Chapter **4**

Erin Victory/TCI

Goldenrod

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." In the absence of 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 Wildlife Management and Visitor Services), and Alternative C (Natural Processes Emphasis, Focal Species Management, and Wilderness Designation (Service-Preferred Alternative)).

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 the actions in Chapter 2, "Alternatives Considered, Including the Service-Preferred Alternative," because they do not individually or cumulatively have any measurable environmental impacts and do not vary by alternative. Each could be categorically excluded if proposed as a stand-alone action. Those actions 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 projects (e.g., kiosk, interpretive signs)
- native vegetation planting
- issuance of new or revised management plans when only minor changes are planned
- law enforcement activities

In Chapter 2, we propose changes to off-site priority public uses, specifically proposing to increase environmental education and interpretation programs and activities in cooperation with partners on Martha's Vineyard (Alternatives B and C). Additionally all three alternatives include the provision for the ongoing or potential UXO surveillance and clearance operations by the U.S. Navy. Alternative C recognizes that Nomans Land Island meets certain criteria for a Wilderness Study Area and recommends the area suitable for wilderness designation. Since Congress has reserved the authority to make final decisions on

wilderness designation, the wilderness recommendation is a preliminary administrative determination that would receive further review and possible modification by the Director, the Secretary of Interior, or the President. However, the analysis of environmental consequences is based on the assumption that Congress would accept the recommendation and designate Nomans Land Island NWR as wilderness. The information and analyses in the EA/draft CCP would be used to compile a wilderness study report and legislative EIS to accompany the wilderness recommendation.

Effects on Air Quality

Air Quality Impacts That Would Not Vary By Alternative

Massachusetts air quality is considered generally good, except for one pollutant – ozone. The nearest air quality monitoring stations to Nomans Land Island are located in Fairhaven and Truro, Massachusetts. Neither of these stations was in violation of ozone levels over a 3-year average (MA DEP 2009). Given the location of the island, the air quality immediately around the Refuge is good. Under all three alternatives, periodic prescribed burning by the U.S. Navy to clear and remove UXO, or by the Service to maintain shrubland habitat, would occur, though this would be dependent upon approval through MRA under Alternative C. This would cause some short-term, minor localized impacts to air quality. However, the episodic nature of these burns (Wise 2006) and the isolation of the island result in negligible impacts on Martha's Vineyard, the nearest land mass. Despite best efforts to prevent it, it is possible for wind direction to shift during a prescribed burn, and smoke can drift over parts of Martha's Vineyard, as was the case in 2008. When this happens, the air quality is temporarily impacted, usually for not more than a few hours.

Treatment of invasive plant species to maintain quality habitat conditions would occasionally incorporate mechanical, chemical or biological control as necessary by varying degrees, depending on the alternative. Under Alternative C, these actions would be subject to MRA. These actions may result in temporary site disturbance; however, any impacts to air quality would be localized and short-lived. No major ground-disturbing activities that would affect air quality are proposed under any of the alternatives.

Air Quality Effects of Alternative A (Current Management)

Air Quality Benefits and Impacts

Current management activities neither substantially benefit nor adversely affect local and regional air quality. There is a small amount of hydrocarbon emissions caused by Refuge activities including emissions from transportation to and from the Refuge and the occasional use of an all terrain vehicle (ATV) on the Refuge to conduct resource management operations. The vehicle fleet at the Refuge headquarters is becoming more efficient and cleaner as older vehicles are replaced by low emission hybrid cars and trucks. No air quality impacts would be associated with Refuge visitation other than by Refuge staff, since the Refuge is not open to the public, and is an island surrounded by restricted waters.

Any prescribed burns conducted by the Navy as part of their UXO clearance operations could cause a temporary decline in local air quality due to smoke particulates. Though the Navy is responsible for the planning and implementation of these burns, they conform to all local, state, and federal air quality laws and regulations.

Treatment of invasive plant species to maintain quality habitat conditions would occasionally incorporate mechanical, chemical or biological control as necessary under Alternative A. These actions may result in temporary site disturbance; however, any impacts to air quality would be localized and short-lived. Of the three, chemical application through both aerial and backpack sprayers have the greatest potential to impact a wider area than is targeted through spray drift (the movement of herbicides to non-target sites). Herbicides are chosen based on low LD-50s, very short soil persistency and the least potential to migrate in the soil or in water (T. Eagle, personal communication).

Backpack sprayers are used most often on the Refuge, and have optimal target specificity due to the close range of application. Aerial spraying occurs much less often, but does include a higher potential for drift. However, when aerial application is used on the Refuge, days with little or no wind are targeted. The Service effectively eliminates spray drift through careful calibration of spray nozzles to achieve the correct droplet size and rate of application (T. Eagle, personal communication). Products used are EPA approved and labeled for the appropriate use. All aerial herbicide applications are reviewed first by the Service's Regional Office, and then the Washington Office. These precautions result in a localized, temporary decrease in air quality at the Refuge, but any adverse impacts associated with drift beyond the Refuge are effectively prevented.

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

Air Quality Benefits and Impacts

Proposed management activities would neither substantially benefit nor adversely affect local and regional air quality. Under this alternative, invasive plant treatment would be more intensive compared to current management to incorporate a zero tolerance policy for species that are highly invasive and/or stand-replacing. This would be enacted through mechanical, chemical or biological control as necessary and feasible, and associated benefits and impacts would be similar to that described under Alternative A, though there may be a slight increase in frequency of application or area of application. We anticipate only short-term, minor, localized impacts to air quality from these increased management activities in the removal of invasive plants. While there would be more boat trips to the Refuge under this alternative, the total number of trips conducted annually would not likely exceed 20, resulting in a small increase in hydrocarbon emissions from transportation. The Refuge would remain closed to the public, and therefore no air quality impacts would be associated with Refuge visitation other than by Refuge staff.

Under this alternative, the Service would initiate a fire regime on the Refuge to perpetuate shrub habitat. Though these burns would not necessarily supplant burns conducted by the Navy, there would be opportunity to coordinate prescribed burning to maintain Refuge habitat with UXO surveillance. Prescription burns conducted by the Service would occur every 7 to12 years per habitat patch, with at least two habitat patches delineated. This would result in a fire being conducted on the Refuge approximately every three to six years. During prescribed fires, there is a short-term decrease in local air quality due to smoke and smoke particulates. According to the Eastern Massachusetts NWR Complex Fire Management Plan (USFWS 2003c), "The goals of smoke management on the refuges will follow goals enumerated by the National Wildfire Coordinating Group (1985): reduce fire emissions, enhance the dispersal of smoke plumes, steer smoke plumes away from smoke-sensitive areas, and coordinate the ignitions of prescribed burns. Smoke management practices will include maximizing combustion efficiency (to reduce particulate emissions)." These practices would further minimize impacts to air quality.

Post-fire vegetation monitoring would enable us to gauge the effectiveness of these management activities. In this alternative, we would have a greater capacity to use adaptive management to alter rates and mechanisms of these applications to better achieve habitat goals, or utilize to new technology that further minimizes any adverse impacts to air quality.

Air Quality Effects of Alternative C (Natural Processes Emphasis, Focal Species Management, and Wilderness Designation (Service-Preferred Alternative))

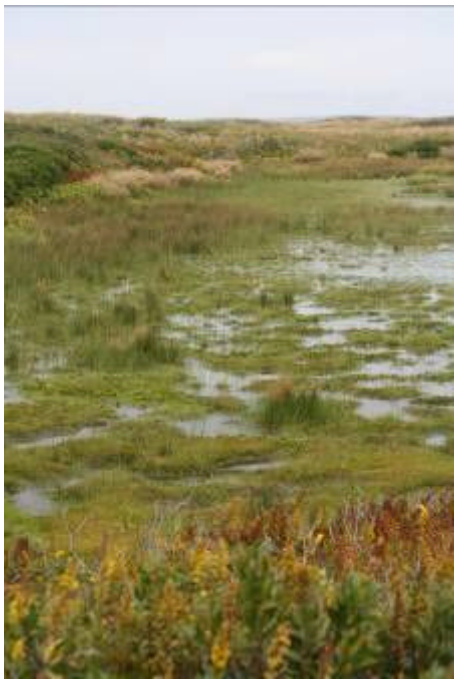
Air Quality Benefits and Impacts

The potential for wilderness designation under this alternative may provide a slight benefit to air quality, as management activities would need to conform to wilderness policy and guidelines. Use of ATV's, prescription fires and invasive species treatment would need to be evaluated within the context of wilderness policy and the minimum requirement and minimal tools analyses. In general, air quality benefits and impacts would be similar to Alternative A in terms of frequency of Refuge visitation by Refuge

staff, and, if approved, method and frequency of herbicidal application. Prescription burns, if approved, would be carried out as described in Alternative B, but there would likely be fewer burns, so the benefits and impacts would be less than described in Alternative B. Wilderness policy may determine how these activities are prioritized. Less use of mechanized equipment in the wilderness area will result in less emissions and a lower carbon footprint.

Effects on Water Quality

Water Quality Impacts That Would Not Vary by Alternative



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Refuge wetland

Nomans Land Island is surrounded by the Atlantic Ocean. Tidal waters generally do not reach inland, except occasionally on the north shore. Island groundwater is contained by a saltwater intrusion at the periphery of the island, isolating it from aquifers at Martha's Vineyard (Foster Wheeler Corporation 2001). Island wetlands include emergent wetlands, bogs, and open water ponds, including four artificial ponds. Nomans Land Island has a long history of extensive human use, which likely has impacted water quality and hydrology to some degree. These uses included forest clearing, sheep-grazing, a fishing community, fish stocking, introductions of muskrats and other wildlife for hunting and trapping, and finally use as a military aerial bombardment and gunnery range with live and dummy bombs from 1943 to 1996. Studies conducted by the U.S. Navy in the 1990's have indicated that there are metals (copper, zinc and lead) present in the surface waters and sediments tested on the island (Foster Wheeler Corporation 2001; see Chapter 3 and Appendix H). These potential impacts have already occurred, regardless of which alternative is selected.

The impacts to water quality from public access and use are non-existent since the Refuge is closed to the public under all three alternatives. In addition, access around the island's wetlands is restricted due in large part to less ordnance clearing in these areas. Therefore, even the occasional staff visits are not likely to have much of an impact on the Refuge's water resources. 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.

Water Quality Impacts of Alternative A (Current Management)

Benefits

Removal of aquatic invasive species including purple loosestrife and Phragmites in wetland habitats would potentially improve hydrology and associated water quality (Able et al. 2003). Monitoring of some wetland birds and rare plant surveys would provide some measure of wetland conditions.

Adverse Impacts

Some risks could occur to water quality from use of herbicides and mechanical methods by the Refuge to control invasive plant species, but these risks are low (Shepard et al. 2004). We would use Integrated Pest Management to prevent or minimize any impacts from use of herbicides, and would only use herbicides that are safe for aquatic habitats when working near water bodies or wetlands on the Refuge.

