associated riparian areas.</p> <p>Maintaining the current extent of mature forest habitat retains a closed canopy forest above the stream corridor, which is important for fish species of concern.</p>	<p>Re-locating the trail from its existing location along and across the brook and/or installing footbridges would minimize or eliminate potential adverse effects on habitat from trail erosion and runoff. This would help off-set potential risk from increased visitation and proposed fishing.</p> <p>Maintaining the current extent of mature forest habitat would retain a closed canopy forest above the stream corridor, which is beneficial for fish species of</p>	<p>In addition to Alternative B, this alternative includes one stream enhancement project and assessment and restoration of stream riparian habitat to benefit fish species of concern.</p> <p>Maintaining the current extent of mature forest habitat would retain a closed canopy forest above the stream corridor, which is beneficial for fish species of concern. Making the Ecology Trail ADA compliant would result in elimination of about 600 square</p>

		<p>concern.</p> <p>Evaluating in-stream habitat conditions and fish populations.</p> <p>Assessing the impacts of Route 103A winter road treatments on stream and riparian health would help protect habitat conditions, benefiting fish and the water quality of the lake.</p> <p>In the event that forestry management actions become necessary, motorized equipment will not be allowed to work in the Beech Brook riparian corridor, unless it can be accomplished without impacting these productive, fragile habitats</p>	<p>feet of riparian vegetation.</p> <p>Installation of a water quality monitoring station on the brook below Route 103A would benefit habitat and water quality by proactively identifying and mitigating road runoff.</p> <p>In the event that forestry management actions become necessary, motorized equipment will not be allowed to work in the fens and Beech Brook riparian corridor, unless it can be accomplished without impacting these productive, fragile habitats.</p>
<p><b>Wetlands Habitat</b></p>	<p>Locations of vernal pools, fens, and other wetlands would be recorded as encountered and largely protected though lack of active management in the surrounding upland, thereby maintaining the hydrology and soil holding capacity. No predicted increases in refuge visitation that would potentially increase risk.</p>	<p>More proactive inventory and mapping of vernal pools, fens, and wetlands would provide greater protection and recognition of these habitats and benefit species of concern associated with these habitats.</p> <p>Recording of vernal pool obligate species found on the refuge would be beneficial by confirming the importance of the refuge vernal pools to these species.</p> <p>In the event that forestry management actions become</p>	<p>In addition to B, explores opportunity to create a new vernal pool or enhance existing pool.</p> <p>In the event that forestry management actions become necessary, motorized equipment will not be allowed to work in the fens, unless it can be accomplished without impacting these productive, fragile habitats.</p> <p>The creation of a trail from the Ecology Trail to the nearest fen and back would provide additional opportunities for interpretation</p>

		<p>necessary, motorized equipment will not be allowed to work in the fens, unless it can be accomplished without impacting these productive, fragile habitats.</p> <p>The creation of a trail from the Ecology Trail to the nearest fen and back would provide additional opportunities for interpretation and wildlife observation and photography. We would conduct monitoring to ensure that management activities or trail relocation do not adversely impact the fens.</p>	<p>and wildlife observation and photography. We would conduct monitoring to ensure that management activities or trail relocation do not adversely impact the fens.</p>
<p><b>Migratory Birds</b></p>	<p>All three alternatives maintain the primary purpose of the refuge as a sanctuary for migratory birds. The alternatives differ modestly in the role of natural process management versus active management and the amount of meadow and other early successional habitat in proportion to mature forest habitat. Given the small size of the Refuge, the results of refuge habitat management activities will create modest or negligible changes to migratory birds that use the refuge. Other activities, such as removal of dead, dying and down trees, increased visitation, and expanded trail and lakeshore activities may cause greater disturbance and impacts to migratory birds.</p>		
	<p>Maintains emphasis on mature forest habitat, sustained through natural processes. Low level of public use has a minimal affect on birds.</p>	<p>Modest expansion of meadow habitat to benefit early successional focal species and for viewshed management; negligible negative impact on mature forest habitat and associated birds. The projected higher visitation would not appreciably increase impacts to birds.</p>	<p>Slightly greater emphasis on early successional habitat by up to 6.0 +/- acres and associated focal species and more active forest management to enhance regeneration of cultural heritage component; negligible negative impact on mature forest habitat and associated birds. As in Alternative B, the projected higher level of visitation would not substantially increase impacts to birds.</p>

<p><b>Public Use &amp; Access</b></p>	<p>Four of the six priority public uses (wildlife observation, photography, environmental education, and interpretation) are allowed on the Refuge and would be continued. Fishing and hunting are currently not allowed.</p> <p>Environmental education and interpretive programs are limited to that provided by partners and existing Refuge brochures due to lack of any refuge staff on-site; outreach is provided by partners through an MOU with The Fells, and the 0.9 mile self-guided trail.</p> <p>The lack of on-site staff prevents adequate monitoring and enforcement of unauthorized uses such as boat landing, picnicking, fishing, biking, cross-country skiing or snowshoeing, and monitoring of trail uses and impacts to resources.</p>	<p>Hiring of a seasonal visitor services staff person would expand opportunities for the five priority public uses with more materials for school programs, brochures, public programs, community outreach, and more stand-alone interpretive signs along trail and a kiosk at trailhead.</p> <p>Continue to rely on partners for assistance with year-round outreach and education. Maintain year-round no hunting.</p> <p>Opening the Refuge to fishing would increase visitation somewhat by attracting anglers, a new user group, to the Refuge.</p> <p>Re-locating the John Hay trail away from the brook and/or installing footbridge(s) and creating two new trails would protect refuge resources from public use impacts and allow new locations to take advantage of wildlife viewing opportunities.</p> <p>Visitor use may be adversely impacted by temporary trail and/or Refuge closures to respond to catastrophic weather events (i.e., removal of hazard trees) but will be offset by improvements to visitor safety.</p>	<p>Hiring of a fulltime visitor services staff person would expand opportunities for the six priority public uses with more materials for school programs, brochures, public programs, community outreach, and more stand alone interpretive signs along trail and a kiosk at trailhead.</p> <p>Opening the Refuge to fishing would increase visitation somewhat by attracting anglers, a new user group, to the Refuge.</p> <p>Evaluate the compatibility of archery-only deer hunting. The addition of hunting would increase visitation somewhat by attracting this new user group to the Refuge; however, it could potentially result in conflicts with existing visitor user groups.</p> <p>As in B, re-locating the John Hay trail away from the brook and/or installing footbridge(s) and creating new trails would protect refuge resources from public use impacts and allow new location to take advantage of wildlife viewing opportunities.</p> <p>Expands opportunity for trail access by creating an Americans with Disabilities compliant trail,</p>
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			<p>by widening the existing trail, adding boardwalks, and building a viewing platform/fishing pier on the lakeshore.</p> <p>Visitor use may be adversely impacted by temporary trail and/or Refuge closures to respond to catastrophic weather events (i.e., removal of hazard trees) but will be offset by improvements to visitor safety.</p>
<p><b>Cultural Resources</b></p>	<p>Under all three alternatives, we would initiate an archaeological survey prior to any ground-disturbing activities. We do not anticipate any differences in cultural impacts between the three alternatives.</p>		