

# Environmental Consequences

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## INTRODUCTION

This chapter analyzes both beneficial and adverse impacts that would result from implementing any of the alternatives considered in this plan/EIS. This chapter also includes methods used to analyze direct, indirect, and cumulative impacts. A summary of the environmental consequences for each alternative is provided in table 7, which can be found in “Chapter 2: Alternatives.” The resource topics presented in the current chapter and the organization of the topics correspond to the resource discussions in “Chapter 3: Affected Environment.”

## METHODOLOGY FOR ASSESSING IMPACTS

In accordance with the Council on Environmental Quality (CEQ) regulations, direct, indirect, and cumulative impacts are described under each impact topic (40 CFR 1502.16), and the impacts are assessed in terms of context and intensity (40 CFR 1508.27). Where appropriate, mitigating measures for adverse impacts are also described and incorporated into the evaluation. The specific methods used to assess impacts for each resource may vary; therefore, these methodologies are described under each impact topic.

### TYPE OF IMPACT

Impacts are discussed by type, as follows (the terms “impact” and “effect” are used interchangeably throughout this document):

- Direct:** Impacts that would occur as a result of the proposed action at the same time and place of implementation (40 CFR 1508.8).
- Indirect:** Impacts that would occur as a result of the proposed action but later in time or farther in distance from the action (40 CFR 1508.8).
- Adverse:** Impacts that cause an unfavorable result to the resource when compared to the existing conditions.
- Beneficial:** Impacts that would result in a positive change to the resource when compared to the existing conditions.

### ASSUMPTIONS

The analysis of impacts incorporates several important assumptions, listed below.

- The following assumptions apply to all action alternatives:
  - Vegetation will have recovered within approximately 8–10 years once target density of deer is reached or following exclosure of deer from an area.
  - The Seashore would incorporate the practice of adaptive management during implementation of the NPS preferred alternative. For additional information on the concept of adaptive management, see chapter 2.
  - A minimum requirements decision guide would be completed prior to implementation of any actions potentially affecting wilderness, including translocation of deer into the Fire Island Wilderness to determine suitability and appropriate mitigation strategies.
- The following assumption apply to alternatives B and D:
  - Because an acceptable reproductive control agent that meets all of the established criteria does not currently exist, the plan/EIS analyzes the impacts based on a generic agent that would meet all criteria.
- The following assumption applies to alternatives C and D:

- Target deer density would be reached in approximately two years using direct reduction methods to reduce initial deer density.
- The following assumptions apply to alternative B:
  - The impacts described in this chapter are written to capture two potential scenarios regarding the availability of an acceptable fertility control agent (as described in chapter 2) as a tool to reduce the deer population to the target density. The impact analyses first describe the impacts of each alternative under the assumption that an acceptable fertility control agent is available immediately; however, an acceptable agent may not be available realistically for approximately 10 years from the drafting of this document. Therefore, the impact analyses also describe how impacts under each alternative would differ if an acceptable fertility control agent does not become available for another 10 years.
  - Use of an available fertility control agent would result in target deer density being reached in approximately 13 years.
  - Fencing at the William Floyd Estate would be put up in one configuration, remain in place for at least 10 years, and then be moved to a second configuration for another 10 years.
- The following assumption applies to alternative D:
  - The Seashore could use fertility control and/or direct reduction methods to maintain the deer population at or below the target density. Although the same 10 year delay in availability of an acceptable fertility control method as described under alternative B would be possible, such a delay may not cause a noticeable difference in impacts because direct reduction methods could be used in the interim. The difference in impacts, where applicable, is described under each topic below.

## CUMULATIVE IMPACT ANALYSIS METHODOLOGY

Cumulative impacts are defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, or reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions” (40 CFR 1508.7). Cumulative impacts are considered for all alternatives.

Cumulative impacts were determined for each resource by combining the impacts of the alternative being analyzed with the impacts of unrelated actions that affect the same resource. Because some of these unrelated actions are in the early planning stages, the evaluation of the cumulative impact is based on a general description of the projects. These actions were identified through the internal and external project scoping processes and are summarized below.

### Past, Present, and Reasonably Foreseeable Future Actions

**Tick Monitoring and Management Program.** The National Park Service would continue to monitor tick issues at the William Floyd Estate and provide education to visitors and staff regarding ticks, tick-borne illnesses, preventive measures that visitors can take to avoid exposure to ticks, and proper responses to tick bites. This program has the potential to impact vegetation, unique vegetation communities, and special-status plant species; other wildlife and wildlife habitat; visitor use and experience/recreation; public health and safety; and Seashore operations.

**4-Poster Deer Treatment Devices.** In 2011 Cornell University completed a three-year study on the use of 4-Poster devices to treat deer with the pesticide permethrin when they feed, with the purpose of killing ticks on deer. The devices were located on nonfederal lands on Fire Island and Shelter Island and used whole kernel corn as a lure to attract the deer. The study was a condition of the New York State Special Local Need Registration (SLN NY-07005) for the 4-Poster Tickicide (EPA

Registration Number 39039-12) to investigate control of ticks and human and wildlife associated risks. In January of 2012, the New York State Department of Environmental Conservation registered 4-Poster Tickicide along with assigning a Special Local Need Supplemental Labeling for the device. This resulted in two Fire Island communities located within the Seashore's boundaries requesting deployment of a total of three devices: two devices in the village of Saltaire and one device in Fair Harbor. The National Park Service issued a Letter of Authorization for both communities, as requested. However, the National Park Service has concerns regarding policies and regulations against the supplemental feeding of wildlife, specifically white-tailed deer on Fire Island. The National Park Service continues to reject the use of the 4-Poster Tickicide on federal lands because the devices provide a regular, introduced food source for the deer population, which contradicts NPS Management Policies 2006 and NPS efforts to reduce human-deer interactions and lower the abundance of deer throughout the Seashore. The registration of 4-Poster Tickicide and the continued use of these devices on Fire Island has the potential to impact vegetation, unique vegetation communities, and special-status plant species; the white-tailed deer population; other wildlife and wildlife habitat, visitor use and experience/recreation, Fire Island communities and adjacent landowners, and public health and safety.

**Waterfowl Hunting.** Fire Island National Seashore provides limited opportunities for waterfowl hunting. Hunters must first obtain a hunting permit from the Seashore. Fire Island National Seashore's East End Hunting Area is adjacent to the Fire Island Wilderness. A sportsman's recreational vehicle driving permit may be used to access the beach on the Atlantic Ocean side of the Fire Island Wilderness from September 15 through December 31. Access to the bay side of Fire Island is by foot or shallow-draft vessel only. Waterfowl hunting is permitted only from Hayhole Point, west of the Wilderness Visitor Center, to Long Cove, east of Watch Hill. No hunting is allowed from the small bay islands north of Fire Island in this area. A portion of the Pattersquash Gun Club's hunting rights are within the boundaries of Fire Island National Seashore. Fire Island's West End Hunting Area is restricted to shoreline waterfowl hunting from East Fire Island, West Fire Island, and Sexton Island. All areas are designated as "Carry-In/Carry-Out." Waterfowl hunting has the potential to impact other wildlife and wildlife habitat, wilderness, visitor use and experience/recreation, and Seashore operations.

**Deer Hunting and Deer Damage Permits.** Deer may be hunted in the Fire Island communities and on lands adjacent to the William Floyd Estate in accordance with state regulations guiding hunting and state-issued deer damage permits, which allow for removal of nuisance deer outside of the regular hunting season. The New York State Department of Environmental Conservation, Division of Fish, Wildlife, and Marine Resources, publishes annual state-wide deer harvest reports. The number of deer harvested in Suffolk County on Long Island was reported to be 2,873 deer in 2013 (NYS-DEC 2013a). The potential removal of deer by hunting and deer damage permits in the Fire Island communities and on lands adjacent to the William Floyd Estate have the potential to impact vegetation, unique vegetation communities, and special-status plant species; the white-tailed deer population; other wildlife and wildlife habitat; cultural landscapes; visitor use and experience/recreation; and Seashore operations.

**William Floyd Estate Cultural Landscape Report and Treatment Plan.** The National Park Service anticipates preparing a cultural landscape report and treatment plan for the William Floyd Estate in the reasonably foreseeable future. Consistent with the recommendations of the plan, once completed, the lower acreage would continue to be managed as a cultural resource and would be monitored to retain its natural resource values. Implementation of this plan has the potential to impact vegetation, unique vegetation communities, and special-status plant species; cultural landscapes; the white-tailed deer population; other wildlife and wildlife habitat; visitor use and experience/recreation; and Seashore operations.

**Enhanced Monitoring and Management of Invasive Plant Species.** The National Park Service would continue work to control nonnative invasive plant and animal species that pose a specific threat to native species and other natural resources within the Seashore. The spread of invasive species is recognized as one of the major factors contributing to ecosystem change and instability throughout the world. An invasive species is “a nonnative species whose introduction does, or is likely to cause, economic or environmental harm or harm to human, animal, or plant health” (Executive Order 13112, “Invasive Species”). These species have the ability to displace native species, alter fire regimes, damage infrastructure, and threaten human livelihoods. The National Park Service is working to manage invasive species on Seashore lands through a suite of national and local programs that use the following strategies: cooperation and collaboration, inventory and monitoring, prevention, early detection and rapid response, treatment and control, and restoration. In the foreseeable future, the National Park Service would develop a comprehensive invasive species management plan for the Seashore that addresses prevention, surveillance, and management priorities. Consistent with the Seashore’s overall management approach, educational programs, media, incentive programs, and other outreach methods would be used to garner assistance in this effort from Fire Island communities and other private and public entities. These efforts have the potential to impact vegetation, unique vegetation communities, and special-status plant species; the white-tailed deer population; other wildlife and wildlife habitat; cultural landscapes; visitor use and experience/recreation; and Seashore operations.

## **ASSESSING IMPACTS USING CEQ CRITERIA**

The impacts of the alternatives are assessed using the CEQ definition of “significantly” (40 CFR 1508.27), which requires consideration of both context and intensity:

- a) **Context** – This means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Short- and long-term effects are both relevant.
- b) **Intensity** – This refers to the severity of impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action. The following should be considered in evaluating intensity:
  1. Impacts that may be both beneficial and adverse. A significant effect may exist even if the federal agency believes that on balance the effect would be beneficial.
  2. The degree to which the proposed action affects public health or safety.
  3. Unique characteristics of the geographic area such as proximity to historic or cultural resources, parklands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.
  4. The degree to which the effects on the quality of the human environment are likely to be highly controversial.
  5. The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.
  6. The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.
  7. Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a

cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.

8. The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.
9. The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act (ESA) of 1973.
10. Whether the action threatens a violation of federal, commonwealth, or local law or requirements imposed for the protection of the environment.