Water Quality Impacts of Alternative B (Enhanced Wildlife Management and Visitor Services)

Benefits

The presence of invasive plants can have a major adverse impact on the biological integrity, diversity, and environmental health of habitats (Ruiz et al. 1999, Silliman et al. 2004, Minchinton et al. 2006, Schooler et al. 2009). Environmental harm may include detrimental changes in ecological processes. For example, invasions by purple loosestrife, Phragmites or other invasive plants can displace native wetland vegetation (Albright et al. 2004, Silliman et al. 2004, Minchinton et al. 2006), which then may also adversely impact bird and other animal species that have certain habitat requirements (Able et al. 2003, Schooler et al. 2009). Alternative B would provide the greatest opportunity to control aquatic invasive species including purple loosestrife and Phragmites in wetland habitats. In addition, increased monitoring of invasive aquatic species, surveys of rare wetland plants and invertebrates, and monitoring of wetland birds would provide a measure of aquatic habitat conditions, including water quality. The presence of UXO precludes any attempt to directly measure water quality, however, we would use adaptive management to guide our management based on an improved understanding of these water bodies through these indirect methods.

Adverse Impacts

The potential risks to water quality could increase temporarily and slightly over Alternative A, due to increased invasive species control using chemical or mechanical methods. We would use Integrated Pest Management to determine best control based upon effectiveness, cost, and minimal ecological disruption, which considers minimum potential effects to non-target organisms and the Refuge environment. Herbicides would be used where physical and biological methods or combinations thereof, are impractical or incapable of providing adequate control, eradication, or containment. They would be used primarily to supplement, rather than as a substitute for, practical and effective control measures of other types. Wherever possible, application will be by backpack instead of aerial application in order to better focus the application of the chemical. Any herbicide used near water or wetlands would be approved to be used in those habitats, no matter the application method employed.

Water Quality Impacts of Alternative C (Natural Processes Emphasis, Focal Species Management, and Wilderness Designation (Service-Preferred Alternative))

Benefits

Wetlands would be subject to natural processes, unless invasive species posed a direct threat to wetland integrity or became stand-replacing. Then, invasive species management would be similar to Alternative A, if approved through MRA.

Other invasive species treatment that would occur in habitats adjacent to wetlands would likely be addressed through mechanical or physical means, but would also be subject to MRA. If herbicide application was used, a backpack sprayer would be the likely method, reducing any impacts to non-target areas, including wetlands. We would use Integrated Pest Management to prevent or minimize any impacts from use of herbicides, and would only use herbicides that are safe for aquatic habitats when working near water bodies or wetlands on the Refuge. Thus, there would be minimal anticipated effects on water quality from chemical or mechanical treatments.

Adverse Impacts

Some risks could occur to water quality from use of herbicides and mechanical methods if employed by the Refuge to control invasive plant species, but these risks are low (Shepard et al. 2004). We would use Integrated Pest Management to prevent or minimize any impacts from use of herbicides, and would only use herbicides that are safe for aquatic habitats when working near water bodies or wetlands on the Refuge.

Effects on Soils

Soil Impacts That Would Not Vary By Alternative

Under all three alternatives some soil disturbance occurs from prescribed burning and invasive species management, though these actions would be subject to MRA under Alternative C. In addition, site reviews by the U.S. Navy would continue, which could include removal of unexploded ordnance over time. These reviews will occur every five years, but the nature of the review, and the degree of UXO removal or other warranted actions could vary depending on the Remedial Action Alternative chosen in the Navy's Phase III/Feasibility Study Report and NEPA process (see Chapters 2 and 3). UXO removal includes site preparation such as prescribed burning to clear vegetation and surface clearing of ordnance debris and residual materials.

Continuous wave action along the island's western and southern shores has created steep 50-foot high bluffs; this erosive action is likely ongoing and no specific actions will be undertaken by the Service to stop or address this erosion except in extreme circumstances where we are mandated to protect cultural resources. The ban on public access under all three alternatives significantly reduces risk of soil erosion from human recreational activities. There could be minimal contribution to soil compaction from staff use of ATV's used to traverse the established maintenance trails, though this occurs only a few times a year. There could be increased soil disturbance as a result of additional UXO removal in areas that need to be accessed by Refuge staff for management purposes or in a culturally sensitive area. This would be a short-term temporary impact.

Soil Impacts of Alternative A (Current Management)

Soil Benefits

Any prescribed fires conducted by the U.S. Navy should benefit soils in the short-term by releasing nutrients bound up in plant biomass back into the soil (Dudley and Lajtha 1993), the degree to which is dependent upon fire intensity (USFWS 2003c). Maintaining native shrubland habitat and reducing invasive plant species would likely improve soil condition.

Adverse Soil Impacts

Some soil compaction occurs from walking the existing maintenance trail network during Refuge management and monitoring visits and by U.S. Navy personnel. In addition, the Service uses ATVs to traverse the island, and Navy UXO clearance operations may include the use of larger pieces of equipment that would contribute to soil compaction. These activities are only occasional and short-term and as such, soil compaction is minimal overall as a result. The mechanical removal of invasive plant species has the potential to cause localized soil disturbance and erosion until new plant species establish.

Soil Impacts of Alternative B (Enhanced Wildlife Management and Visitor Services)

Soil Benefits

The benefits to the soils of Nomans Land Island from Alternative B are the same as those of Alternative A, whether prescribed fire is conducted by the Service or the Navy.

Adverse Soil Impacts

The adverse soil impacts from Alternative B are similar to Alternative A, although more frequent visits to the island could slightly increase soil compaction. There could be more soil disturbance associated with higher levels of invasive species control, but any soil disturbed by the physical removal of plants will be tamped down and compacted. This is a standard aspect of any mechanical removal operation. Efforts to restore the water control structure on the wetland near Rainbow Pond might create temporary soil impacts

but will have long term benefits as the potential for this section of the trail to erode due to the failing water control structure will be reduced.

As a part of Alternative B, several cultural initiatives are proposed, which may result in additional short-term soil disturbance activities. These include dune restoration to protect cultural sites, addressing the impacts of cliff erosion on the Luce cemetery and maintaining the Luce cemetery, repatriation of Wampanoag Tribal remains, and documentation of the remnants of human habitation on the island. Protocols for these endeavors would vary, but all would include approval by and coordination with the U.S. Navy for safety compliance, and would seek to minimize soil disturbance. Any soil disturbance would be temporary, and would be replaced and/or tamped down and compacted when the project was complete.

There would be some soil disturbance on the interpretative trail from the installation of wayside exhibits and/or interpretive panels at the Aquinnah Cultural Center on Martha's Vineyard. Also there would be an increase in foot traffic which could lead to some erosion and soil compaction on the trail.

Soil Impacts of Alternative C (Natural Processes Emphasis, Focal Species Management, and Wilderness Designation (Service-Preferred Alternative))

Soil Benefits

Benefits to Refuge soils would be similar to that described in Alternative A. Prescribed fires conducted by the Service under this alternative would be subject to MRA, but if approved, should benefit soils in the short-term by releasing nutrients bound up in plant biomass back into the soil (Dudley and Lajtha 1993). Prescribed burn protocols would be evaluated through a MRA to identify the minimum impact methods and tools to accomplish necessary activities safely and with a minimal amount of impairment to wilderness character. In addition, Refuge staff visits would be less than in Alternative B, so any compaction as a result of staff activities would be minimal, and similar to Alternative A.

Adverse Soil Impacts

Adverse soil impacts would be similar to that described in Alternative A. Under this alternative, however, we are adapting a more targeted resource management approach, committing to management of the area to maintain and enhance the island's wilderness character. Under this scenario, some management actions and equipment may be altered or reprioritized to comply with wilderness policy guidelines, and would be subject to MRA.

There would be some soil disturbance on the interpretive trail from the installation of wayside exhibits and/or interpretive panels at the Aquinnah Cultural Center on Martha's Vineyard. Also there would be an increase in foot traffic which could lead to some erosion and soil compaction on the trail.

Effects on Shrub Habitat – Breeding and Migratory Birds and Other Wildlife

Shrub Habitat Impacts That Would Not Vary by Alternative

The 628-acre Nomans Land Island Refuge supports at least 400 acres of shrubland habitat. This habitat on the Refuge is one of the primary reasons the island is a regional landbird focus area in BCR 30 (Steinkamp 2008). Under all three alternatives, a primary goal is to maintain this shrubland habitat for breeding and/or migratory birds and other flora and fauna. Alternative A relies on UXO clearance operations by the U.S. Navy to maintain shrub habitat, while in Alternatives B and C the Service will take the initiative to perform prescribed burns so they are conducted in a biologically meaningful way; however, prescribed burns would be subject to MRA in Alternative C. Similarly, these alternatives involve differing levels of wildlife and plant inventories and monitoring and the use of adaptive management to guide management of shrub habitat and associated species, including the possible release of New England cottontail on the Refuge in Alternatives B and C.

Shrub Habitat Impacts of Alternative A (Current Management)

Under current management, we would continue to minimally manage shrub habitats. The island location of the Refuge and the distance to the Refuge headquarters allows for only limited management and monitoring activities by Refuge staff. Under this alternative, therefore, the only active shrub habitat management or alterations would be as a result of continuing removal of UXO by the U.S. Navy. The prescribed burns by the Navy as part of their clearance operations would benefit shrub-dependent focal bird species, but the management regimes would not be biologically-based.

Fourteen species of invasive plant species are known to occur on the island, and many of these are found throughout the shrub habitat. Under Alternative A, the control of invasive species only along existing maintenance pathways would potentially degrade the quality of native shrub habitat for focal species in areas where invasive plants are left untreated.

Under current management, the Service conducts basic surveys and monitoring of Refuge wildlife in shrub habitat, including breeding bird surveys and occasional migratory raptor banding with partners. These baseline surveys would provide some measure of bird response to ongoing management activities, although not on an annual basis.

Shrub Habitat Impacts of Alternative B (Enhanced Wildlife Management and Visitor Services)

Under Alternative B, we would engage in more active management of 400+ acres of shrub habitat, which would likely result in greater control of habitat conditions that benefit focal shrub species. For example, gray catbird and eastern towhee are shrubland breeders on the Refuge, and both require slightly different structural complexity and density for their breeding habitat. To this end, we would distinguish at least two habitat patches and conduct prescription burns on a rotational basis so that each patch would burn every 7 to 12 years. Having at least two habitat patches that are alternately burned would also ensure habitat availability for shrubland wildlife and other taxa during and immediately following a fire.

Under this alternative, the Service would be responsible for any prescribed burns on the Refuge. Periodic burns would ensure the perpetuation of shrubland habitat; despite the influences of salt-spray and wind that delay succession, it is not certain that high-quality shrubland habitat would persist on the Refuge without enacting a regular disturbance regime. The biologically-based fire regime proposed under this alternative would better target habitat needs and would have minimal impact on nesting and migrating birds and invertebrates (Vickery et al. 2005). Dormant season burns would occur after avian migration, and would reduce impacts to pollinators on the Refuge; those that are mobile have already left, and the remaining species are likely hibernating or aestivating in the soil (St. Sauver 2009).

Dormant season burns would also be beneficial for shrub species which are physiologically inactive during this time and thus suffer no major setbacks. Species such as northern bayberry, found on the Refuge, are typically top-killed, and begin resprouting through seeds and rhizomes following a fire. Resprouting and stem density of shrubs can be higher following dormant season burns, compared to growing season burns (Drewa et al. 2002). Vegetation response to fire is species-specific, and is ultimately dependent upon fire duration, intensity, fuel load, and moisture levels. Post-fire effects on vegetation would be measured in established plots. Adaptive management would be used to alter the fire regime as necessary based on these differences in vegetation response to achieve our target habitat conditions for wildlife.

Current estimates based on aerial photography are that invasive species account for approximately 10 percent of the shrubland habitat. Because of access issues in this habitat, 10 percent would continue to be our tolerance threshold under this alternative, and any increase beyond that number would be immediately treated. We would have a zero tolerance policy for any invasive species that became stand-replacing, or that posed a direct and immediate threat to habitat integrity. Through greater vigilance, a more concerted effort island-wide to control invasive plant species would enhance native shrub habitat and provide greater benefit to shrub-dependent focal species.

Additional trails would be cleared on the Refuge to provide access for monitoring and management, including invasive species control. There would be a small amount of shrubland habitat lost as a result of this additional clearance activity.

Under this alternative, we would further evaluate the potential for releasing New England cottontail in the Refuge's shrubland habitat. This species is the only cottontail endemic to the Northeast, yet only five disjunct populations remain in 14 percent of its historic range (Litvaitis et al. 2006). To date, only three national wildlife refuges in the Northeast have documented the presence of this species: Rachel Carson (Maine), Mashpee (Massachusetts) and the Rhode Island Complex. Habitat fragmentation and maturation continue to be primary threats to the survival of this species, and the maintenance and availability of large habitat patches are required for this species to persist (Barbour and Litvaitis 1993). It is currently a candidate for federal listing under the ESA.

New England cottontail specimens have been documented from both Martha's Vineyard and Nantucket Islands (Godin 1977), and this species was present on Tuckernuck Island (Nantucket) prior to the release of eastern cottontails in the early 20th century (T. French, personal communication). New England cottontails are currently present on Cape Cod. These islands were at one time connected with Cape Cod when sea levels were low following the last glacial maximum, and Martha's Vineyard and Nomans Land Island are thought to have been connected until approximately 1,000 years ago (LaFarge 1933). Though it is not yet certain that this species was historically present on Nomans Land Island, given its prevalence on neighboring islands and the historical connectivity between them, it is likely to have been there at one time.

Successfully releasing rabbits on coastal islands has occurred for over a century. Nantucket was the first of Massachusetts' coastal islands to be stocked with eastern cottontails prior to 1900 (Johnston 1972). Nantucket then became a stocking source for other coastal islands including Martha's Vineyard, beginning in 1920. Approximately 79 individuals from Vermont, "out-of-state," and the mainland were translocated to Penikese Island in 1925, with no prior record of rabbits present; the individuals from Vermont were likely New England cottontail while the others were likely eastern cottontail (Johnston 1972, T. French, personal communication). This became the source population of a stocking program by the state, and over 4,600 rabbits were transferred to the mainland over the next 15 years.

Recently, the State of Massachusetts has established an objective "to establish self-sustaining refuge populations of New England cottontails on selected coastal islands of Massachusetts" (MA DFG 2005). To date, New England cottontail was released on Grape Island in Massachusetts in 1985, and by 1996 over 40 individuals were estimated (Cardoza 1998). Collaboration with the MA DFG to release New England cottontails on Nomans Land Island would help fulfill this objective for the state, and provide partner support for ongoing monitoring and management on the Refuge.

State and federal experts agree that Nomans Land Island provides a unique habitat alternative for this species due to its isolation from anthropogenic disturbances, lack of mammalian predators, and the absence of eastern cottontail. According to Litvaitis et al. (2007), "Initially, management efforts should be directed at expanding existing populations that occupy habitats where eastern cottontails are absent." Barbour and Litvaitis (1993) found that small habitat patches (2.5 hectares, or approximately 6 acres) served as sinks for dispersing juveniles, where resource availability and thus survival rates were low. Patches of at least 25 acres in size are recommended as suitable (Arbuthnot 2008); with approximately 400 acres of shrub habitat, Nomans Land Island more than meets this criterion. It would, however, be an isolated population without any connectivity to other habitat patches or populations. The long term genetic viability of an isolated population such as this is uncertain, however, given the rapid range contraction of this species, it may be critical to leverage opportunities for translocation in the short term wherever possible (J. Litvaitis, personal communication).

Due to its behavioral adaptations and predator avoidance strategies, New England cottontail requires dense habitat for cover, approximately 20,000 woody stems per acre (Arbuthnot 2008). Initial evaluation of Nomans Land Island's shrub habitat indicates good potential for New England cottontail, with regard to

vegetation thickness and forage diversity (A. Tur, personal communication). Structural complexity and not species composition has been used to describe suitable habitat for New England cottontail (Eabry as cited in Litvaitis et al. 2007). The proposed rotational fire regime under this alternative would ensure the continuation of early successional habitat, dense cover, and habitat availability during and immediately following a burn.

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Dense Refuge vegetation

The presence of a New England cottontail population on the Refuge would undoubtedly have some impact on the habitat and other wildlife species present. In spring and summer, cottontails have a primarily herbaceous diet, eating what fresh leaves, flowers, grasses, sedges and rushes become available. In fall and winter, their diet shifts to include fruits and ultimately buds, bark, and twigs (Dalke and Sime 1941). Observations over the course of one winter showed that cottontails could consume nearly all of the previous year's growth in a blackberry stand, and girdle a stand of sumac, though this initiated sucker sprouting and increased the number of plants (Dalke and Sime 1941).

Changes in species composition and distribution throughout the Refuge's upland habitat, including the spread of invasive species beyond where they presently occur, are potential impacts associated with a New England cottontail release. Consumption of sensitive plant species is another facet that needs to be explored further. Despite several plant surveys over the last several decades, access restrictions around upland areas and limited opportunities mean that there may be plant species present on the island that are unaccounted for. Impacts cannot be fully assessed without thorough knowledge of this ecosystem. However, according to the MA DFG, the presence of the cottontail should not pose an undue threat to sensitive plant species, such as Arethusa, on the Refuge (T. French and B. Connolly, personal communication).

Typically, New England cottontails seek refuge in burrows created by other species or rock walls when frightened (Litvaitis et al. 2007). Species creating and/or utilizing burrows on the Refuge include painted, snapping and spotted turtles, muskrat, and Leach's storm petrel. Rock walls still remain intact in some areas of the Refuge, particularly on the western side of the island, and are also used by Leach's storm petrels. This could lead to some competition for sites between these species.

Further research and consideration is needed to determine if a genetically viable New England cottontail population could be perpetuated on the Refuge, its potential impacts on other species and communities, and how feasible a long term cottontail management program would be. However, given the likelihood of its

historical presence on the Refuge, minimal concern regarding impacts to sensitive species, and similar release efforts on coastal Massachusetts islands by MA DFG, it appears to be a viable option for the Refuge.

Shrub Habitat Impacts of Alternative C (Natural Processes Emphasis, Focal Species Management, and Wilderness Designation (Service-Preferred Alternative))

Impacts to shrub habitat under Alternative C would be similar to Alternative B in habitat management, but with no focus on breeding landbirds or pollinators other than butterflies. Instead, management efforts on migrating landbirds including raptors would be emphasized. New England cottontail would be considered for release under this alternative as well, with the same potential impacts described in Alternative B if introduced. However, wilderness stewardship policy indicates that we generally will not transplant species into wilderness areas if the species is not native to that area. If the prior inhabitation of Nomans Land Island by the New England cottontail cannot be confirmed or strongly indicated, then this species may not be introduced, resulting in the same potential impacts as Alternative A.

Under this alternative, we are recommending Nomans Land Island suitable for wilderness designation and committing to management of the area to maintain and enhance wilderness character. Some Refuge management actions (e.g., prescribed burns, control of invasive species and release of New England cottontail) may be modified or reprioritized to comply with wilderness policy guidelines. Though prescribed burns, if approved, are not scheduled according to a periodic cycle in Alternative C, but rather are implemented as needed according to habitat condition, regular vegetation monitoring would remain the same as in Alternative B.

As in Alternative B, additional trails would be cleared on the Refuge to provide access for monitoring and management, including invasive species control. There would be a small amount of shrubland habitat lost as a result of this additional clearance activity. These proposed actions and protocols would be evaluated through MRA to identify the minimum impact methods and tools to accomplish necessary activities with a minimal amount of impairment to wilderness character.

Effects on Vegetated Dune Habitat

Vegetated Dune Habitat Impacts That Would Not Vary by Alternative

Coastal beach and dune habitat continues to be some of the most threatened habitats in the U.S. (Brown et al. 2001). They are naturally unstable, dynamic ecosystems that are subject to erosion and accretion processes due to wind and wave action (MA DFG 2006). The Refuge has 15 acres of vegetated dunes that provide habitat for nesting terns and shorebirds including American oystercatcher. All three alternatives utilize varying levels of active management to maintain the dune habitat. Similarly, the alternatives involve differing levels of wildlife and plant inventories and monitoring and the use of adaptive management to guide management of dune habitat and associated species. All alternatives would incorporate actions, where possible and as funding allows, that monitor for any impacts to the Refuge due to sea level rise under the SLAMM model. Unless some management action is undertaken, this habitat is predicted to be lost or largely reduced by 2100 (Clough and Larson 2009). Because the life of this CCP is relatively short by comparison, we would focus on establishing a baseline from which to continue long term monitoring efforts to determine the best mitigation strategies in the future.

Vegetated Dune Habitat Impacts of Alternative A (Current Management)

Under Alternative A we would continue to minimally manage up to 15 acres of vegetated dune habitat that provides habitat for shorebirds and terns. Some of the dune habitat is already succeeding to woody vegetation; that trend would continue under this alternative. Annual inventories of nesting terns and limited vegetation surveys would provide some measure of habitat suitability for dune species, but would not provide information on bird productivity.

The control of invasive species only along existing maintenance pathways or easily accessible areas would potentially degrade the quality of the vegetated dune habitat for focal species, where invasive plants are left untreated. Invasive plants may adversely impact native dune plants through direct resource competition and can contribute to the decline of threatened or rare native plant species (Thomson 2005).

It is well documented that gulls are nest predators of tern and other coastal bird species, and also compete with terns and other species for nesting habitat (O'Connell and Beck 2003, Donehower et al. 2007). These are likely factors for the decline in tern abundance on the Refuge. Under Alternative A limited predator control would be used only as deemed necessary, and would provide some benefit to nesting terns, but might not be sufficient to allow terns to fully recover or re-colonize on the island.

Vegetated Dune Habitat Impacts of Alternative B (Enhanced Wildlife Management and Visitor Services)

Under Alternative B we would actively manage up to 15 acres of vegetated dune habitat that provides habitat for nesting terns and shorebirds. This would include a more concerted effort to control invasive plant species that would provide greater benefit to dune focal species. To maintain the herbaceous dune habitat and prevent succession to woody growth, we would remove woody vegetation as needed by hand pulling or mechanical means. We would also evaluate the need for dune restoration to protect cultural resources.

Annual inventory of nesting oystercatchers and terns and monitoring of productivity for these species would provide feedback on effectiveness of management efforts. Habitat management would include creating areas of this vegetated dune habitat that have 30 to 70 percent cover to benefit common and roseate terns, respectively, if a colony of at least 50 pairs is present. Once this threshold is met, more comprehensive predator monitoring and control would provide greater protection to nesting terns. This would include maintaining a five acre gull-free zone which would be accomplished by habitat management and harassment to prevent nesting, nest removal, egg destruction and/or lethal removal.