For each impact topic analyzed, an assessment of the potential significance of the impacts according to context and intensity is provided in the “Conclusion” section that follows the discussion of the impacts under each alternative. Resource-specific context is presented in the “Methodology” section under each resource topic and applies across all alternatives. Intensity of the impacts is presented using the relevant factors from the list in (b) above. Intensity factors that do not apply to a given resource topic or alternative are not discussed.

## **IMPACTS ON VEGETATION, UNIQUE VEGETATION COMMUNITIES, AND SPECIAL-STATUS PLANT SPECIES**

### **METHODOLOGY**

The analysis of vegetation impacts for each alternative within this section is based on best available vegetation and deer density data collected by scientists and Seashore staff, a review of the scientific literature, best professional judgment by NPS staff and outside experts, and noted observations by biologists working at the Seashore. The most comprehensive set of vegetation data comes from monitoring permanent plots at the Sunken Forest, the rarest and most sensitive vegetative community at the Seashore. Over a 45-year period, scientists have observed vegetative changes at the Sunken Forest due to a high density of deer. This historic data set is helpful in analyzing potential impacts from the proposed alternatives. Until recently, scientists have not performed vegetation sampling within other natural areas of the Seashore. In 2012 and 2013, the first such analysis was conducted at Talisman and Blue Point on Fire Island and the deciduous forests at the William Floyd Estate. These recent data provide baseline conditions for understanding current impacts and directing future management decisions. Vegetation thresholds for the Sunken Forest are based on documented plot sampling results from 1967 prior to impacts from high deer densities. Thresholds for other forested areas on Fire Island (other than the Sunken Forest) and the William Floyd Estate were established using a combination of actual data collected at each site (NPS 2013e, NPS 2013f), long-term data collected in the Sunken Forest, the scientific literature, and professional experience and opinions.

Analyzing the impacts on vegetation at the Seashore is important to determine whether actions proposed under any alternative would comply with specific NPS policies and enacted legislation. The Seashore has evaluated impacts in this section in the context of complying with the following policies and laws:

- NPS directives for managing vegetation and unique vegetation communities include “preserving and restoring the natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal populations and the communities and

ecosystems in which they occur; restoring native plant and animal populations in parks when they have been extirpated by past human-caused actions; and minimizing human impacts on native plants, animals, populations, communities, and ecosystems, and the processes that sustain them.”(NPS 2006a, section 4.4.1).

- The enabling legislation of 1964 established Fire Island National Seashore “for the purpose of conserving and preserving for the use of future generations certain relatively unspoiled and undeveloped beaches, dunes, and other natural features within Suffolk County, New York, which possess high values to the Nation as examples of unspoiled areas of great natural beauty in close proximity to large concentrations of urban population.”
- The enabling legislation specifically addresses management of the Sunken Forest with the directive that it “shall be preserved from bay to ocean in as nearly its present state as possible.”
- The ESA mandates all federal agencies to consider the potential impacts of their actions on listed threatened or endangered species to protect the species and preserve their habitats. Specifically, section 7 of the Endangered Species Act states that federal agencies must use their authority to conserve listed species and ensure that their actions do not jeopardize their continued existence. NPS policies require that Seashore actions consider effects on state-listed species (NPS 2006a).

For ease in reviewing this section, the narrative below begins with a discussion of general vegetative impacts Seashore-wide for each alternative, followed by specific vegetation impacts for Fire Island natural areas, the Sunken Forest, and the William Floyd Estate. Impacts on vegetation within the Fire Island communities are discussed under the impact topic of “Fire Island Communities and Adjacent Landowners.”

## IMPACTS OF ALTERNATIVE A

### Impact Analysis

Alternative A includes public education/interpretation, vegetation monitoring, and deer population surveys continued at current levels. Under this alternative, no measures would be implemented to control deer numbers at the Seashore.

**Fire Island Natural Areas.** Preliminary vegetation sampling has begun in areas of the Seashore to analyze the characteristics of the vegetation across areas of the Seashore in addition to the Sunken Forest (NPS 2013e, 2013f). These include the natural area surrounding the Light House Annex, the Fire Island Wilderness, the William Floyd Estate, and maritime forests at the Seashore (Carrington Tract, Talisman, and Blue Point). Under this alternative, the Seashore would continue the collection of vegetation data across all natural areas in order to better understand deer foraging behavior, browsing preferences, and vegetation impacts across different regions of the Seashore. Continued vegetation monitoring would provide important information for the management of vegetation Fire Island-wide over decades.

The substantial amount of vegetation data collected at the Sunken Forest (Art 1976, 1987; Forrester 2004; Underwood 2005; Forrester, Leopold, and Underwood 2006) and other natural areas (NPS 2013e, 2013f) of the Seashore clearly point to a decline in tree seedlings, shrubs, herbaceous annuals, and perennials due to browsing from a high density of deer. Because alternative A would not reduce deer numbers as a management action and the deer density would remain at the current levels or continue to increase across Fire Island, this trend of vegetation impacts from deer browse would continue. Although trees above the reach of deer would not be affected, browsing pressure would be



directed at the shrub and herbaceous layers, leading to a lack of forest regeneration (Collins and Carson 2003; Stout 1999), low survivorship of herbaceous plants, and the eventual dominance of unpreferred and browse-resistant plants (Mosbacher and Williams 2009; NPS 2013d), several of which are nonnative (Russell, Zippin, and Fowler 2001; Eschtruth and Battles 2008; Duguay and Farfaras 2011). Furthermore, heavy browsing would likely result in changes in vegetative structure, particularly in forest understories, by reducing species richness and densities, promoting plants avoided by foraging deer such as black cherry (*Prunus serotina*), and eventually altering ecological succession and structure in these areas (Stout 1999; Rawinski 2008; NPS 2013d, 2013e).

Vegetation at the Fire Island Wilderness has not yet been sampled to the extent that current effects of deer browsing on plant physical condition and species composition can be determined. Yet, studies elsewhere have shown that heavy deer browse at population densities near those currently present at the Fire Island Wilderness (54 deer per square mile) inhibits forest regeneration (Tilghman 1989; Stout 1999; Horsley, Stout, and deCalesta 2003; White 2012) and results in the near extirpation of certain herbs and shrubs (Art 1990; Southgate 2002). It is likely, therefore, that some degree of vegetation impact from deer browse is occurring, and would continue to occur under this alternative. Impacts may include loss of newly sprouted growth and terminal buds from woody shrubs and vines, and the consumption of herbs and forbs beyond the ability for plants to flower and reproduce. The Seashore would monitor the condition of vegetation at the Fire Island Wilderness to better measure the degree that browsing impacts may be occurring. However, this alternative would offer no actions that would lower the deer density, and the deer browsing pressure would remain.

The New York State Energy Research and Development Authority prepared a synthesis report on climate change with the opinion that, “major changes to ecosystems including species range shifts, population crashes, and other sudden transformations could have wide-ranging impacts” on natural ecosystems (Rosenzweig et al. 2011). With a projected increase of 4°–9° in average temperature by the year 2080, sea levels are projected to rise 8–23 inches by the year 2080 making large portions of the Seashore highly vulnerable to sea-level rise (Pendleton, Williams, and Thieler 2004). These predicted changes in temperature and sea levels are expected to impact vegetation across the Seashore, and include the loss of marsh vegetation due to inundation, vegetation community shifts as dryer areas become wet, vegetative stress from saltwater intrusion, and loss of vegetation from wind damage and overwashes caused by more intense storms. Actions proposed by the Seashore within the Fire Island natural areas under this alternative would likely add to the impacts caused by these effects. The deer browsing pressure is expected to remain high, thus affecting vegetation. Those impacts would be exacerbated with the impacts of climate change. Natural areas such as the Fire Island Wilderness could experience increased frequency of severe wind storms and flooding causing the loss of vegetation from overwashes. In addition, habitats along the bay side of Fire Island would incur shifts from rising water elevations that could diminish vegetative communities. This alternative is not expected to contribute to climate change through greenhouse emissions. However, vegetation die offs, vegetative community shifts, and increased frequency of overwashes from sea-level rise, in addition to the browsing pressure under this alternative, would have adverse impacts on vegetation at the Fire Island natural areas.

**Sunken Forest.** Heavy browsing by deer can have profound effects on forest ecosystems. Under this alternative, since deer numbers would be unmanaged at the Sunken Forest, the deer density would remain high, currently estimated at 93 deer per square mile, and the deer would continue to have full range and access to the Sunken Forest as foraging habitat. Similarly, alterations to vegetation at the Sunken Forest due to deer browse have been occurring for decades (Art 1976, 1990; Forrester 2004; Forrester and Leopold 2005; Forrester, Leopold, and Underwood 2006, 2008). Scientists have determined that certain understory herbaceous plants once common during the 1960s have either

decreased substantially in numbers or have been locally extirpated (Art 1990; Underwood 2005; Forrester, Leopold, and Art 2007). In addition, prevalent overstory species identified as key characterizing features of this rare habitat type are unable to contribute to the seedling and sapling layers due to deer browsing (Art 1990; Forrester, Leopold, and Art 2007; NPS 2013d). Instead, undesirable seedling and sapling constituents disliked by deer as a food source (Wakeland and Swihart 2009; NYS-DEC 2013b) are growing in numbers (NPS 2013e), and the resulting long-term trend is the slow conversion of the dominant holly/shadblow/sassafras canopy to something other than a rare holly maritime forest (Forrester, Leopold, and Art 2007; NPS 2013d). As mortality in the old-growth forest canopy creates forest gaps, those gaps would be overcome by woody vines (lianas) (Forrester, Leopold, and Underwood 2006) and undesirable woody species such as black cherry (Forrester, Leopold, and Underwood 2008; NPS 2013d). Overstory species such as American holly, sassafras, oaks, and shadblow would not be able to contribute to the seedling and sapling layer because of deer browse, and trend towards long-term canopy conversion would continue (Forrester, Leopold, and Underwood 2008).

Other studies implicate high deer densities as the cause of imbalanced size distribution of woody recruitment (Harlow and Downing 1970; Anderson and Loucks 1979; Marquis 1981; Tilghman 1989; Trumbull, Zielinski, and Aharrah 1989; Healy 1997; Horsley, Stout, and deCalesta 2003), as well as impacts on herbs and forbs (Augustine and Frelich 1998). Heckel et al. (2010) suggested that a high density of deer caused a cascading decline of forest species in a Pennsylvania study area. The data collected at the Sunken Forest, as well as other studies, point towards a long-term continuous change in species composition caused by deer browsing. These changes resulting from heavy deer browsing would be combined with predicted changes from sea-level rise and climate change as described for the Fire Island natural areas. At the Sunken Forest, vegetation would be vulnerable to dramatic vegetative shifts from a lack of forest regeneration and heightened erosion and loss of forested vegetation from higher water elevations along the bay shoreline. As a result, the requirement in the 1964 enabling legislation to protect and sustain the Sunken Forest “to as nearly its present state as possible” would be jeopardized. These adverse impacts on the vegetation under this alternative would continue for decades at the Sunken Forest.

**William Floyd Estate.** The William Floyd Estate is an important national cultural feature that can also be affected by heavy deer browsing as described for the Sunken Forest. Management of vegetation at the William Floyd Estate is essential in maintaining the cultural landscape of this resource. Current actions consist of maintaining ornamental plantings surrounding the historic house, maintaining the patchwork of existing fields, and protecting the natural forests in the area known as the “lower acreage.” Deer browse is currently impacting these vegetative areas. Heavy deer browse in natural forests hinders understory development, forest regeneration, and natural vegetative processes to such a degree that a browse line is observable in many areas. Under this alternative, the deer population would not be managed, and a high density of deer, estimated at 139 deer per square mile, would continue. Key forest canopy constituents would be unable to naturally reproduce in perpetuity because of browse impacts on seedlings and saplings. Over time, the forests would eventually be subjected to a shift in species composition (Stout 1999; Horsley, Stout, and deCalesta 2003; Pedersen and Wallis 2004; Long, Pendergast, and Carson 2007; Miller et al. 2009), native understory forbs could experience local extirpation, and invasive species avoided by browsing deer could expand. Forested areas, dominated by oak in the northern portion of the property and blackgum in the southern section, could eventually convert to species less preferred by foraging deer such as black locust, black cherry, and sassafras (NPS 2013f). In addition to predictive vegetative changes caused by deer browse, Clark (1986) has documented vegetative changes that are already occurring at the William Floyd Estate due to sea-level rise. From historical accounts, pollen counts, and tidal gauge data, Clark (1986) has determined that the forests have been migrating northward (i.e., landward) as soil moisture levels have increased in the southern part of the property

closest to the bay. These changes, coupled with alterations to forest species composition caused by deer, would continue under this alternative.

**Special-status Plant Species.** Special-status plant species include six state-listed species and one federally listed species (see chapter 3). Six of the plants can be found at Fire Island and one plant is known to occur at the William Floyd Estate. Under this alternative, the deer population density would remain uncontrolled, creating maximum browsing pressure on these listed plants. These plants prefer beaches, foredunes, or wetland habitats, which are systems most vulnerable to sea-level rise and a higher risk of overwashes caused by climate change. Deer browsing impacts would be in addition to potential loss of habitat from climate change. Seashore staff perform annual searches for special-status plants, and have directly observed browse impacts when plants are discovered. Once plants are found, management actions at Fire Island have included minimal fencing or netting to prevent deer from reaching individual plants. Alternative A would include the continuation of the same management actions to protect these special-status species with no expectation of a decline in browsing pressure. These listed plants remain highly vulnerable to damage from deer browse before Seashore staff can implement any protective measures, which could limit reproductive capacity and the long-term viability of sustainable plant populations.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions at the Seashore affecting vegetation under alternative A would include the following activities: the tick monitoring and management program, the use of 4-Poster devices, deer hunting and deer damage permits, a William Floyd Estate cultural landscape report and treatment plan, and enhanced monitoring and management of invasive plant species. Collectively, these actions have resulted or may result in adverse and beneficial impacts on vegetation. For instance, the enhanced monitoring and management of invasive plant species and deer hunting on private lands and deer damage permits would provide beneficial impacts on native vegetation for habitat throughout the Seashore for decades. By monitoring for invasive plants, the Seashore would be able to observe and treat new infestations before invasive species become dominant constituents and overtake native plant habitats. In addition, deer hunting and the issuance of deer damage permits help to reduce deer population growth and ultimately the browsing pressure on native vegetation in the region. Conversely, the setup of the 4-Poster devices would require the clearing of vegetation that would continue for as long as the 4-Poster devices are permitted. The impact of these past, present, and reasonably foreseeable future actions would generally be long term and both beneficial and adverse. When combining the impacts of these projects with the impacts of alternative A, the cumulative impact would be adverse. Alternative A would contribute an appreciable increment to the cumulative adverse impact on vegetation because deer browse likely would be the primary driver of vegetation composition throughout the Seashore.

### **Conclusion**

Under alternative A, the Seashore would continue to experience adverse impacts on vegetation, unique vegetative communities, and special-status plant species due to ongoing heavy browsing pressure from a high deer population. Impacts on vegetation would include loss of vegetation, a reduction in plant diversity, introduction of more opportunities for invasive species to become established and proliferate, inhibited natural regeneration of maritime forests, and long-term shifts in species composition at the Sunken Forest and William Floyd Estate. Impacts on vegetation would be heightened due to climate change under this alternative. In addition to sea-level rise and the potential for the increased frequency of storm overwashes, the resulting impacts from deer would include a decline in the understory species richness and density of herbs, forbs, shrubs, and woody seedlings within maritime forests on Fire Island, the Sunken Forest, and deciduous forests at the

William Floyd Estate. The rate of browse would continue to place desirable native plant species at a competitive disadvantage against invasive or undesirable species less preferred by deer. With no management of deer browsing, this alternative would also contribute to the continued impacts of the understory within the Sunken Forest. The heavy deer browse would cause a decline of this globally rare holly maritime forest, which would impact the Seashore's ability to meet the obligations of its legislative mandate. Impacts would also be significant at the Sunken Forest under this alternative due to its importance as a unique scientific resource. The Seashore would also experience a species shift in the forests at the William Floyd Estate from deer browse. As canopy specimens are lost to natural mortality, the absence of natural regeneration due to deer browsing would change the character of the forest, promote invasive species in the understory, and thereby result in adverse impacts on the vegetative community.

Special-status plant species would continue to experience browsing pressure, potentially affecting the ability of individual stems to mature, flower, and establish seeds necessary for recovery. Under this alternative, special-status plants would be most vulnerable to deer browse, risking the local extirpation of these rare species. Adverse impacts on special-status plants from heavy deer browsing pressure under this alternative would continue in perpetuity. If impacts were to rise to the level that take of federally-listed species becomes a concern, the Seashore would re-initiate consultation with the USFWS.

Alternative A would contribute an appreciable increment to the cumulative adverse impact on vegetation. The above adverse impacts on vegetation, unique vegetative communities, and special-status plant species under alternative A would be significant because no comprehensive plan would be enacted to preserve the natural abundances, diversities, dynamics, and distributions of native plant populations, communities, and ecosystems. Natural processes left to proceed without human intervention would allow current adverse impacts to continue, whereas the enabling legislation for the Seashore calls for conservation and preservation of natural features, specifically including the unique communities within the Sunken Forest. Actions taken to conserve listed species would take place outside of a comprehensive deer management plan. Impacts are also considered significant because when considering cumulative impacts, deer browse likely would be the primary driver of vegetation composition throughout the Seashore.

## **IMPACTS OF ALTERNATIVE B**

### **Impact Analysis**

Alternative B would include a gradual reduction in the deer population at the Seashore using reproductive control techniques to promote natural vegetation recruitment and recovery. Female deer would be treated with an immunocontraceptive as described in chapter 2 to reach the target deer density across Fire Island of 20–25 deer per square mile within an adaptive management framework. Analysis of impacts is based on the immediate availability of a fertility control agent or the possibility that it may take up to 10 years before a fertility control agent meeting the NPS requirements becomes available. This alternative assumes it would take a minimum of 13 years, and potentially longer, to achieve the target deer density once treatment is initiated.

The target population density is expected to allow the recovery of vegetation impacted by heavy browsing (Horsley, Stout, and deCalesta 2003). However, special management actions would be needed at the Sunken Forest and William Floyd Estate to protect and restore vegetation from any browsing impacts. Thus, this alternative would include the installation of rotational and permanent exclusion fences. This alternative also calls for the capture of deer causing negative

human-deer interactions within the Fire Island communities and translocating those deer to the Fire Island Wilderness.

**Fire Island Natural Areas.** Under alternative B, a gradual reduction in the deer population using fertility control would occur over an assumed period of a minimum of 13 years with the immediate availability of a fertility control agent. Once fertility control is started, the resulting effect across the natural areas of the Seashore, other than the Sunken Forest where specialized actions would occur, would be a gradual reduction in browsing pressure on herbs, seedlings, saplings, and shrubs. The reduction in browsing pressure would provide beneficial impacts on vegetation once the target deer density is reached. After this point, the Seashore estimates it will take an additional 8–10 years for forest seedlings, shrubs, saplings, and herbaceous plants to recover within the framework of an adaptive management program based on continued vegetation monitoring. Therefore, upon the immediate availability of a fertility control agent, vegetation recovery would occur in approximately 21–23 years (i.e., minimum 13 years for effective reduction in deer population plus 8–10 years for forest vegetation recovery).

Under this alternative, natural areas would continue to experience vegetation impacts similar to alternative A for the first 13 years of the plan. The lowering of the deer population would result in the gradual reduction in browsing pressure until fertility control has lowered the deer density to the target density. For the maritime forests at the Carrington Estate, Talisman, and Blue Point Beach, a gradual increase in the recruitment of native shrubs and canopy species should occur once the deer density is incrementally lowered to the target deer density of 20–25 deer per square mile (Horsley, Stout, and deCalesta 2003). It is expected to take approximately 8–10 years beyond the deer density target for the effects of the lower browsing pressure to result in successful vegetation recruitment. Several forms of beneficial impacts would be realized. Beneficial impacts would include the natural propagation of native tree seedlings, forbs, and herbaceous plants trending towards ecosystem recovery where deer browsing damage has previously occurred. Tree seedlings would be available to replace overstory canopy stems in the event of canopy tree mortality from insects, disease, or a catastrophic storm event; native shrubs once common to the area would return in larger numbers; and herbaceous coverage and species richness would increase. These beneficial impacts would help to offset predicted impacts on vegetation from sea-level rise and climate change as described for alternative A. Through a monitoring program, the Seashore would consider other actions to encourage vegetation establishment using an adaptive management approach, such as the hand removal of undesirable plants or the planting of desirable species. It should be noted that additional compliance may be required for adaptive management actions which are not fully analyzed in this impacts assessment.

This alternative includes the capture of deer known to approach humans within the Fire Island communities west of Sailors Haven and translocating them to the Fire Island Wilderness. The removal of these animals would immediately lower the deer density within the home ranges of the translocated deer at the Fire Island communities and adjacent federal lands. Natural vegetation impacted by deer would incur less browsing pressure, providing opportunities for native plants to mature and reproduce.