It is unlikely that the potential release of New England cottontail under this alternative would have some impacts on this habitat and/or on tern species. European hares on Falkner Island in Connecticut were known to inadvertently destroy tern nests and eggs through nocturnal activity along the beaches and by utilizing burrows with established roseate tern nests (J. Spendelow, personal communication). This may not be an issue on Nomans Land Island, however. With over 400 acres of shrubland, there would be adequate habitat available to meet the food and cover requirements for a released population of cottontails. In addition, studies done by Smith and Litvaitis (2000) demonstrated that New England cottontails were reluctant to leave areas of thick cover, even to gain access to higher quality food sources. Given this reluctance, it is unlikely that a New England cottontail population on the Refuge would leave shrubland habitat for the more open vegetated dunes for forage or nesting sites. Should interspecific conflicts over sheltered sites ever emerge, management intervention for both species, by providing artificial nesting structures, has proven successful (Arbuthnot 2008, Spendelow 1982).

Vegetated Dune Habitat Impacts of Alternative C (Natural Processes Emphasis, Focal Species Management, and Wilderness Designation (Service-Preferred Alternative))

Under Alternative C we would rely on monitoring efforts every three to five years to assess habitat condition for terns and nesting shorebirds. In the case that a common tern colony establishes on the Refuge in excess of 50 pairs, we would evaluate the need for predator control and habitat management measures. In the absence of this scenario, natural processes would prevail in this habitat.

Annual oystercatcher and tern surveys would provide some feedback on habitat conditions as well. New England cottontail would be considered for release under this alternative as well, and would have the same potential impacts as under Alternative B.

Under this alternative, we are recommending Nomans Land Island suitable for wilderness designation and committing to management of the area to maintain and enhance wilderness character. Some Refuge management actions (dune vegetation and maintenance measures, control of invasive species, predator control for gulls, and artificial nesting structures for tern species) may be modified or reprioritized to comply with wilderness policy guidelines. Proposed actions and protocols would be evaluated through a MRA to identify the minimum impact methods and tools to accomplish necessary activities with a minimal amount of impairment to wilderness character.

Effects on Marine Intertidal Beach and Rocky Shore

Marine Intertidal Beach and Rocky Shore Habitat Impacts That Would Not Vary by Alternative

The intertidal beach and rocky shores of Nomans Land Island provide important nesting, resting and foraging habitat for many priority species of conservation concern, and are regionally important because of the island's land protection status. Throughout the Atlantic coast, quality beach habitat is imperiled due to increases in human uses and development (MA DFG 2006). The approximately 100 acres of this habitat on the island benefits marine mammals, nesting waterbirds such as the double-crested cormorant, and migrating shorebirds.

All of the alternatives utilize varying levels of active management to maintain the intertidal and rocky shore habitat, including monitoring for invasive species. Similarly, the alternatives involve differing levels of wildlife and plant inventories and monitoring and the use of adaptive management to guide management of rocky beach habitat and associated species. All alternatives would incorporate actions, where possible and as funding allows, monitoring the predicted habitat losses due to sea level rise under the SLAMM 5.0 model. Unless some management action is undertaken, this habitat is predicted to be lost or largely reduced by 2100 (Clough and Larson 2009). Given the relatively short time frame of this CCP, the next 15 years will provide us with baseline information and a systematic monitoring regime from which to base future climate change mitigation decisions for the Refuge.

Stephanie Koch/USFWS

Refuge rocky shoreline and cobble spit

Marine Intertidal Beach and Rocky Shore Habitat Impacts of Alternative A (Current Management)

Under Alternative A we would continue to minimally manage up to 100 acres of marine intertidal beach and rocky shore habitat to benefit marine mammals such as seals, nesting waterbirds, and migrating shorebirds. Any shoreline changes would be noted as discovered during Refuge visits. Habitat conditions would largely be evaluated through indirect monitoring and surveys of nesting cormorants, American oystercatchers that sometimes nest among the cobble, and records of seal presence.

Marine Intertidal Beach and Rocky Shore Habitat Impacts of Alternative B (Enhanced Wildlife Management and Visitor Services)

Under Alternative B we would actively protect up to 100 acres of marine intertidal beach and rocky shore habitat that benefit marine mammals such as seals, nesting waterbirds, and migrating shorebirds. Protection of this habitat under Alternative B would involve monitoring shoreline erosion rates and changes associated with climate change, and working with partners to monitor and control invasive species such as sea cucumbers and macroalgae.

Marine Intertidal Beach and Rocky Shore Habitat Impacts of Alternative C (Natural Processes Emphasis, Focal Species Management, and Wilderness Designation (Service-Preferred Alternative))

Under Alternative C we would protect the existing 100 acres of marine intertidal beach and rocky shore habitat that benefit marine mammals, nesting waterbirds and migrating shorebirds in much the same way as in Alternative B.

Under this alternative, we are recommending Nomans Land Island suitable for wilderness designation and committing to management of the area to maintain and enhance wilderness character. Management actions on the Refuge would be evaluated through a MRA and modified to comply with wilderness policy guidelines. However, no changes are anticipated to actions proposed under this alternative, as surveys would likely continue under a wilderness scenario.

Effects on Scrub Shrub and Emergent Wetlands, Bogs, and Open Water Habitat

Wetland Habitat Impacts That Would Not Vary by Alternative

Refuge wetlands include ponds, permanently flooded marshes and seasonally flooded marshes. They support a small black-crowned night heron rookery, and species including American black duck and Virginia rail. Though no comprehensive surveys have been done of these wetland habitats beyond secretive marshbird surveys due to access restrictions, they do support the spotted turtle (previously listed in the state as special concern), and muskrat which are experiencing unexplained regional population declines (CT DEP 2008, VT FWD 2006). Refuge wetlands are the least well-known habitat type on the Refuge. Unexploded ordnance clearance has never been conducted in any of the ponds, precluding any attempt to inventory fish and invertebrate species. Access restrictions around the island due to the presence of ordnance limits our abilities to traverse wetland areas.

Alternatives A and B utilize varying levels of active management to maintain the 100 to 150 acres of wetland habitats. Similarly, Alternatives A and B involve differing levels of wildlife and plant inventories and monitoring and the use of adaptive management to guide management of wetland habitats and associated species. Alternative C would be similar to Alternative A, though actions therein would be subject to evaluation through a MRA.

Wetland Habitat Impacts of Alternative A (Current Management)

Under Alternative A we would continue to minimally manage the 100-150 acres of freshwater wetland habitat to support breeding marshbirds and native plant communities. The removal of aquatic invasive species including purple loosestrife and Phragmites would benefit wetland habitats and associated species (Able et al. 2003, Chambers et al. 2003, Albright et al. 2004).

Monitoring of secretive nesting marshbirds, surveys of rare wetland plants, and anecdotal observations of invertebrates would provide some measure of wetland habitat conditions.

Wetland Habitat Impacts of Alternative B (Enhanced Wildlife Management and Visitor Services)

Under Alternative B we would actively protect and manage the 100-150 acres of freshwater wetland habitat to support breeding marshbirds and native plants and animal communities. Similar to Alternative A we would treat aquatic invasive species including purple loosestrife and Phragmites to benefit wetland habitats and associated species. In addition, we would initiate a zero tolerance policy toward highly invasive, stand-replacing species.

If approved, the release of New England cottontail would have some impact on wetland flora. Suitable habitat for this species includes shrub swamps (Arbuthnot 2008). During spring and summer, cottontails preferentially consume grasses and sedges, and species including loosestrife (Lysimachia quadrifolia) and cranberry (Vaccinium oxycoccus) were noted during feeding observations (Dalke and Sime 1941). New England cottontail would utilize shrub habitats for foraging and breeding habitat, and would also aid in seed dispersal. It is not likely that sensitive plant species, including Arethusa, would be at risk due to the presence of New England cottontail (T. French and B. Connolly, personal communication).

Alternative B would involve more expanded annual surveys and baseline studies that would provide better guidance on the status of plant and animal populations and wetland habitat conditions. Specifically, these would include annual marshbird surveys and comprehensive rare plant and invertebrate surveys with partners. Increasing access through these wetland areas would allow for more complete surveys and better data collection. These surveys would provide more information about the habitat quality of these wetlands. We can then use adaptive management to adjust changing conditions to benefit focal species of concern where possible, though there may be some limitations given the presence of UXO.

Wetland Habitat Impacts of Alternative C (Natural Processes Emphasis, Focal Species Management, and Wilderness Designation (Service-Preferred Alternative))

Under Alternative C, wetland impacts from management actions would be similar to Alternative A, but would be evaluated through a MRA and modified if necessary to comply with wilderness policy guidelines. New England cottontail is also under consideration for release under this alternative, and impacts would be similar to that described under Alternative B.

Effects on Public Access, Education, and Community Outreach

Public Access, Education, and Community Outreach Impacts That Would Not Vary by Alternative

Under all three alternatives none of the six priority wildlife-dependent uses are allowed on the Refuge, as we are obligated to maintain and enforce the ban on public access for safety reasons on Nomans Land Island. Although the distance of the Refuge from Sudbury headquarters limits our capabilities, some level of off-site environmental education and interpretation related to the Refuge occurs for all three alternatives.

Public Access, Education, and Community Outreach Impacts of Alternative A (Current Management)

Alternative A would maintain the current level of interpretation and outreach. Given the closure of the Refuge to public access, this entails maintaining the virtual tour of the Refuge that is available on the Refuge website. This provides some level of interpretation of Refuge resources, however, it is reliant on general knowledge and awareness of its existence. Outreach consists of news releases to announce large-scale management activities on the Refuge. To help maintain the closure policy we would maintain at least eight regulatory signs on the Refuge and work with partners to ensure compliance with the ban on public access.

Public Access, Education, and Community Outreach Impacts of Alternative B (Enhanced Wildlife Management and Visitor Services)

Alternative B would offer the greatest expansion of our environmental education and interpretive programs on Martha's Vineyard, specifically in partnership with the Wampanoag Tribe and the Aquinnah Cultural Center. Expanded programs would include an interpretive trail and associated kiosk and viewing area including a spotting scope focused on the island, brochures and materials to be distributed at the Center and other sites, and educational materials to be used in local classrooms. These would focus on the importance of coastal resources, the history of and ecosystems present on Nomans Land Island, environmental stewardship, and the role of Nomans Land Island in the Refuge System. These increases in opportunities for environmental education and interpretation would allow us to reach a broader audience than under Alternative A, and would increase the visibility of the Service locally. It would also have the benefit of creating a connection between visitors to western Martha's Vineyard and Nomans Land Island, which is visible from the Aquinnah Cliffs and Cultural Center.

Community partnerships would be strengthened under Alternative B, especially with the Wampanoag Tribe, and would open up additional opportunities for new partnerships and cooperative ventures. Outreach would be expanded to include press releases, public notices of Refuge management, and alerts about Refuge restrictions distributed in the local communities. We would prioritize involvement in local events under this alternative, as well. This alternative would enable us to become more integrated into the communities nearest the Refuge.

The Refuge website would be enhanced by possible use of professional photographers and videographers to document Refuge species and habitat as part of the virtual tour. Interviews with members of the Tribe about the importance of Nomans Land Island to their culture, and about coastal resources in general would also enhance the Refuge website. The expanded outreach under Alternative B would provide an opportunity to use the Refuge as a vehicle to illustrate the impact of climate change on island conditions.