The deer population at the Fire Island Wilderness is estimated to be approximately 95–100 individuals, or 54 deer per square mile. For the first year under this alternative, an estimated 20–25 deer within the Fire Island communities would be translocated, assuming no mortality during the translocation process. This estimate is based on deer behavior observations by biologists during the most recent deer distance sampling count, in which approximately 11% of the deer were observed approaching humans (NPS 2011a). The addition of up to 25 deer to the Fire Island Wilderness population is expected to slightly and temporarily increase the browsing pressure on the vegetative

communities in that region. Adverse impacts would include the increased consumption of herbaceous plants and woody browse causing a reduction in individual stem numbers and potential decrease in species richness and diversity. Assuming the translocated deer claim the Fire Island Wilderness as their home range and remain in the area, the collective deer population would grow from approximately 100–125 the first year, an increase in density from 54–65 deer per square mile. Seashore biologists have observed natural fluctuations in the deer population at the Fire Island Wilderness, which ranges between 100 and 150 deer. To the extent that an increase of 25 deer due to translocation would remain within the natural range of population variability, biologists have concluded that impacts on vegetation from deer browse at the Fire Island Wilderness, although slightly higher than antecedent conditions, would be within the range experienced under natural fluctuations of the population. Nonetheless, assuming translocated deer and resident female deer would be immediately treated with a reproductive control agent, the deer population would experience a gradual lowering of deer numbers over the next 13 years as adults experience natural mortality, resulting in beneficial impacts on vegetation at the Fire Island Wilderness from lower browsing pressure. For each subsequent year of translocation activity, the number of deer translocated is expected to decrease as fewer deer that approach humans exist in the Fire Island communities. Thus, the projected adverse impacts on vegetation at the Fire Island Wilderness from translocated deer are expected to be the highest during the first year as more deer would be present to consume herbaceous plants and woody shrubs. In future years as the population reaches the target density, beneficial impacts would occur from lower deer browsing pressure on native herbs, seedlings, saplings, and shrubs at the Fire Island Wilderness.

Alternative B would require the establishment and maintenance of bait stations to lure deer for administering reproductive control treatments. Such stations may incur localized adverse impacts on vegetation for a few months of the year as a result of hand clearing vegetation to create open areas for bait stations. In addition, vegetation impacts are likely to occur from trampling of ground plants by deer in concentrated numbers as they feed at the bait stations. Because bait stations would be manned during the fall season, impacts on vegetation would be seasonal. Impacts would not interfere with flower or seed maturation and dispersal for most plants, and vegetation recovery would be expected during the following spring season as woody stems grow new branches and annual/perennial herbs grow after the dormant season.

When assuming a fertility control agent is not available for up to 10 years, impacts on vegetation due to heavy deer browse within the natural areas would persist during the 10-year delay period and during the additional 13 years the fertility control agent is applied to reduce the deer population to the target density. Adverse impacts on vegetation during this 23-year period would be compounded by the effects of climate change such as vegetation shifts due to inundation from rising sea levels, tidal flooding, and a higher frequency of major storms that could cause overwashes. Impacts would include the loss of native herbaceous ground cover, shrubs, and understory regeneration similar to those described for alternative A. Invasive species would become more dominant in the understory of the maritime forests as the palatable native plants are lost from browsing with no deer population control for up to 10 years. Once fertility control is implemented, the vegetation recovery period would be 10 years after the target deer density is reached, which is approximately 31–33 years into the plan under this alternative. During the approximately 23 year period before the deer density is reached, the Seashore would continue to experience potential losses of native herbaceous plants from heavy deer browse to the point that some plants may be extirpated altogether. During this same time period, invasive species would also have the opportunity to gain foothold, spread, and become dominant vegetative constituents in the absence of native species competition due to heavy deer browse. With more invasive species dominating the Seashore ecosystems, it would be more difficult for the Seashore to restore native vegetation. Adverse impacts on vegetation at the Fire Island Wilderness would increase slightly for 10 years as translocated deer add to the browsing

pressure until the fertility control agent begins to gradually lower deer numbers. After the initial translocation effort during the first year, it is expected that the number of translocated deer would amount to two to three deer per year. As described earlier, scientists believe this increase in deer numbers would fall within the normal range of population fluctuation at the Fire Island Wilderness such that impacts on vegetation would not be noticeable. Once fertility control lowers the deer population to the target density, vegetation recovery would begin, resulting in beneficial impacts from increased growth of herbaceous ground cover, shrubs, seedlings, and saplings.

**Sunken Forest.** To reach desired conditions for this 44-acre, globally rare holly maritime forest known as the Sunken Forest, this alternative would erect a permanent 8-foot-tall (VerCauteren et al. 2010) exclusion fence totaling approximately 7,127 linear feet around the entire forest. The fence would require the clearing of a path with a maximum width of 8 feet of vegetation (4 feet on each side) to provide workspace for installation resulting in 1.31 acres of vegetative disturbance. Clearing would be accomplished by hand using hand tools such as machetes, pruning shears, and chain saws. Shrubs and herbaceous plants would be removed within the immediate location of the fence, and Seashore staff would select alignments for the fence that would minimize removal of overstory trees. Desirable shrub and herbaceous plants could be collected by Seashore staff and replanted immediately in other areas of the Sunken Forest. Localized ground cover vegetation would experience impacts from contractors as they trample on plants during fence installation. Vegetation would be allowed to recover along the edge of the fence where construction impacts occurred, resulting in impacts being temporary. Vegetative recovery is expected within one to two growing seasons after fence installation. Impacts on vegetation would occur during maintenance and repair of the fence. Staff may need to clear vegetation that has fallen and damaged the fence. In doing so, vegetation impacts would occur as crews access areas for maintenance, including trampling by workers bringing equipment and supplies, or trimming to provide a pathway to damaged fence.

Vegetative impacts due to sea-level rise, predicted to be 8–23 inches by 2080 (Pendleton, Williams, and Thieler 2004), are expected along the bay shoreline of the Sunken Forest where the fence would be installed. Sea-level rise impacts include shoreline erosion, plant inundation, and salt water intrusion. These actions, combined with the vegetation impacts in this area caused by installation of the exclusion fence, would add to the intensity of the adverse impacts on vegetation at the Sunken Forest.

Once the fence is installed, the Seashore would remove all deer from the Sunken Forest by implementing a drive (i.e., a line of pedestrians making noise) to scare deer through a fence opening. Temporary impacts on vegetation would occur as people and deer trample vegetation during the deer drive. Other vegetation impacts may include the cutting of branches and vines with a machete by people walking through the fenced area to drive the deer to the fence opening. Deer that routinely use the Sunken Forest as part of their home range would be forced to reside in the outer perimeter habitats. This may slightly increase the deer density on surrounding lands, with a concurrent increase in browse pressure on adjacent vegetative communities until the deer density is reduced by fertility control. Once the deer are removed from the Sunken Forest, vegetation recovery would begin inside the fence. The Seashore would expect tree and shrub seedling recruitment from existing stems, as well as herbaceous species reproduction from the seed bank, resulting in the recovery of multiple layers of vegetation within 8–10 years. These actions under alternative B are expected to result in beneficial impacts on vegetation at the Sunken Forest.

If a fertility control agent is not available for up to 10 years, the higher deer density caused by deer being displaced from the Sunken Forest enclosure to the surrounding habitat would be persist up to an additional 10 years before the population reduction efforts began. During this period, the browsing pressure on vegetation would increase above current levels causing extreme losses of

native understory vegetation. With the added 13-year delay before fertility control reduces the deer population to the target density (up to 23 years following implementation of the plan), native species of herbs and shrubs would be adversely impacted to the degree that species could possibly face localized extirpation outside of fenced areas. In addition, virtually no forest seedlings would become established within the forest understory outside of fenced areas because of the increased browsing pressure. Under this scenario, the use of a fertility control agent would reduce the deer density to the initial target of 20–25 deer per square mile within 23 years and vegetative recovery would occur within 33 years.

**William Floyd Estate.** Alternative B includes the use of rotational fences in the lower acreage to exclude deer within designated areas of the forests until desired seedling counts are met and saplings grow to a height beyond the reach of foraging deer (figure 4). In addition, the Seashore would install a fence to protect the northern third of the William Floyd Estate from deer browse in perpetuity. This area is the core cultural resource on the property where the historic structures are located. Once the core area fence is installed, Seashore staff would drive the deer out of the northern section of the property. As rotational fencing is installed, deer would be removed from those areas as well. Meanwhile, deer population reduction would be accomplished using fertility control. Vegetation would be monitored within rotational fences, and each rotational fence would be removed once vegetation targets are met.

Adverse impacts on vegetation would occur under this alternative during the installation of the fences. Approximately 2,400 linear feet of permanent fence would be installed to protect the historic core area, and 29,700 linear feet of rotational fencing would be installed in two rotations. An approximate 8-foot-wide area would be cleared to provide contractors sufficient space for installation resulting in a total disturbance area of approximately 5.6 acres. Assuming a spacing of 10 feet between each fence post, an estimated total of 3,030 posts would be installed. The Seashore would attempt to align all fences in a manner that avoids the removal of trees such as along woods trails. In addition, lopped trees - culturally important landmarks - would be protected from damage by fencing. Overhanging branches and individual shrubs would be cut using hand tools such as machetes, pruning shears, or chain saws to clear away woody vegetation for construction. Herbs and vines would be cleared at the locations of posts, and a narrow linear strip would be cleared for the actual wire mesh fence. Soil excavated from each post hole would be sidecast next to each hole, which would result in approximately 10 square feet of area potentially inhabited by herbaceous vegetation that could be covered with soil. Within the cleared area for the fence, herbaceous vegetation would be trampled by construction workers as they travel back and forth along the fence line bringing supplies and tools. This would cause damage to vegetation until such time that the construction is completed and herbaceous vegetation would return. Once the permanent core fence and the rotational fences are installed, disturbed vegetation would be allowed to recover; therefore, impacts on vegetation from fence installation would be temporary.

The installation of the core area fence is intended to exclude deer from the principal cultural resource area in order to restore and protect plantings important to the cultural landscape. The core area, however, would also exclude deer from approximately 40 acres of a natural hardwood forest intermixed with evergreen species. The elimination of deer from this area would provide beneficial impacts on the understory in this forested area as trees would be allowed to regenerate without the threat of deer browsing. With no deer residing in this area, the forest system of ground cover, seedlings, vines, and shrubs would fully recover in approximately 8–10 years resulting in beneficial impacts on vegetation.



After the historic core area fence is installed, a deer drive would be necessary to move deer out of the fenced area. Similar to the process as described for the Sunken Forest, vegetation impacts would be expected as humans walk through the historic core area driving deer to an exit point in the fence. Impacts on vegetation would include the trampling of ground cover and the potential cutting of vines and branches using a machete during the deer drive. These impacts would be adverse and temporary. Disturbed vegetation would be expected to return once the deer drive is finished.

During the first year of the plan, the fence protecting the core historic area and the first round of rotational fencing in the lower acreage would be installed. Deer would be displaced from these fenced areas, resulting in deer being forced to reside in a smaller area and increasing the deer density. Assuming a fertility control agent is immediately available, the deer density would remain high where deer have free roam for approximately 13 years or longer until fertility control reduces the population density to the desired target. Where deer are forced into smaller areas, browsing pressure would increase, resulting in the continued loss, or increased loss, of native herbs, seedlings, saplings, and shrubs, further restricting the ability of those forests to regenerate. Undesirable seedling/sapling constituents and invasive species disliked by deer as a food source (Wakeland and Swihart 2009; NYS-DEC 2013b) would likely grow in higher numbers as the more palatable native species are heavily browsed. These impacts would gradually decline with the lowering of browsing pressure as the deer density is reduced using fertility control.

For areas that are fenced, beneficial impacts on vegetation would occur as browsing is completely removed and plants begin a recovery period lasting an estimated 8–10 years until the forest seedling target is reached and seedlings have grown in height above the reach of foraging deer. These protected forested areas are expected to experience increases in herbs, shrubs, and overstory recruitment at the target rate of 1,200 seedlings per acre within multiple layers. Monitoring would occur during the recovery period to measure vegetation growth (see appendix B). Once the vegetation targets are met with the first round of rotational fencing (assumed to be 10 years), the fencing would be moved to provide protection to other areas of the forest, and deer would gain access to the previously fenced area while use of a fertility control agent continues to reduce deer numbers to the desired target. Vegetation impacts would resume from deer browse within the previously fenced areas; however, the lower browsing intensity from the lower deer density is expected to facilitate forest seedling and sapling establishment sufficient to replace overstory trees.

As described for the area surrounding the Sunken Forest deer enclosure, if a fertility control agent is not available for up to 10 years, deer displaced to smaller areas of the William Floyd Estate due to enclosure fencing would maintain higher densities compared to current conditions for the first 10 years of the plan under this alternative. During this period, impacts on vegetation in these areas would be the same as described for areas surrounding the Sunken Forest enclosure.

Inside the first rotational fencing enclosure, however, once the seedling/sapling target is reached and saplings have grown above the deer browsing height (assumed to be an approximately 10-year recovery period), the fence would be moved to exclude deer from heavily browsed forested areas to allow vegetation recovery in new areas resulting in beneficial impacts on vegetation. Deer would be allowed to enter the previously fenced area, which would cause adverse impacts on herbs and shrubs in those areas as the deer resume browsing at a high population density until fertility control is started; however, tree saplings having 10 years of growth would have grown tall enough to survive the deer browse. Impacts would continue until either the fence is rotated back to the area after another 10-year rotational period or the target density is reached using fertility control. In summary, a 10-year delay in obtaining a fertility control agent under this alternative would place higher numbers of deer into smaller areas for longer periods of time at the William Floyd Estate causing browsing impacts on native understory vegetation, increased competition from invasive

plants, and a loss of forest regeneration where deer are free to roam. The recovery of native vegetation across the lower acreage from fencing would also require a longer time.

Under this alternative, the use of a fertility control agent would reduce the deer density to the initial target of 20–25 deer per square mile is estimated to require up to 13 years and vegetative recovery would occur in an additional 10 years, for a total of 23 years. If a fertility control agent is not available for up to 10 years, vegetation recovery would be delayed by an additional 10 years for a total of 33 years following implementation of the plan.

**Special-status Plant Species.** In the initial years under this alternative, special-status plant species would be subjected to similar adverse impacts from deer browse as described under alternative A until population reduction is achieved. An exception may be those special-status plants residing within the Fire Island Wilderness, which may be exposed to a slightly higher risk of deer browse the first year with the translocation of deer from the Fire Island communities. As deer numbers across the Seashore begin to decrease via fertility control, however, browsing pressure on these species would decline, and the risk of deer browse to special-status plants would be reduced, although direct impacts on plants from deer trampling would remain a possibility. This alternative would provide beneficial impacts on special-status species in future decades as the deer browsing pressure is reduced, allowing more opportunities for special-status plants to mature, regenerate, and increase in numbers. These actions would help to offset any potential impacts caused by climate change such as damage to habitat from overwashes or sea-level rise.

If a fertility control agent is not available for up to 10 years, adverse impacts on special-status species from deer browse would continue for the 10-year duration as described for alternative A. Staff would continue annual searches for special-status plants and provide netting or fencing around plants to protect them from deer browse. As the deer density is reduced to the target level within approximately 23 years (or 33 years if an acceptable fertility control agent is not available for another 10 years), beneficial impacts on special-status plants would occur because of the lower deer browsing pressure.

### Cumulative Impact Analysis

Past, present, and reasonably foreseeable future actions at the Seashore affecting vegetation under alternative B would include the following activities: the tick monitoring and management program, use of 4-Poster devices, deer hunting and deer damage permits, a William Floyd Estate cultural landscape report and treatment plan, and enhanced monitoring and management of invasive plant species. Collectively, these actions have resulted or may result in adverse and beneficial impacts on vegetation. For instance, the enhanced monitoring and management of invasive plant species would provide beneficial impacts on vegetation as new infestations are discovered and treated, protecting native vegetation across the Seashore. In addition, deer hunting and the issuance of deer damage permits contribute to the reduction of deer numbers and impacts on vegetation regionally due to a corresponding reduction on browsing. Conversely, the actions from maintaining the 4-Poster devices would require that vegetation be cleared in the immediate vicinity of the 4-Poster device resulting in impacts on vegetation. The impact of these past, present, and reasonably foreseeable future actions would be both beneficial and adverse. When combining the impacts of these projects with the impacts of alternative B, the cumulative impact would be long term and beneficial. Alternative B would contribute an appreciable beneficial increment to the cumulative beneficial impact on vegetation.

## Conclusion

Alternative B would result in beneficial impacts on vegetation across Fire Island, within the Sunken Forest, other maritime forests, and at the William Floyd Estate as the deer population is lowered and maintained using fertility control. The timing of the beneficial impacts would vary depending on whether a fertility control agent is immediately available or available within 10 years. If an agent is available immediately, beneficial impacts related to lower deer population would be realized within 23 years; alternately, the timeline could be up to 33 years if an agent does not become available before 10 years. Natural vegetative communities impacted by heavy deer browse would recover, providing increased populations of native herbaceous plants, increased forest seedlings, and increased species diversity. Compared to the other action alternatives, this alternative would take the longest to reach the targeted vegetative success criteria. For the federally owned maritime forests other than the Sunken Forest (which would be fenced), vegetation impacts from a high deer density would continue to be adverse until the decline in browsing pressure begins from a reduced deer population using fertility control. The impacts expected during the 22–23 year period would include the continued spread of invasive species and the growing dominance of undesirable native plants such as black cherry (*Prunus serotina*) avoided by deer that, established in higher numbers, management actions to control these species would become more intensive and restoration of vegetative communities more difficult. Once the target deer density is reached, vegetation recovery is expected to occur over time within natural areas of the Seashore resulting in beneficial impacts.

Regardless of the availability of an acceptable fertility control agent, fencing would be installed immediately at the Sunken Forest and the William Floyd Estate to protect vegetation from deer browse while fertility control reduces the deer population to the target density, resulting in vegetation recovery in these areas. Direct adverse impacts on vegetation would occur during installation of fences. Permanent fences would be installed at the Sunken Forest and the William Floyd Estate historic core area, and rotational fencing would occur at the William Floyd Estate lower acreage lasting an estimated 8–10 years. During the time rotational fencing is protecting vegetation, there would likely be direct adverse impacts on understory vegetation outside of fenced areas because of an initial increase in deer density and browsing pressure until the fertility program is implemented. However, impacted vegetation would be restored at the William Floyd Estate within all fenced areas providing beneficial impacts on forest understory vegetation from the absence of deer browse. Within the context of an adaptive management program, rotational fencing would eventually be removed as a management tool once vegetation and the deer density targets are reached, and as fertility control is applied to maintain the deer density at the target level, resulting in beneficial impacts on vegetation at the William Floyd Estate.

Localized plants would be either trampled or cut to make room for the installation of posts and the wire mesh fence at the Sunken Forest and William Floyd Estate, and localized ground vegetation would be trampled again during the removal of rotational fences after approximately 20 years causing adverse impacts on vegetation. It is expected that disturbed herbaceous vegetation from fence installation and removal would be reestablished within one growing season, and shrubs would begin to reestablish within two or three growing seasons. Impacts on localized vegetation at the Sunken Forest would be long term and adverse in the immediate area of the posts and wire mesh fence since the fence would remain a permanent fixture. At the William Floyd Estate, impacts on vegetation at the locations of the posts and wire mesh fence from the first rotation are expected to last approximately 20 years until deer targets are met, vegetation is allowed to recover within the enclosure, and the fence is removed.

The addition of translocated deer to the Fire Island Wilderness deer population is not expected to noticeably detract from the overall health of the vegetative community. Scientists have concluded

that the additional number of deer that approach humans from the Fire Island communities, estimated at 20–25 deer the initial year, would not cause the population at the Fire Island Wilderness to exceed the existing average year-to-year population range. Impacts on vegetation from deer browse would be very small at the start of the plan with the addition of the translocated deer. As fertility control across Fire Island reduces the deer population at the Fire Island Wilderness, vegetation impacts due to deer browse would be decreased, providing indefinite beneficial impacts in this area.

Impacts on special-status plant species under alternative B would be similar to alternative A at the initiation of the plan. If a fertility control agent is not available for 10 years, those adverse impacts would continue until the agent becomes available and is in use. Once fertility control begins to reduce the deer numbers, the risk of deer browse impacts on special-status plants would also be reduced. Plant species would have greater opportunities for expansion and ultimate recovery under this alternative. Management actions to protect special-status species from deer as described under alternative A would continue to be employed by Seashore staff under this alternative. Seashore staff would continue to inventory and protect known plants from deer browse using small fencing or screening.