Alternative B also provides greater law enforcement presence and patrol to enforce the ban on public access, and enhances communication with partners to disseminate timely information. We would continue to maintain eight regulatory signs around the island.

Public Access, Education, and Community Outreach Impacts of Alternative C (Natural Processes Emphasis, Focal Species Management, and Wilderness Designation (Service-Preferred Alternative))

Alternative C would expand our environmental education and interpretive programs beyond Alternative A, but would be more focused than under Alternative B. Specifically, we would work with the Aquinnah Cultural Center to complete an interpretive trail with panels and a spotting scope, as well as associated brochures and materials for distribution. We would also develop a display for the Tribe's interactive kiosk at the Aquinnah Cliffs. These increases in interpretation beyond Alternative A would allow us to reach a broader audience, create a connection between visitors to western Martha's Vineyard and Nomans Land Island, highlight the Refuge's role in coastal resource conservation and the Refuge System, and educate the public about the values of wilderness and the National Wilderness Preservation System.

Steve Hillebrand/USFWS

A spotting scope at the ACC would allow visitors to view the Refuge

As with Alternatives A and B, community partnerships would continue to be important under Alternative C, especially with the Wampanoag Tribe. We would also continue to use news releases for important Refuge events and initiatives, and would participate in local community events at least once every five years. These efforts would allow us to better communicate with local communities, strengthen partnerships, and open the possibility of cooperative ventures.

Similar to Alternative A, we would maintain the eight regulatory signs on the Refuge and work with partners to ensure compliance with the ban on public access on the Refuge. In addition to Alternative A, we would enhance communication with partners to disseminate timely information about emergency response.

Effects on Cultural and Archaeological Resources

Cultural and Archeological Resources Impacts That Would Not Vary by Alternative

Despite five known archaeological sites, there has been no comprehensive, professional cultural resources survey of Nomans Land Island. Because the island is closed to the public, and no facility development or major ground disturbing activities are anticipated, it is unlikely that there would be any impacts to known or unknown cultural sites under any of the three alternatives. Erosion, however, is a potential issue, especially along the cliffs and dune beaches. The Service is concerned about protecting and maintaining known cultural and archaeological resources under all three alternatives. Pursuing a partnership agreement with the Wampanoag Tribe of Gay Head (Aquinnah) is common to all alternatives.

Cultural and Archaeological Resources Impacts of Alternative A (Current Management)

Under Alternative A we would follow Service protocol to prevent the loss of cultural and archaeological resources, record items or sites as they are encountered, and coordinate with the Navy on compliance with the National Historic Preservation Act. We would also maintain the historic Luce cemetery using volunteers and Service staff to remove vegetation when feasible. This alternative would not increase our knowledge of the history of the island per se; however, it would minimally ensure some action is taken to preserve what cultural resources exist on the Refuge in compliance with federal mandates.

We would consult with the Wampanoag Tribe on biological and cultural issues, and continue to strengthen our partnership through a partnership agreement.

Cultural and Archaeological Resources Impacts of Alternative B (Enhanced Wildlife Management and Visitor Services)

Similar to Alternative A we would follow Service protocol and federal mandates to prevent the loss of cultural and archaeological resources, record sites as they are encountered, and coordinate with the Navy on compliance with the National Historic Preservation Act. We would also maintain the historic Luce cemetery using volunteers and Service staff to remove vegetation when possible and we would consult with the Chilmark Historical Commission to learn more about the cemetery and those buried there. We would also work with the Chilmark Historical Commission to conduct a remote sensing survey for unmarked graves, if approved by the Navy.

We would initiate a cultural resources overview, maintain an inventory of known and newly found sites and structures, provide cultural resource training to Refuge staff, and work with the Wampanoag Tribe and the Chilmark Historical Commission with an oral history project. These endeavors combined would greatly increase our knowledge about the history of the island, contribute to the collective archaeological knowledge base of the region, and would offer opportunities to increase education and historical interpretation of the island. Alternative B offers greater opportunities to protect and interpret cultural and archaeological resources, particularly in partnership with the Wampanoag Tribe and the Chilmark Historical Commission. Enhanced interpretive materials would be available at the Aquinnah Cultural Center, in the Town of Chilmark, and on the Refuge website.

Under Alternative B we would continue to consult with the Wampanoag Tribe on biological and cultural issues, including coordination for research efforts related to cormorants, seals, and other areas of interest to the Tribe. Biological work would be enhanced by any archaeological and cultural knowledge gained in this alternative, as clues to past land use and evidence of animal species provide context to Refuge management. We would work to build a strong and mutually beneficial relationship with the Tribe.

Archaeological resources are best protected under this alternative and cultural resources and history are best preserved and understood under this alternative.

Cultural and Archaeological Resources Impacts of Alternative C (Natural Processes Emphasis, Focal Species Management, and Wilderness Designation (Service-Preferred Alternative))

Cultural and archaeological efforts are increased in this alternative from Alternative A, but are less than in Alternative B. In addition to actions mentioned in Alternative A, this alternative provides a moderate level of cultural resource protection, beyond compliance with Service policy and federal mandates, and does increase our knowledge base of the cultural and archaeological value of the island. This would be accomplished through completion of a cultural resources overview, establishing a protocol for when cultural and archaeological items, or human remains, are found, and addressing issues concerning Luce cemetery erosion. Under this alternative, we are recommending Nomans Land Island suitable for wilderness designation and committing to management of the area to maintain and enhance wilderness character. Proposed actions and protocols would be evaluated through a MRA to identify the minimum impact methods and tools to accomplish necessary activities with a minimal amount of impairment to wilderness

character. Though not as comprehensive as Alternative B, this alternative does offer opportunities for education and historical interpretation. Moreover, through these efforts we anticipate a stronger partnership with the Tribe.

Wilderness Recommendations and Designation

Wilderness Recommendations and Designation Impacts of Alternative A (Current Management)

Under this alternative no wilderness would be proposed for the Nomans Land Island NWR. There are no current management activities or uses under Alternative A that would directly or indirectly jeopardize the roadless character, size, naturalness, or supplemental ecological and cultural features of the WSA in the short-term. There would be no changes in land use or land ownership and no new or expanded Refuge management activities or Refuge uses that would significantly alter the existing physical landscape of the island. At least for the short-term, the Nomans Land Island WSA would continue to be impacted primarily by natural forces.

The Nomans Land Island NWR would not be afforded the benefit of long-term legislative protection under Alternative A. In the long-term it is possible that management direction could be a departure from how the Service has managed the Refuge in the past. When the CCP is revised or a new CCP prepared, the management direction could change which may result in less protection for wilderness resources in parts of the Refuge.

Wilderness Recommendations and Designation Impacts of Alternative B (Enhanced Wildlife Management and Visitor Services)

Under Alternative B, no wilderness would be proposed for the Nomans Land Island NWR. Similar to Alternative A, there are no proposed Refuge management activities or uses under Alternative B that would directly or indirectly jeopardize the roadless character, size, naturalness, or supplemental ecological and cultural features of the Nomans Land WSA. At least for the short-term, the Nomans Land Island WSA would continue to be impacted primarily by natural forces.

This alternative would involve the most active management of habitats and natural and cultural resources of the three alternatives evaluated for the CCP. Refuge management activities and Refuge uses would not be designed to minimize impacts to wilderness character. There would be no restrictions or limitations on the use of motorized vehicles, motorized equipment and mechanical transport. This alternative would provide the maximum management flexibility. Negligible to moderate, short and long-term impacts on natural resources and wilderness character could occur in localized areas of the Refuge depending on the methods and tools utilized to carry out the management activity.

The Nomans Land Island NWR would not be afforded the benefit of long-term legislative protection under Alternative B. In the long-term it is possible that management direction could be a departure from how the Service has managed the Refuge in the past. When the CCP is revised or a new CCP prepared, the management direction could change which may result in less protection for wilderness resources in parts of the Refuge.

Wilderness Recommendations and Designation Impacts of Alternative C (Natural Processes Emphasis, Focal Species Management, and Wilderness Designation (Service-Preferred Alternative))

Under this alternative, all of the 628-acre Nomans Land Island WSA would be recommended suitable for designation and inclusion in the National Wilderness Preservation System. Since Congress has reserved the authority to make final decisions on wilderness designation, the wilderness recommendation is a preliminary administrative determination that would receive further review and possible modification by

the Director, the Secretary of Interior, or the President. The WSA would be managed as "de-facto" wilderness pending designation.

Refuge management strategies and techniques would be chosen to comply with wilderness stewardship principles and prevent degradation of wilderness character. All Refuge management activities and uses that would require use of motorized vehicles, motorized equipment, and mechanical transport would be evaluated through a MRA, either on a programmatic or case-by-case basis, to determine if the activities are necessary and to identify measures to mitigate impacts to wilderness character. We would conduct or authorize such an activity only if we demonstrate that it is necessary to meet the minimum requirement for administering the area as wilderness and necessary to accomplish Refuge purposes.

Pending evaluation through a MRA, the Refuge would likely continue to utilize an ATV with attached mowing unit to maintain existing access trails, maintain the usage of the Conex storage structures, and maintain existing signage on the island. The trails have been cleared of surface ordnance and are necessary to ensure safe access around and across the island for Refuge management activities. The Conex storage structures are presently utilized for storage of the ATV and field camp supplies and equipment, and this would continue to be a necessity for future management of the Refuge. The structures are also necessary to provide emergency shelter for Refuge staff in the event of storm or hurricane activity. Existing signage would likely be maintained or replaced; the signs are required to inform the public of access restrictions and safety hazards.

Erin Victory/TCI

"Wilderness character"

Proposed management activities and protocols for invasive species control, prescribed burning, predator control, and maintenance or stabilization of cultural sites and the Luce cemetery would be evaluated through MRA, and if approved, would be carried out using the minimum impact methods and tools to accomplish the work safely and with a minimal amount of impairment to wilderness character.

Wilderness designation establishes an additional Refuge purpose of protecting wilderness character and values. The wilderness area would be managed to accomplish Refuge purposes, including wilderness purposes, and the Refuge System mission, while also preserving wilderness character and natural values for future generations.

Under Alternative C, wilderness designation would directly support the following CCP goals:

- Perpetuate the biological integrity and diversity of coastal island habitats to support native wildlife and plant communities, including species of conservation concern; and,
- Protect, maintain, enhance, and preserve the wilderness character of Nomans Land Island.

Designation of the Nomans Land Island NWR as wilderness would contribute to the diversity in the National Wilderness Preservation System. The only designated wilderness island on the East Coast north of North Carolina within the current NWPS is the Monomoy Wilderness Area managed by the Service.

This alternative is intended to permanently protect the natural, cultural, and wilderness resources of the Nomans Land Island WSA. Congressional designation would ensure that the Refuge would retain these values in perpetuity.

Effects on Socioeconomic 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.

Socioeconomic 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 Chilmark was $30,306 which is at least 50 percent of authorized levels (see Chapter 3). 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.

Under all three alternatives the Nomans Land Island Refuge remains as a satellite station of the Eastern Massachusetts NWR Complex, headquartered in Sudbury, Massachusetts, with no on-site staffing. In addition, we will continue to maintain eight regulatory signs, two brown USFWS signs, and two moorings on the Refuge, though under Alternative C the methods employed would be subject to MRA. Expenditures related to Refuge staff and other administrative costs will largely accrue to the communities around Sudbury, but may also to some extent in Falmouth on Cape Cod. Falmouth Harbor is the departure point to get to the island, and some staff expenditures for meals and gas associated with trips to the Refuge may accrue in this community over time. On occasion, staff meet with conservation partners on Martha's Vineyard, so additional staff expenditures for meals, gas and lodging there will also occur.