Alternative B would contribute an appreciable beneficial increment to the cumulative beneficial impact on vegetation, unique vegetation communities, and special-status plant species. Although there is a risk of continued adverse impacts, similar to those described under alternative A, especially in the case that an acceptable fertility control method is not available immediately, the Seashore would undertake fencing and expects to reduce the deer population to a point at which vegetation can successfully regenerate after approximately 23–33 years. Ultimately, the beneficial impacts on vegetation, unique vegetative communities, and special-status plant species under alternative B are expected to be significant because the Seashore would implement a comprehensive plan to preserve the natural abundances, diversities, dynamics, and distributions of native plant populations, communities, and ecosystems. The NPS intervention in current natural processes would allow Seashore managers to conserve and preserve the natural features, specifically including the unique communities within the Sunken Forest, as called for the Seashore's enabling legislation. Actions taken to conserve listed species would be incorporated into the comprehensive deer management plan. Beneficial impacts are also considered significant because when considering cumulative impacts, deer browse likely would be the primary driver of vegetation composition throughout the Seashore if left unmanaged. The adverse impacts on vegetation could approach significant outside of fenced areas depending upon how long of a delay there is before the deer population density is reduced. Although a comprehensive plan would be enacted to preserve the natural abundances, diversities, dynamics, and distributions of native plant populations, communities, and ecosystems, immediate vegetation protection measures would be limited to exclosures, allowing a heightened risk of local species extirpation and altered species abundance.

## **IMPACTS OF ALTERNATIVE C**

### **Impact Analysis**

Alternative C would use direct reduction methods (i.e., sharpshooting, capture and euthanasia, and hunting) to reduce and maintain the deer population. Small-scale fencing would be used around selected plants within the historic core area. In addition, this alternative would involve the capture and removal of deer the approach humans within the Fire Island communities rather than capture and translocation.

**Fire Island Natural Areas.** Under this alternative, the deer population would decrease as deer would be directly removed via direct reduction methods to reach the target density of 20–25 deer per square mile. Vegetative communities on Fire Island such as the maritime forests at Talisman, Carrington Estate, and Blue Point Beach would experience fewer deer and lowered browsing pressure as described under alternative B, but within a much shorter timeline of approximately two years. These vegetative communities would move towards recovery as described under alternative B, but along a much shorter timeframe, approximately 10–12 years sooner. The more immediate reduction of deer browse would reduce the chance that species would be locally extirpated and would also reduce the chance that less natural species abundances (including both invasive species and native species not preferred by deer) would become established.

Hunting would be an available action to help control deer numbers at the Fire Island Wilderness. Consistent with the Seashore guidelines, hunters would not be allowed to use motorized vehicles in the Fire Island Wilderness.

As described for alternative B, this alternative is not expected to contribute to the predicted climate change-induced vegetation impacts from inundation or salt water intrusion such as vegetation die offs and community shifts along the upland/wetland transitions of the Seashore. However, with lower deer numbers and lower browsing pressure under this alternative, benefits gained in vegetation growth and establishment would likely help to offset impacts from climate change, such as the vegetative recovery of future erosion and overwashes caused by severe storms.

Special-status plant species would experience long-term beneficial impacts with a reduction of the deer population as described under alternative B. The benefits, however, would be realized much sooner with population reduction, within two years, compared to fertility control taking 13 years or longer. The reduction of the deer population would lessen the browsing pressure on special-status plants giving them the opportunity to mature, reproduce, and expand in numbers.

**Sunken Forest.** In keeping with the management objective that the Sunken Forest should be completely free from deer browse as described in alternative B, this alternative would also erect an exclusion fence around this globally rare holly maritime forest. Impacts associated with this action would be the same as those described for alternative B.

**William Floyd Estate.** Under alternative C, the Seashore would implement sharpshooting to reduce deer numbers at the William Floyd Estate. This would result in an immediate decline in the deer density with the expectation that the target population density would be reached within one to two years. Beneficial impacts on vegetation would be the same as described under alternative B but would begin earlier because deer target density would be reached within two years compared to 13 years or longer for alternative B. Forest seedlings, saplings, shrubs, and herbaceous ground cover are expected to increase with lower deer browsing pressure. The Seashore would monitor vegetation establishment within the forested areas in the context of an adaptive management program to determine if the vegetation response reaches planned targets.

## **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions at the Seashore affecting vegetation under alternative C would include the following activities: the tick monitoring and management program, use of 4-Poster devices, deer hunting and deer damage permits, a William Floyd Estate cultural landscape report and treatment plan, and enhanced monitoring and management of invasive plant species. Collectively, these actions have resulted or may result in adverse and beneficial impacts on

vegetation. For instance, a William Floyd Estate cultural landscape report and treatment plan and the enhanced monitoring and management of invasive plant species would provide long-term beneficial impacts on vegetation as a cultural landscape resource in the core area of the William Floyd Estate and native vegetation for habitat across the Seashore. Conversely, the actions from the tick monitoring and management program may require treatment of vegetation such as mowing to manage tick populations causing adverse impacts on vegetation. The impact of these past, present, and reasonably foreseeable future actions would be both beneficial and adverse. When combining the impacts of these projects with the impacts of alternative C, the cumulative impact would be beneficial. Alternative C would contribute an appreciable beneficial increment to the cumulative beneficial impact on vegetation.

## Conclusion

Vegetation at the Seashore under alternative C would experience a recovery from heavy deer browse resulting in beneficial impacts in perpetuity, similar to those described for alternative B. The rapid removal of deer to reach the desired deer density would cause beneficial impacts from vegetation recovery to be realized within a shorter timeframe compared to alternative B. Beneficial impacts would include the recovery of native vegetation within the Fire Island natural areas, Sunken Forest, and William Floyd Estate. The Seashore would experience a return of native forest regeneration, growth and expansion of native herbs, and the recovery of once common shrub species. The growth and recovery of vegetation is expected to offset predicted impacts from climate change due to sea-level rise and damage from a higher frequency of storm events. Beneficial impacts on vegetation would occur at the Sunken Forest with the installation of an exclusion fence to keep all deer out as described for alternative B. Once the fence is installed, vegetation would recover, providing beneficial impacts in perpetuity necessary for meeting the enabling legislative mandate regarding protection of the Sunken Forest. Important canopy constituents such as American holly (*Ilex opaca*) and shadblow (*Amelanchier canadensis*) would regenerate, become established, and grow to be key components of the sapling layer. Adverse impacts on vegetation would occur at the Sunken Forest in order to clear for the installation of the exclusion fence. Because the fence would remain in perpetuity, impacts on vegetation would be long term to maintain the fence as described for alternative B. Temporary impacts on vegetation at the Sunken Forest would also occur as construction workers trample and disturb vegetation during the fence installation process. Disturbed vegetation from fence installation and maintenance would be expected to return in one or two growing seasons. Alternative C would also lower the deer browsing pressure on special-status plant species and on vegetation at the William Floyd Estate. Special-status plants would have greater opportunities to mature, propagate, and increase in numbers.

Alternative C would contribute an appreciable beneficial increment to the cumulative beneficial impact on vegetation, unique vegetation communities, and special-status plant species. Overall, the beneficial impacts on vegetation, unique vegetation communities, and special-status plant species under alternative C are expected to be significant because the Seashore would implement a comprehensive plan to preserve the natural abundances, diversities, dynamics, and distributions of native plant populations, communities, and ecosystems. The NPS intervention in the current natural processes would allow Seashore managers to conserve and preserve the natural features, specifically including the unique communities within the Sunken Forest, as called for the Seashore's enabling legislation. Actions taken to conserve listed species would be incorporated into the comprehensive deer management plan. Beneficial impacts are also considered significant in the context of cumulative impacts because deer browse likely would be the primary driver of vegetation composition throughout the Seashore if left unmanaged. Adverse impacts would not be significant because of their temporary, small-scale nature.

## **IMPACTS OF ALTERNATIVE D**

### **Impact Analysis**

Deer population reduction would initially be performed using direct reduction methods (i.e., sharpshooting, capture and euthanasia, and hunting) to quickly lower deer numbers, and the population density would be maintained using direct reduction and/or a NPS approved fertility control agent. If an agent is not available, direct reduction methods would be used to maintain the deer population at the desired level. Fencing would be used at the Sunken Forest the same as under alternatives B and C. Permanent fencing would be installed to protect the historic core area of the William Floyd Estate as in alternative B.

Alternatives C and D call for the rapid reduction of the deer population and the installation of an exclusion fence around the Sunken Forest. Alternative D differs from alternative C in that the Seashore may choose to use fertility control methods to maintain the deer population at the target density in addition to or in place of direct reduction. The method of deer density maintenance used is not expected to affect vegetation differently. Thus, beneficial impacts on vegetation would be the same as those described under alternative C.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions at the Seashore affecting vegetation under alternative D would include the following activities: the tick monitoring and management program, use of 4-Poster devices, deer hunting and deer damage permits, a William Floyd Estate cultural landscape report and treatment plan, and enhanced monitoring and management of invasive plant species. Collectively, these actions have resulted or may result in adverse and beneficial impacts on vegetation, the same as those described for alternative C. The impact of past, present, and reasonably foreseeable future actions would be both beneficial and adverse. When combining the impacts of these projects with the impacts of alternative D, the cumulative impact would be beneficial. Alternative D would contribute an appreciable beneficial increment to the cumulative beneficial impact on vegetation.

### **Conclusion**

Vegetation at the Seashore would experience beneficial impacts under alternative D, the similar those described for alternatives B and C. Beneficial impacts would be realized within 2 years as deer are rapidly removed to reach the target deer density. Recovery of native herbs, seedlings, saplings, and shrubs would be expected within about 8 to 10 years in natural areas, the Sunken Forest, and the William Floyd Estate. Adverse impacts on vegetation would occur at the Sunken Forest and the William Floyd Estate historic core area in order to install the exclusion fence as described for alternative B, and vegetation recovery is expected within the forest providing long-term beneficial impacts on vegetation at the Sunken Forest. Benefits include the growth and expansion of native herbaceous plants in the forest understory, the establishment of native shrubs, and the establishment of forest seedlings and saplings regenerated from key overstory tree species. The reproductive capacity of the maritime forests would be increased to ensure canopy replacement in the event of tree mortality from disease or storm damage. Beneficial impacts on special-status plant species would occur as deer browsing pressure is reduced Fire Island-wide. Seashore staff would continue to implement screens and fencing around special-status plants to protect them from deer browse as described under alternative A. Benefits would occur regardless of the method of deer density maintenance chosen by Seashore managers (i.e., direct reduction and/or fertility control).

Alternative D would contribute an appreciable beneficial increment to the cumulative beneficial impact on vegetation, unique vegetation communities, and special-status plant species. Overall, the beneficial impacts on vegetation, unique vegetation communities, and special-status plant species under alternative D are expected to be significant because the Seashore would implement a comprehensive plan to preserve the natural abundances, diversities, dynamics, and distributions of native plant populations, communities, and ecosystems. The NPS intervention in the current natural processes would allow Seashore managers to conserve and preserve the natural features, specifically including the unique communities within the Sunken Forest, as called for the Seashore's enabling legislation. Actions taken to conserve listed species would be incorporated into the comprehensive deer management plan. Beneficial impacts are also considered significant in the context of cumulative impacts because deer browse likely would be the primary driver of vegetation composition throughout the Seashore if left unmanaged. Adverse impacts would not be significant because of their temporary, small-scale nature.

## IMPACTS ON WETLANDS

### METHODOLOGY

Map locations of wetlands were compared with locations of proposed development and modifications of existing facilities. Predictions about site impacts were based on previous studies of impacts on wetlands from similar projects and recent scientific data.

Resource-specific context for the evaluation of impacts on wetlands includes the following:

- Executive Order 11990, which directs the National Park Service to avoid to the extent possible the long- and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative.
- Section 404 of the Clean Water Act (33 USC 1344), which prohibits the discharge of dredge or fill material into waters of the United States, including wetlands, except as permitted by the U.S. Army Corps of Engineers (USACE). Rules for implementing section 404 of the Clean Water Act are found in 33 CFR 320-330. The state of New York also regulates wetlands under the authority of Chapter X, Part 660-663 of the state code of regulations. The New York State Department of Environmental Conservation is the regulatory agency that oversees state water quality certification under section 401 of the Clean Water Act.
- The Coastal Zone Management Act (CZMA), administered by the National Oceanic and Atmospheric Administration Office of Ocean and Coastal Resource Management (OCRMR), provides for management of the nation's coastal resources and balances economic development with environmental conservation.
- NPS Procedural Manual 77-1 (NPS 2012a) adopts a goal of “no net loss of wetlands”; in addition, the National Park Service will strive to achieve a longer-term goal of net gain of wetlands.
- Wetlands have unique functions and values (e.g., groundwater recharge; stormwater storage and discharge; unique habitats; etc.) that are intrinsic to wetlands and cannot be easily duplicated or replaced.
- Wetland functions and values have a direct effect on the quality of the associated wetland systems.



The assessment of impacts on wetlands near the Sunken Forest is based on a review of existing vegetative studies and mapping (Klopfer et al. 2002); interpretation of recent aerial photographs; knowledge and familiarity of wetland systems from experience working in the field at the Sunken Forest; and, basic assumptions regarding fence installation.

The geographic area of analysis for this impact topic is limited to a linear corridor in the Sunken Forest where the installation of fencing has the potential to impact wetlands.

## **IMPACTS OF ALTERNATIVE A**

### **Impact Analysis**

Alternative A would continue with the current actions to manage the deer density at the Seashore. This alternative would not include any actions that would impact wetlands.

### **Cumulative Impact Analysis**

No past, present, and reasonably foreseeable future actions may affect wetlands in the area of analysis. Additionally, alternative A would have no impacts on wetlands in the area of analysis. Consequently, there would be no cumulative impacts on wetlands under alternative A.

### **Conclusion**

Under alternative A, no actions would occur related to deer population management at the Seashore that would require encroachments and/or impacts on wetlands and their functions.

## **IMPACTS OF ALTERNATIVE B**

### **Impact Analysis**

Impacts on wetlands under alternative B would include the construction of a fence surrounding the 44-acre Sunken Forest to provide protection to vegetation from deer browse (figure 10). The fence would remain in place in perpetuity. Emergent and scrub-shrub wetlands occur north of the Sunken Forest, and the fence is expected to bisect these wetlands for a total distance of 273 linear feet. Approximately 21 linear feet of emergent marsh wetlands would be bisected, and 252 linear feet of the blueberry shrub wetland type would be bisected. Construction of the fence would involve disturbances to wetlands by clearing an 8-foot-wide path that would require wetland vegetation to be cut near the soil surface and laid aside to make room for contractors to get the equipment and fencing material into the work areas and install the wooden posts and wire mesh fence. A 0.05-acre area of wetlands would be impacted. Posts holes would be created either by hand or by a hand-held motorized auger to an estimated depth of 4 feet. Soil excavated from the post holes would be sidecast into wetlands resulting in small discharges of soil material into the wetlands. Temporary impacts on the wetlands may occur from sediment suspension within the water column in those areas with surface water. The sidecast soils from the post holes would be of insufficient volume to cause a conversion of the wetland type, and vegetation is expected to return within the first growing season. Sea-level rise, projected to be between 8 and 23 inches by the year 2080 (Pendleton, Williams, and Thieler 2004), would collectively add to the impacts on wetlands as a result of this alternative. The placement of the fence near the bay shoreline could exacerbate shoreline erosion and soil instability because of a rising water level. However, the fence is not expected to alter

wetland functions such as habitat for aquatic species, water filtration, and storm attenuation/buffering.

### **Cumulative Impact Analysis.**

No past, present, and reasonably foreseeable future actions may affect wetlands in the area of analysis. Consequently, there would be no cumulative impacts on wetlands under alternative B.

### **Conclusion**

Under alternative B, a fence would be installed to protect vegetation in the Sunken Forest from deer browse. The fence is expected to bisect jurisdictional wetland marsh and scrub-shrub areas causing adverse impacts on wetlands. Impacts include the clearing of approximately 0.05 acre of wetland vegetation (273 linear feet at a width of 8 feet) to make room for installing the fence, the excavation of soil for the posts holes, and the sidecasting of the soils extracted from the post holes into wetlands. Wetland vegetation is expected to return in the cleared areas within the first growing season, and wetland functions would not be impaired from the placement of the fence. As bayside shoreline erosion is expected to occur as sea-level rise causes the shoreline to encroach towards the Sunken Forest, the permanent fence may exacerbate erosion causing impacts on wetland vegetation. There would be no cumulative impacts on wetlands under alternative B. These adverse impacts of alternative B on wetlands are not expected to be significant because there would be no loss of wetland functions, wetlands would be avoided to the extent possible, and all minor impacts would be consistent with policies and regulations for the protection of wetlands.

## **IMPACTS OF ALTERNATIVE C**

Alternative C also includes the placement of a fence around the Sunken Forest at the same location as described under alternative B. Therefore, impacts on wetlands under this alternative would be the same as those described under alternative B.

### **Cumulative Impact Analysis**

No past, present, and reasonably foreseeable future actions may affect wetlands in the area of analysis. Consequently, there would be no cumulative impacts on wetlands under alternative C.

### **Conclusion**

Impacts under alternative C would be the same as those described under alternative B. There would be no cumulative impacts on wetlands under alternative C. These adverse impacts of alternative C on wetlands are not expected to be significant because there would be no loss of wetland functions, wetlands would be avoided to the extent possible, and all minor impacts would be consistent with policies and regulations for the protection of wetlands.

## **IMPACTS OF ALTERNATIVE D**

Alternative D includes the placement of a fence around the Sunken Forest at the same location and in the same manner as described under alternative B. Therefore, impacts on wetlands under this alternative would be the same as for alternative B.

**LEGEND**

-  Sunken Forest Preserve
-  Sunken Forest Trail/Boardwalk
-  Sunken Forest Fence
- Wetlands**
-  Highbush Blueberry Shrub Swamp
-  Reedgrass Marsh

 0 400 Feet

Source: NPS GIS Data; Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



White-tailed Deer Management Plan and Environmental Impact Statement

FIGURE 10  
Wetland Impacts - Sunken Forest



## **Cumulative Impact Analysis**

No past, present, and reasonably foreseeable future actions may affect wetlands in the area of analysis. Consequently, there would be no cumulative impacts on wetlands under alternative D.

## **Conclusion**

Adverse impacts under alternative D would be the same as those described under alternative B. There would be no cumulative impacts on wetlands under alternative D. These adverse impacts of alternative D on wetlands are not expected to be significant because there would be no loss of wetland functions, wetlands would be avoided to the extent possible, and all minor impacts would be consistent with policies and regulations for the protection of wetlands.

# **IMPACTS ON THE WHITE-TAILED DEER POPULATION**

## **METHODOLOGY**

Years of deer count data related to the immunocontraception study, the professional experience and deer observations of researchers and Seashore staff, and scientific literature were used to evaluate impacts on the deer population described in this section. Data generally include deer population estimates from distance sampling and sex ratios that continue to be collected annually. Data on actual physical condition are unavailable at the Seashore, except via personal observations (Underwood 2005). This discussion primarily focuses on the impacts on the population as a whole, with limited discussion about the impacts on individual animals as a result of action treatments. Resource-specific context for the white-tailed deer population is as follows:

- The absence of hunting and natural predators on Fire Island has allowed what was originally a very small deer population in the 1970s to reach a density of over 207 deer per square mile in some areas of the Seashore by 1995, not only within the natural environment but in many portions of the human environment (i.e., the Fire Island communities and Seashore facilities).
- Directives include “preserving and restoring the natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal populations and the communities and ecosystems in which they occur; restoring native plant and animal populations in parks when they have been extirpated by past human-caused actions; and minimizing human impacts on native plants, animals, populations, communities, and ecosystems, and the processes that sustain them” (NPS 2006a, section 4.4.1).
- The enabling legislation of 1964 established Fire Island National Seashore “for the purpose of conserving and preserving for the use of future generations certain relatively unspoiled and undeveloped beaches, dunes, and other natural features within Suffolk County, New York, which possess high values to the Nation as examples of unspoiled areas of great natural beauty in close proximity to large concentrations of urban population.”

## **IMPACTS OF ALTERNATIVE A**

### **Impact Analysis**

Under alternative A, the deer population would remain uncontrolled resulting in high densities across Fire Island and the William Floyd Estate as described in chapter 3. Seashore staff would

continue monitoring deer numbers using distance sampling techniques (Buckland et al. 1993) within the Fire Island communities, Sailors Haven, Fire Island Wilderness, and William Floyd Estate; and, the Seashore would continue providing technical guidance to Fire Island community residents on a limited basis through public outreach and education about deer management, reducing artificial food supplies, and offering information about gardening with deer-resistant native plants.

Under this alternative, deer would continue to reside at the Seashore in high numbers and to compete for available resources. Continued increases in the population may affect overall deer condition and reproductive patterns of the herd if nutrition becomes a limiting factor (Verme 1969). As an example, data collected from the Seashore deer hunt of 1988-89 showed differences in pregnancy rates between deer residing in the Fire Island Wilderness (50%) and those residing in the Fire Island communities (100%) (Underwood 2005), likely due to the availability of food supplies in the communities. In addition, body weights of fawns at the Seashore were found to be less than those harvested on Long Island, which was attributed to the high population densities on Fire Island at the time (Underwood 2005). Furthermore, the high population density also exerts a higher level of risk for the spread of communicable deer diseases such as chronic wasting disease (CWD) (Samuel et al. 2003; Joly et al. 2006). Adverse impacts affecting individuals within the population could include growth abnormalities, behavior abnormalities such as being disoriented or lethargic, and mortality.