As stated in the transfer agreement between the U.S. Navy and the U.S. Fish and Wildlife Service, the continued presence of UXO throughout the island requires that the Service enforce the ban on public access to Nomans Land Island NWR. In addition, waters surrounding the island are restricted to unauthorized vessels, enforced by the U.S. Coast Guard. Therefore, most socioeconomic impacts associated with proposed actions relating to Nomans Land Island Refuge would occur on Martha's Vineyard, particularly in the Towns of Chilmark and Aquinnah at the western end of the island. These towns, the Aquinnah Cultural Center, and the shops operated by members of the Wampanoag Tribe of Gay Head (Aquinnah) at the Aquinnah cliffs could receive more visitation and tourist trade if an interpretive trail and spotting scope is located at the Aquinnah Cultural Center as proposed. This will be addressed separately.

Socioeconomic Effects of Alternative A (Current Management)

Refuge Visitor Expenditures

Under Alternative A, there is minimal opportunity for the public to interact with the Refuge on Martha's Vineyard; therefore there are no visitor expenditures or benefits to the local communities of Chilmark or Aquinnah that can be attributed to the Refuge.

Impacts from Refuge Administration

Administratively, Nomans Land Island NWR is an unstaffed satellite station of the Eastern Massachusetts NWR Complex, headquartered in Sudbury, Massachusetts. There are no staff stationed on Nomans Land Island, however, Complex biologists conduct site visits several times a year. The Refuge utilizes three Conex storage containers, and is responsible for the maintenance of eight regulatory signs, two brown USFWS signs, and two moorings, but otherwise maintains no facilities on the island. Since there are no on-site staff and only minor active management activities, we contribute negligibly to the local economy on Martha's Vineyard in terms of Refuge staff jobs, income, expenditures, and purchases of goods and services for Refuge activities. Any such expenditures would likely accrue in Sudbury, or Falmouth, where occasional staff expenditures for food or gas associated with trips to the Refuge take place. On occasion, staff meet with conservation partners on Martha's Vineyard, so additional staff expenditures for meals, gas and lodging there will also occur.

Socioeconomic Effects of Alternative B (Enhanced Wildlife Management and Visitor Services)

Refuge Visitor Expenditures

Under all three alternatives the Refuge will remain closed to visitors, so there are no Refuge-specific visitor expenditures. Under Alternative B we propose an expanded off-site outreach, environmental education and interpretation program, especially in association with the Aquinnah Cultural Center. We anticipate that these changes, including an interpretive trail, spotting scope and kiosk at the Aquinnah Cultural Center will benefit the Center itself, the Wampanoag Tribe and the communities of Chilmark and Aquinnah through increased tourist visitation and trade.

Impacts from Refuge Administration

Under Alternative B, Nomans Land Island Refuge would remain as a satellite station of the Eastern Massachusetts NWR Complex, headquartered in Sudbury, Massachusetts, though site visits would increase annually under this alternative. Expenditures related to Refuge staff and other administrative costs will largely accrue to the communities around Sudbury, though there may be some incremental increase in expenditures in Falmouth for gas and meals associated with trips to the Refuge. On occasion, staff meet with conservation partners on Martha's Vineyard, so additional staff expenditures for meals, gas and lodging there will also occur.

The creation of off-site environmental education and interpretive materials and programs, more visits to the Vineyard by Refuge staff, and a dedicated effort to participate in local community events would increase expenditures and purchases of goods and services in the local communities on the Vineyard.

Socioeconomic Effects of Alternative C (Natural Processes Emphasis, Focal Species Management, and Wilderness Designation (Service-Preferred Alternative))

Refuge Visitor Expenditures

Under all three alternatives the Refuge will remain closed to visitors, so there are no Refuge-specific visitor expenditures. Off-site environmental education and interpretation would be increased from current levels under Alternative A, but would be less than levels proposed in Alternative B. In partnership with the Aquinnah Cultural Center, we would complete an interpretive trail and associated outreach materials for Nomans Land Island NWR, benefiting the Center itself, the Wampanoag Tribe and the local communities of Chilmark and Aquinnah. We anticipate that this expanded outreach would likely increase visitation above current levels to these Vineyard communities.

Impacts from Refuge Administration

Socioeconomic impacts from Refuge Administration under Alternative C would be slightly increased from Alternative A, but less than Alternative B. Under Alternative C, Nomans Land Island Refuge would

remain as a satellite station of the Eastern Massachusetts NWR Complex, headquartered in Sudbury, Massachusetts, with no on-site staffing. Therefore, expenditures related to Refuge staff and other administrative costs will largely accrue to the communities around Sudbury, though there may be some incremental benefit to Falmouth for gas and meals associated with trips to the Refuge over time. On occasion, staff meet with conservation partners on Martha's Vineyard, so additional staff expenditures for meals, gas and lodging there will also occur. These would be essentially commensurate with levels described in Alternative A.

The slight increase in off-site interpretation and outreach under Alternative C would result in more visits to the Vineyard by Refuge staff compared to current. Therefore, our contribution to the local economy in terms of expenditures and purchases of goods and services would not be as great as Alternative B, but would increase slightly from Alternative A.

Nomans Land Island would be recommended for wilderness designation under this alternative; however, it is not anticipated to have any positive or negative socioeconomic impacts to local communities.

Cumulative Impacts

Cumulative impacts on the physical, biological, and human environment result from the combined effects of the proposed actions added to those of other past, present, and reasonably foreseeable future actions. They can result from individually minor but collectively significant actions taking place over a period of time.

This assessment of cumulative impacts includes other agencies' or organizations' actions if they are interrelated and influence the same environment. Thus, it considers the interaction of activities at the Refuge with others occurring in a larger spatial and temporal frame of reference.

Air Quality

Air quality is generally good in the region. Some areas in Massachusetts periodically experience high ozone levels (MA DEP 2009); however, the island location of the Refuge ensures relatively good air quality. We would expect short-term, localized effects on air quality from the prescribed burns conducted by the U.S. Navy during clearance of unexploded ordnances, or by the Service for maintenance of shrubland habitat. If the Service initiates prescribed burns, as in Alternatives B and C, it would replace the Navy's burn regime to achieve Refuge habitat objectives. The cumulative impacts of prescribed burning throughout a region may be short-term and moderate (Zeng et al. 2008), but the temporary and periodic nature of the proposed fire regime on Nomans Land Island, and its isolated location, minimizes any contribution to potential cumulative effects in the region.

Similarly, occasional herbicidal applications to Refuge habitats are for the most part applied through backpack sprayers and are very target-specific. This type of application would not be anticipated to have any impacts to air quality, as they would be directly applied to the target plants. Aerial herbicide application may have some short-term, localized air quality impacts at the Refuge, but would comply with EPA guidelines that are established to minimize any potential adverse impacts. As with prescribed burning, the limited use of aerial herbicide application on Nomans Land Island, and its isolated location, minimizes any contribution to potential cumulative effects in the region.

While wilderness designation may not essentially alter habitat management activities, it could potentially reprioritize management methods. This designation would create no adverse impacts, and may in fact provide slight benefits to local and regional air quality through wilderness policy compliance.

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.

Water Quality and Soils

There would be no significant cumulative adverse effects to water quality or soils under any of the alternatives. Past land uses have likely had the greatest impact on water quality, and studies conducted by the Navy have shown that surface waters and sediments on the Refuge contain metals (lead, copper, zinc). All three alternatives propose no actions that would further impact water quality. Herbicides used in or near wetlands on the Refuge are approved for use in aquatic habitats, and would be in compliance with product usage and EPA guidelines established for minimal impacts. Invasive species treatments would improve water and habitat quality.

There are no anticipated soil impacts under any of the three alternatives, as there are no proposed activities that would involve any large-scale digging or ground alterations. Any invasive species treatments, erosion control mitigation activities, or archaeological sites would conform to best management practices and Integrated Pest Management to minimize any adverse effects from these treatments.

While wilderness designation may not essentially alter habitat management activities, it would potentially reprioritize management methods. This designation would create no adverse impacts, and may in fact provide slight benefits to Refuge water quality and soil through wilderness policy compliance.

Biological Resources

All alternatives would strive to maintain or improve biological resources on the Refuge. Given the prohibition of public access to the Refuge, including for all six priority public uses, the island's flora and fauna are afforded a high level of protection from human disturbance, or predators associated with human disturbance. There would be no significant cumulative adverse effects to biological resources under any of the alternatives. We would utilize adaptive management to varying degrees under all the alternatives to maintain habitat conditions for focal species. 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. If 50 pairs of terns establish a colony on the Refuge, then predator management actions will be taken to maintain a 5-acre gull-free zone. This could result in a small decrease in the number of gulls on the island and a reduction in the number of young produced on the Refuge. The potential establishment of a New England cottontail population on the Refuge would help secure the population in the northeast by providing a large patch of suitable habitat without any anthropogenic disturbances, mammalian predators, eastern cottontails, or interspecific competition for forage resources.

Erin Victory/TCI

Blue flag Iris

While wilderness designation may not essentially alter habitat management activities, it would potentially reprioritize or pose more specific guidelines on management methods. This designation would pose no threat to any biological resources, and would at least provide the potential to indirectly benefit these resources at the Refuge.

The Commonwealth of Massachusetts released an Ocean Management Plan in 2009, which identified two locations off the Massachusetts coast where large scale (150+ turbines) would be encouraged. One of these locations is in state waters off the south side of Nomans Land Island. In early 2010, the Service learned that developers were interested in siting wind farms in federal waters adjacent to the state waters off Nomans Land Island as well. Refuge staff will work with other Service staff to recommend environmental studies to fill known data gaps. Of particular concern is the impact that offshore wind turbines will have on bats and birds, as well as the proposed wilderness designation of the Refuge.

Socioeconomic 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 any of the alternatives would result in minor beneficial impacts on the communities nearest the Refuge. We would expect the greatest contribution to accrue to the Aquinnah Cultural Center, the Wampanoag Tribe, the Town of Aquinnah, and the Town of Chilmark, particularly under Alternative B, but also to some extent under Alternative C.

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 on the Refuge and on Martha's Vineyard.

Cultural and Archaeological Resources

We expect none of the alternatives to have significant adverse cumulative impact on cultural resources in the region. Under all three alternatives we would work to prevent the loss of cultural and archaeological resources and work collaboratively with the U.S. Navy to prevent such loss during their ordnance clearing procedures. Our partnership with the Wampanoag Tribe of Gay Head (Aquinnah) is of great importance and would be strengthened under all three alternatives.

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 published an informative technical review report in 2004 titled "Global Climate Change and Wildlife in North America" (Inkley et al. 2004). It interprets results and details from such publications as the 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 (Inkley et al. 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 and to ecosystem changes, their interactions with other species, and the impacts from other stressors in the environment. In other words, only imprecise generalizations can be made about the implications of our Refuge management on regional climate change.

Our review of proposed actions in this CCP suggest that only two activities may contribute negligibly, but incrementally, to stressors affecting regional climate change: the prescribed burn program carried out by the U.S. Navy or the Service and travel to the Refuge from the complex headquarters in Sudbury, Massachusetts. We discuss the direct and indirect impacts of those activities elsewhere in Chapter 4. With regards to our travel logistics, we are trying to reduce our carbon footprint wherever possible by driving

hybrid vehicles, and using recycled or recyclable materials, along with reduced travel and other conservation measures. In addition, Nomans Land Island is one of several coastal refuges in the northeast that underwent SLAMM analysis designed to project coastal potential coastal habitat changes correlated with sea-level rise. Based on the SLAMM analysis, we would incorporate actions to mitigate potential outcomes resulting from global climate change and rises in sea level as deemed necessary and appropriate.

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. 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 (Inkley et al. 2004). This position states 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 some of these recommendations:

- 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/. Actions that can be implemented at the local level are being developed by Service managers.

- Manage for diverse conditions
  Our proposed habitat management actions described in Chapter 2 is intended to promote healthy, functioning shrub, wetland, and beach communities. We will implement an adaptive management approach as new information becomes available.

- Do not rely solely on historical weather and species data for future projections without taking into account climate change
  This recommendation relates to the point that historical climate, habitat and wildlife conditions are less reliable predictors as climate changes. For example, there may be a need to adjust breeding bird survey dates if migratory birds are returning earlier to breed than occurred historically. A three-week difference in timing has already been documented by some bird researchers. We are aware of these implications and plan to build these considerations into our inventory and monitoring plan so that we can make adjustments accordingly. Our results and reports, and those of other researchers on the Refuge, will be shared within the conservation community.

- Expect surprises, including extreme events
  Refuge managers have flexibility within their operations funds to deal with emergencies. Other Regional operations funds would also be re-directed as needed to deal with an emergency.

- Prevent and control invasive species
  This recommendation emphasizes the increased opportunities for invasive species to spread because of their adaptability to disturbance. Invasive species control will be essential, including extensive monitoring and control to preclude larger impacts. Invasive species control is a major initiative within the Service and on Nomans Land Island. The Northeast Region, in particular, has taken a very active stand. In Chapter 2, we describe our plans on the Refuge to control invasive plants.

- Ensure ecosystem processes
  This recommendation suggests that managers may need to enhance or replace diminished or lost ecosystem processes. Manually dispersing seed, reintroducing pollinators, treating invasive plants and pests, are examples used. We will monitor invasive species and implement actions to reduce their abundance and impact on native plants and wildlife, and our proposed prescribed burn program creates a disturbance regime that will perpetuate shrubland habitat. Beyond these actions, we do not believe at this time there is any need to enhance or replace ecosystem processes.

Further, none of our proposed management actions will diminish natural ecosystems processes. Should our monitoring results reveal that we should take a more or less active role in enhancing or replacing those processes, we will reevaluate and/or refine our management objectives and strategies accordingly.

- Employ monitoring and adaptive management
  This recommendation states that we should monitor climate and its effects on wildlife and their habitats and use this information to adjust management techniques and strategies. Given the uncertainty with climate change and its impacts on the environment, relying on traditional methods of management may become less effective. We agree that an effective and well-planned monitoring program, coupled with an adaptive management approach, is essential to dealing with the future uncertainty of climate change. We have built both actions into our CCP. We will develop a detailed step-down inventory and monitoring plan designed to test our assumptions and management effectiveness in light of on-going changes. With that information in hand, we will either adapt our management techniques, or re-evaluate or refine our objectives as needed.

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

All of the alternatives strive to maintain or enhance the long-term productivity and sustainability of natural resources on the Refuge and in the 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. 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 from prescribed burns and controlling invasive plants. All would be enacted using accepted protocols, safety measures and according to federal guidelines, 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 shrub habitat. If for some reason shrub habitat were no longer an objective, Refuge shrubland would gradually convert to a different habitat type, and over a very long time revert to a more forested condition.

We do not consider small visitor facilities, such as kiosks and educational signs built in collaboration with the Aquinnah Cultural Center, as an irretrievable commitment of resources. 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." In this context, fair treatment means that no group of people should bear a disproportionate share of negative environmental consequences resulting from the action.

Overall, we expect none of the alternatives to place disproportionately high, adverse environmental, economic, social, or health effects on minority or low-income persons. The Refuge itself is closed to all public access, is surrounded by the Atlantic Ocean, and is approximately three miles from Martha's Vineyard, the nearest inhabited landmass.

Table 4.1. Matrix of Environmental Consequences by Alternative.

Nomans NWR Resources	Alternative A: Current Management	Alternative B: Enhanced Wildlife Management and Visitor Services	Alternative C: Natural Processes Emphasis, Focal Species Management, and Wilderness Designation (Service-Preferred Alternative)
Socioeconomic	Under Alternative A, there is minimal opportunity for the public to interact with the Refuge from Martha's Vineyard; therefore there are no visitor expenditures or economic benefits to the local community of Chilmark that can be attributed to the Refuge. The Refuge maintains no facilities on the island. Since there are no on-site staff and only minor 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. The Refuge remains closed to the public and access is restricted to minimal authorized personnel only.	Under Alternative B we propose an expanded environmental education and interpretation program, especially in association with the Aquinnah Cultural Center and Wampanoag Tribe, benefiting the Wampanoag Tribe and the local communities of Aquinnah and Chilmark. The proposed expansion of habitat management, creation of environmental education and interpretive materials, and an increase in island visitation by Refuge staff will increase expenditures and purchases of goods and services in the local communities.	We propose an expanded interpretation program from current, including partnering with the Aquinnah Cultural Center, benefiting the local communities of Aquinnah and Chilmark. Alternative C proposes habitat management and inventory and monitoring similar to levels in Alternative A. Therefore, our contribution to the local economy from Refuge expenditures under Alternative C is similar to that described in Alternative A. If wilderness is designated, the type of management conducted would likely change, though frequency of staff visits should remain the same. Therefore, even under a wilderness designation, Refuge expenditures should remain similar to that described in Alternative A.
	Service land ownership would remain the same under all three alternatives; Refuge revenue sharing payments and impacts on property taxes are not affected. Under the transfer agreement with the U.S. Navy, the island remains closed to public access under all three alternatives.		

Water Quality	Minimal risks to water quality are possible from use of herbicides by the Refuge to control invasive plant species. We would use Integrated Pest Management to prevent or minimize any impacts from use of herbicides, and would only use herbicides that are safe for aquatic habitats when working near water bodies or wetlands on the Refuge. Removal of aquatic invasive species including purple loosestrife and Phragmites in wetland habitats would potentially improve hydrology and associated water quality. Monitoring of some wetland birds and rare plant surveys would provide some measure of wetland conditions including water quality.	The potential risks to water quality would increase slightly over Alternative A, due to increased invasive species control using chemical or mechanical methods. We would use Integrated Pest Management to prevent or minimize any impacts from use of herbicides. Wherever possible, application will be by backpack instead of aerial application in order to better focus the application of the chemical. Any herbicide used near water or wetlands would be approved to be used in those habitats, no matter the application method employed. Removal of aquatic invasive species including purple loosestrife and Phragmites in wetland habitats and increased monitoring of invasive aquatic species would potentially improve hydrology and associated water quality.	The potential risks to water quality are similar to Alternative A, as are the steps taken to minimize these risks. Alternative C would provide no opportunity to monitor water indirectly through monitoring of habitat conditions or wildlife populations. Removal of aquatic invasive species including purple loosestrife and Phragmites in wetland habitats would potentially improve hydrology and associated water quality. Wilderness designation is anticipated to have positive impacts on the islands' water quality.
	Under all three alternatives, minimal risk to water quality from potential prescribed fire used by U.S. Navy to remove unexploded ordnance, or by the Service to achieve habitat objectives, by increasing the potential for soil erosion and sedimentation. The impacts to water quality from public access and use are non-existent since the Refuge is closed to all public use under all three alternatives. 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.		
Air Quality	Current management activities neither	Similar to A, with the potential for only	Slightly less than as in Alternative A as there

	substantially benefit nor adversely affect local and regional air quality. There is a very small amount of hydrocarbon emissions caused by Refuge activities including emissions from transportation to/from the Refuge and the occasional use of an all terrain vehicle on the Refuge to conduct resource management operations. The vehicle fleet at the Refuge headquarters is becoming more efficient and cleaner as older vehicles are replaced by low emission hybrid cars and trucks.	short-term, minor localized impacts to air quality from increased management activities such as mechanical or chemical removal of invasive plants. While there would be more boat trips to the Refuge under this alternative, the total number of trips conducted annually would not likely exceed 20, resulting in a small increase in hydrocarbon emissions from transportation.	would likely be fewer boat trips to the Refuge and less work done on the Refuge than either Alternative A or B. Wilderness designation is anticipated to have positive impacts on the islands' air quality.
	Under all three alternatives, the U.S. Navy or the Service would potentially continue to use prescribed fire which would cause some short-term, minor localized impacts to air quality, as would the occasional use of aerial herbicide application. No major ground-disturbing activities that would affect air quality are proposed under any of the alternatives. 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.		
Soils	Some soil compaction would occur by walking or using ATV's on the existing maintenance trail network during Refuge management and monitoring visits and by U.S. Navy personnel. No major ground disturbing activities would occur under Alternative A; the mechanical removal of invasive plants has the potential to cause minimal adverse impacts to soils.	In addition to Alternative A: There could be more soil disturbance associated with higher levels of invasive species control, but any soil disturbed by the physical removal of plants would be tamped down and compacted. This is a standard aspect of any mechanical removal operation. Efforts to restore the water control structure on the wetland near Rainbow Pond might create temporary soil	Under Alternative C Refuge visits would be decreased commensurate with the decrease in monitoring and management, so soil compaction will be the least under this alternative. Wilderness designation is anticipated to have positive impacts on the islands' soils. There would be some soil disturbance on the interpretative trail from the installation of wayside exhibits and/or interpretive panels at the Aquinnah Cultural Center on Martha's Vineyard.

		impacts but will have long term benefits as the potential for this section of the trail to erode due to the failing water control structure will be reduced. There would be some soil disturbance on the interpretative trail from the installation of wayside exhibits and/or interpretive panels at the Aquinnah Cultural Center on Martha's Vineyard. Also there would be an increase in foot traffic which could lead to some erosion and soil compaction on the trail.	Also there would be an increase in foot traffic which could lead to some erosion and soil compaction on the trail.
	Under all three alternatives some soil disturbance occurs from continued removal by the U.S. Navy of unexploded ordnances as discovered and from the continuous wave action eroding the western and southern shores creating steep 50-foot high bluffs. The lack of public access under all three alternatives significantly reduces risk of soil erosion from human recreational activities.		
Shrub Habitat-Breeding and Migratory Birds and other Wildlife	The maintenance of 400+ acres of shrub habitat through the use of prescribed fire by the U.S. Navy during ordnance removal would benefit shrub-dependent focal bird species by perpetuating shrub habitat, although the management regimes would not be biologically-based. The control of invasive species only along existing maintenance pathways would potentially degrade the quality of native shrub habitat for focal species,	More active management of 400+ acres of shrub habitat would ensure greater control of habitat conditions that benefit focal shrub species. A 7-12 year biologically-based fire regime on a rotational basis for each of two habitat patches would better target habitat needs and would have minimal impact on nesting and migrating birds and invertebrates. This is because burns would take place during the dormant season, when	Alternative C relies on natural processes, including succession, to influence and guide habitat conditions for the 400 acres of existing shrub on the Refuge. Prescribed fire would only be used as habitat conditions warrant to achieve habitat objectives for focal species of concern on the Refuge. This would likely result in lower frequency of prescribed fire on the island. As in Alternative B, prescribed fires would take place during the dormant season to have minimal impact on birds

	where invasive plants are left untreated.	birds are no longer nesting and when most species are less active. A more concerted effort island-wide to control invasive plant species would provide additional benefit to shrub-dependent focal species and natural habitats by promoting native shrubs to persist, which offer temporally critical food resources. The use of herbicides and other treatment methods would conform to Integrated Pest Management guidelines to minimize any impacts. The potential introduction of New England cottontail would likely have minimal impact on the abundant shrubland habitat through browsing on shrub foliage, buds, stems, and bark. This species could serve as a vector for invasive shrub dispersal on the Refuge.	and other species. Control of invasive species would be similar to Alternative A, unless invasive species exceed 10 percent of the shrubland habitat. More aggressive invasive control would then be used and would benefit natural habitat and species that depend upon it. The use of herbicides and other treatment methods would conform to Integrated Pest Management guidelines to minimize any impacts. The potential introduction of New England cottontail would likely have minimal impact on the abundant shrubland habitat through browsing on shrub foliage, buds, stems, and bark. This species could serve as a vector for invasive shrubland species dispersal on the Refuge. Wilderness designation is anticipated to have positive impacts on the islands' wildlife and habitats.
Vegetated Dune Habitat	Alternative A would involve minimal management of up to 15 acres of vegetated dune habitat that provides habitat for shorebirds and terns. This would result in some dune habitat succeeding to woody vegetation. The control of invasive species only along	Alternative B would involve more active protection and management of up to 15 acres of vegetated dune habitat that provides habitat for shorebirds and terns. A more concerted effort island-wide to control invasive plant species would provide	Alternative C relies on natural processes to shape the existing 15 acres of vegetated dune habitat that provides habitat for shorebirds and terns. This would result in some dune habitat succeeding to woody vegetation. Invasive species control would occur only if dune

	existing maintenance pathways would potentially degrade the quality of the vegetated dune habitat for focal species, where invasive plants are left untreated. Limited predator control would provide some benefit to nesting terns, but would result in some negative impacts to the individuals targeted for control. Limited analysis of potential impacts of sea-level rise offers minimal opportunity for monitoring and adaptive management to minimize impacts by implementing mitigation measures is less than under Alternative B.	greater benefit to dune focal species and natural habitat by promoting the persistence of native plant species. Treatment could include physical, mechanical or chemical methods, but would conform to Integrated Pest Management guidelines. The opportunity to implement adaptive management is greatest under Alternative B, given concerted efforts to manage vegetation using different techniques as needed. More active predator monitoring and control would provide greater protection to nesting terns, but would have some negative impacts on the individuals targeted for control. An analysis of potential impacts of sea-level rise offers more opportunity for evaluation, monitoring, and adaptive management, to minimize impacts of sea level rise by implementing mitigation measures.	habitat quality was being compromised and therefore would have less impacts than Alternative B. The presence of any federal-listed breeding bird species would potentially trigger habitat management and predator control actions. This would benefit rare species and negatively impact the few predator individuals targeted as necessary. Wilderness designation is anticipated to have positive impacts on the islands' wildlife and habitats. Analysis of potential impacts of sea-level rise offers minimal opportunity for evaluation, monitoring, and adaptive management to implement mitigation measures to minimize impacts form sea-level rise.
Marine Intertidal Beach and Rocky Shore	Alternative A would involve minimal management of up to 100 acres of marine intertidal beach and rocky shore habitat that benefit	Alternative B would protect up to 100 acres of marine intertidal beach and rocky shore habitat that benefit marine mammals and	Alternative C would allow natural processes to shape the existing 100 acres of marine intertidal beach and rocky shore habitat that benefit

	marine mammals and nesting and migrating shorebirds. An analysis of potential impacts of sea-level rise offers some opportunity for adaptive management, although ability to implement mitigation measures is less than under Alternative B.	nesting and migrating shorebirds. Protection of this habitat under Alternative B would involve adaptive management to mitigate for potential impacts of climate change and working with partners to monitor and control invasive species such as sea cucumbers, and macroalgae. This would ultimately promote the persistence of native species, and further support migrating and nesting shorebirds and waterbirds reliant upon this habitat. More active predator monitoring and control would provide greater protection to nesting cormorants and oystercatchers and migrating shorebirds while potentially impacting few targeted predator individuals as necessary.	marine mammals and nesting and migrating shorebirds. An analysis of potential impacts of sea-level rise offers some opportunity for adaptive management, although ability to implement mitigation measures is less than under Alternatives A and B. Wilderness designation is anticipated to have positive impacts on the islands' wildlife and habitats.
Scrub Shrub and Emergent Wetlands, Bogs, and Open Water	Alternative A would involve minimal management of the 100-150 acres of freshwater wetland habitat to support breeding marshbirds. Treatment and/or removal of aquatic invasive species including purple loosestrife and Phragmites would improve wetland habitats by promoting the	Alternative B would involve protection and management of the 100-150 acres of freshwater wetland habitat to support breeding marshbirds and native plants and animal communities. As in Alternative A, treatment and/or removal of aquatic invasive species including purple	Alternative C would rely on natural processes to influence the 100-150 acres of freshwater wetland habitat that support breeding marshbirds and native plants and animal communities. Treatment and/or removal of aquatic invasive species including purple loosestrife and Phragmites would

	persistence of native plant species, and promote species diversity (both plant and wildlife) by removing monotypic stands. Herbicidal application would have some limited impacts to wetlands, but would be approved for use in wetlands, and would be used according to Integrated Pest Management guidelines to minimize these impacts.	loosestrife and Phragmites would improve wetland habitats by promoting the persistence of native plant species, and promote species diversity (both plant and wildlife) by removing monotypic stands. Herbicidal application would have some limited impacts to wetlands, but would be approved for use in wetlands, and would be used according to Integrated Pest Management guidelines to minimize these impacts.	improve wetland habitats by promoting the persistence of native plant species, and promote species diversity (both plant and wildlife) by removing monotypic stands. Herbicidal application would have some limited impacts to wetlands, but would be approved for use in wetlands, and would be used according to Integrated Pest Management guidelines to minimize these impacts. Wilderness designation is anticipated to have positive impacts on the islands' wildlife and habitats.
Education, and Community Outreach	Alternative A would maintain the current level of interpretation through the Refuge website virtual tour. This would rely on general knowledge of the website and virtual tour to be effective. The ability to engage the public, interpret Nomans Land Island resources, or promote the Refuge System mission is less than in Alternative B or C. Community partnerships would continue to be important under Alternative A, especially with the Wampanoag Tribe. The infrequent trips to Martha's Vineyard by staff under this alternative would likely hamper the creation of new partner initiatives,	Alternative B would offer the greatest expansion of our environmental education and interpretive programs on Martha's Vineyard, specifically in partnership with the Aquinnah Cultural Center and the Wampanoag Tribe. Expanded programs would include alternative ways to bring an experience of the Refuge to visitors and residents of Martha's Vineyard. This would aid in creating a connection with this inaccessible island, as well as providing a more in-depth experience of Refuge habitats and wildlife and their role	Alternative C would expand our interpretive programs beyond Alternative A, but less than Alternative B. This increase in interpretation from present would allow us to reach a broader audience, bring an experience of the island to residents of and visitors to Martha's Vineyard, interpret Refuge resources and management activities, and illustrate how the Refuge fits into the Refuge System. Community partnerships would continue to be important under Alternative C, especially with the Wampanoag Tribe, and we would continue to strengthen existing partnerships and

	and would have less potential for strengthening community ties or reaching a broader audience than in Alternatives B and C.	in coastal ecosystems. An increase in programs and expanded outreach under Alternative B would enable us to reach a broader audience, interpret Refuge resources and management activities, highlight the role of this island in Wampanoag history and culture, educate the public about the importance of dynamic coastal resources and how the Refuge fits into the Refuge System, and to illustrate the impact of climate change on island conditions. Community partnerships would continue to be important under Alternative B, especially with the Wampanoag Tribe, and strengthening existing partnerships and creating new ones would be a Refuge priority. This would be facilitated by increased staff visits to Martha's Vineyard. These partnerships would assist in the ability to expand public programs.	create new ones. This would be facilitated by a more concerted effort by staff to participate in occasional community events, and to establish a presence on Martha's Vineyard with the interpretive trail. These partnerships would assist in the ability to expand public programs. Wilderness designation is not anticipated to impact the islands' access or interpretation potential since access will continue to be closed to the public.
	Under all three alternatives none of the six priority wildlife-dependent uses are allowed on the Refuge, as we are obligated to maintain and enforce a ban on public access for safety reasons on Nomans Land Island. Although the distance of the Refuge from Sudbury headquarters limits our capabilities, some level of interpretation related to the Refuge occurs on Martha's Vineyard for all three alternatives.		
Cultural and	Under Alternative A, we	In addition to	Same as Alternative A in

Archaeological Resources	would follow Service protocol to prevent the loss of cultural and archaeological resources, record sites as they are encountered, and coordinate with the Navy on compliance with the National Historic Preservation Act. This would ensure that archaeological and cultural items are preserved and protected. Interpretation of cultural resources on the Refuge website virtual tour provides only basic interpretation about relatively recent human history of the island, and relies on general knowledge of the website and the existence of the virtual tour. Under Alternative A we would continue to consult with the Tribe on cultural and biological issues, and to build a strong partnership.	Alternative A in relation to archeological resources, we would initiate a cultural resources overview, maintain inventory of known and newly found sites and structures, provide cultural resource training to Refuge staff, work with the Wampanoag Tribe with an oral history project, assist with research into historic land uses, and prepare a narrative prehistory and history of Nomans Land Island. Alternative B offers greater opportunities to protect and interpret these resources. These efforts, in cooperation with our partners, would increase our knowledge about the history of the island and contribute to the archaeological knowledge base of the region, and would offer opportunities to increase education and historical interpretation of the island, while reaching a broader audience. In addition to Alternative A in relation to the Luce Cemetery, we would work with the Chilmark Historical Commission to identify those buried in the Luce cemetery. This too would	relation to archaeological resources. Same as Alternate A in relation to the Luce Cemetery. Under Alternative C there would be a modest increase in interpretation of cultural and archaeological resources from present, but would be less than Alternative B. Same as Alternate A in relation to consultation and building a strong partnership with the Wampanoag Tribe. Wilderness designation is not anticipated to impact the islands' cultural, historic, or archaeological resources.

		increase our knowledge base of the history of the island. Under Alternative B we would continue to consult with the Tribe on cultural and biological issues, and to build a strong partnership.	
Under all three alternatives we would pursue a partnership agreement with the Wampanoag Tribe of Gay Head (Aquinnah) to improve coordination and address tribal concerns regarding repatriation and access for ceremonial purposes. In addition, none of the six priority wildlife-dependent uses are allowed on the Refuge, as we are obligated to maintain and enforce the ban on public access for safety reasons on Nomans Land Island. Although the distance of the Refuge from Sudbury headquarters limits our capabilities, some level of interpretation related to the Refuge occurs for all three alternatives.			