Adverse impacts on the deer population would continue due to deer that approach humans having established home ranges in the Fire Island communities, Sailors Haven, and Smith Point County Park. Future generations of deer would also become conditioned to humans in the absence of predation and harassment (Underwood 2005) and as offspring remain with their mothers (Porter, Mathews, and Underwood 1991) resulting in the continuation of negative human-deer interactions. While deer would continue to be attracted to the Fire Island communities for the food sources offered (household garbage, browsing on private ornamental plants and landscaping, approaching humans for food handouts), deer would continue to be susceptible to harm from unintentional ingestion of harmful substances (Stone et al. 1999), as well as accidental injuries caused by cracks in boardwalks and jumping fences.

In the absence of any population control, deer numbers at the 613-acre William Floyd Estate have ranged between 90 and 140 individuals in recent years, which equates to a deer density of 93–146 deer per square mile. The high deer density results in many individuals competing for limited foraging resources. Although no noticeable decline in deer health has been observed in recent years, malnutrition resulting in weight loss, lower reproductive rates, and higher fawn mortality could occur if deer numbers grow higher with no mechanisms for population control. Deer currently cross through gaps in the William Floyd Estate property fence to expand their foraging range into adjacent suburban neighborhoods, and this activity would continue where deer can gain access through fences. Impacts on deer would include an increased risk of vehicle collisions, harassment by the residents, and disorientation because of unfamiliar settings.

The effects of climate change and sea-level rise could greatly impact the habitat quality for the deer herd at the Seashore. Tree cover could be lost, herbaceous vegetation could die from salt water intrusion, and vegetation growing on backdunes could be completely lost from intense storms and overwashes. Without any mechanism to control deer numbers under this alternative, events that destroy forage available to deer could add stress to an already overpopulated deer herd causing malnutrition and mortality.

## **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions at the Seashore affecting deer under alternative A would include the following activities: the tick monitoring and management program, use of 4-Poster devices, deer hunting and deer damage permits, a William Floyd Estate cultural landscape report and treatment plan, and enhanced monitoring and management of invasive plant species. Collectively, these actions have resulted in adverse and beneficial impacts on deer. Enhanced monitoring and management of invasive plant species would provide long-term beneficial impacts on deer through improvements to deer habitat. Additionally, deer hunting and deer damage permits on nonfederal lands may remove some deer that also partially inhabit federal lands. As a result, additional habitat may be available for the remaining deer population and competition for resources may be reduced at a local scale. Conversely, the Seashore anticipates the continued use of 4-Poster devices by the private communities on Fire Island as described in chapter 3. Currently, two Fire Island communities deploy a total of three devices: two devices in the village of Saltaire and one device in Fair Harbor. Last measured in 2012, the deer density in this region exceeded 227 deer per square mile, the highest at the Seashore. As an artificial food source of several tons each year, the 4-Posters would continue to attract large numbers of deer to this localized area, thereby increasing the chance of negative human-deer interactions by luring deer into the Fire Island communities, resulting in long-term adverse impacts on deer. Deer that use the 4-Poster devices would experience a beneficial impact from reduced parasite loads and an abundant available food source.

The impact of these past, present, and reasonably foreseeable future actions would generally be both beneficial and adverse. When combining the impacts of these cumulative actions with the impacts of alternative A, alternative A would contribute appreciably to an overall adverse cumulative impact on the white-tailed deer population.

## **Conclusion**

Alternative A would continue the current deer management at the Seashore with no planning mechanism to control the deer population. This would result in adverse impacts on the deer population due to overpopulation, higher risk of disease, reduced overall physical condition of the population, and higher mortality. Negative human-deer interactions and negative deer behavior would continue as deer within the Fire Island communities continue to approach humans for food handouts and forage through household garbage. Alternative A would contribute appreciably to an overall adverse cumulative impact on the white-tailed deer population.

The above adverse impacts on the white-tailed deer population under alternative A would not be significant because the native deer population and related natural processes would be left to proceed without human intervention. The deer population would continue to be one of many natural features conserved and preserved by Seashore managers per the Seashore's enabling legislation.

## **IMPACTS OF ALTERNATIVE B**

### **Impact Analysis**

Alternative B would implement several actions to reduce deer numbers and human-deer interactions across the Seashore. The Seashore would control deer numbers using fertility control, personnel would be added to the Seashore staff to serve as a liaison between the Seashore and the Fire Island communities, and coordination efforts would increase with the Fire Island communities to assist with reducing food handouts by people and also better manage garbage placed outside for pickup. Deer that approach humans from the Fire Island communities would be translocated to the

Fire Island Wilderness. Fencing would be implemented to exclude deer from the Sunken Forest and portions of the William Floyd Estate until desired deer density and vegetation conditions are met.

To control deer numbers across the Seashore, alternative B would rely on the use of a fertility control agent. As summarized in chapter 2, the National Park Service has established criteria for the use of a fertility agent that includes the following:

1. There is a federally approved and state registered fertility control agent for application to free-ranging white-tailed deer populations.
2. The agent provides multiple-year (three or more) efficacy (80%–100%) to minimize the cost and labor required to administer the drug to a large number of deer annually.
3. The agent can be administered through remote injection to avoid capturing the animal on a regular basis and to increase the efficiency of distribution.
4. The agent would leave no harmful residual in the meat; meat would be safe for human and non-target animal consumption.
5. The agent would have minimal impact on deer behavior (e.g., reproductive behaviors, social behaviors, out of season estrous cycling).

This alternative would require that female deer be first captured and tagged for identification and then administered the fertility control agent. Options available to capture animals include cannon nets (Hawkins, Martoglio, and Montgomery 1968), clover traps (Clover 1956; VerCauteren, Beringer, and Hygnstrom 1999), or tranquilizing darts. Future treatments of tagged animals would be accomplished remotely without having to handle animals. Approximately 90% of the females would need to be treated the first year and each subsequent third year of the plan in order to reduce deer population growth (Hobbs, Bowden, and Baker 2000; Rudolph, Porter, and Underwood 2000) depending on the efficacy of the agent, the success of capture for the first treatment, and the ease of remote delivery during subsequent treatments. This equates to approximately 600–710 treatments over the first 15 years of the plan on Fire Island (assuming the immediate availability of a fertility control agent) and between 290–315 treatments to females at the William Floyd Estate. Details on the number of females to be treated are provided in chapter 2.

One of the NPS criteria for an approved fertility control agent is to have minimal impact on deer behavior (e.g., reproductive behaviors, social behaviors, out of season estrous cycling). Yet, some behavior responses are to be expected when eliminating or altering estrus cycles in females. For some treated individuals, out of season breeding behavior is possible since reproductive hormones which are responsible for estrous cycling are not suppressed (Miller et al. 2009; McShea et al. 1997; Fraker et al. 2002; McShea and Rappole 1997). Repeated estrous cycling has the potential to extend the population breeding season and rutting behaviors. Additionally, extended estrous seasons may result in late pregnancies if the vaccine fails (Fraker et al. 2002; McShea et al. 1997) causing fawns to be born later in the summer or fall, which may lead to higher fawn mortality as winter ensues. In addition, increased activity during rut can be energetically costly for both sexes. While this is likely offset by the lack of pregnancy demands in female deer, it may have cumulative effects on energy expenditures in male deer (Walter, Kilpatrick, and Gregonis 2003; McShea et al. 1997). Alternately, treated females may experience increased body condition and a longer lifespan compared to untreated individuals as a result of reduced energetic costs of pregnancy and lactation (Warren 2000; Hone 1992). Details on the current science of fertility control are provided in appendix D.

Deer within high urban populations tend to have small home ranges (O’Connell and Sayre 1988; DeNicola et al. 2000), and in order for the Seashore to annually administer fertility control to the proper number of females under this alternative, the Seashore would need to manage trapping and darting locations throughout Fire Island and the William Floyd Estate. This would require that bait



stations be maintained to attract deer for maximum success and cost efficiency. Such stations would introduce artificial food sources that would promote the undesirable food conditioning behavior of deer and result in alterations in deer foraging behavior for several weeks as staff use the stations to treat deer. Impacts on the population would include the disruption of normal deer behavior in the wild by administering artificial food supplies, deer becoming reliant upon those food sources as part of their daily nutritional needs, and a higher potential for the spread of diseases by congregating deer via baiting. Once the treatments are completed, baits at the stations would be removed.

Actions taken by the Seashore under this (and all) action alternatives would include increased staffing to assist with implementing this plan, increasing efforts to better coordinate with Fire Island communities, improved outreach to educate the public about negative human-deer interactions, and increasing enforcement (ticketing) of people who provide food handouts to deer. These actions would reduce negative human-deer interactions at the Fire Island communities and Seashore facilities. Adverse impacts on the deer would include a reduction in human food supplies that deer currently exploit, potentially causing impacts on deer condition within the Fire Island communities. Beneficial impacts, however, include reversing the incidences of human-deer contact from visitors and residents directly feeding deer with human food, reducing the availability of exposed garbage as a food source for deer through improved garbage management, altering deer behavior to accord more with the natural environment and not the human environment, and a reduction in the attractiveness of the Fire Island communities to deer because of artificial food sources that ultimately lead to cases of deer injuries from fencing and boardwalks.

Alternative B would include the use of exclusion fencing at the Sunken Forest and portions of the William Floyd Estate. This action would cause temporary disturbances to deer during the installation of the fences. Once fences are installed, deer would be subject to hazing via human drives to force deer out of fenced areas, which could cause short-term stress and potential injury to deer when encountering the fence. While fences are erected, disruptions would occur to deer movements and home ranges resulting in impacts on local populations. Deer injury could occur as individuals with the strongest fidelity to their original home range may attempt to jump fences. Furthermore, deer excluded from their normal home ranges would be forced to rely on less land space per animal causing higher concentration of animals competing for natural food resources. This could create nutritional stress, or ultimately cause malnutrition during the initial stages of the management program until a fertility control agent lowers the population. The fence at the Sunken Forest would remain in perpetuity. However, the fencing at the William Floyd Estate would include a perpetual fence to shield the core historic area from deer and rotational fencing lasting longer than 20 years to promote the recovery of understory forest vegetation in the lower acreage. Once the rotational fences are removed, deer would be allowed to return to the excluded areas, the deer density level would be achieved through fertility control, and impacts on the resident deer population would be long term and beneficial due to lower deer numbers competing for resources and improvements to habitat from a recovered forest understory.

Under this alternative, deer that approach humans within the Fire Island communities would be captured, anesthetized, radio collared, and translocated to the Fire Island Wilderness. Translocated deer would be tracked to monitor and understand their movements post-release. Because white-tailed deer generally exhibit strong fidelity to established home ranges (Marchington and Hirth 1984; Jones and Witham 1990; DeNicola et al. 2000; Underwood 2005; Campbell et al. 2004) and philopatric behavior (i.e., remain near area of birth) (Porter, Mathews, and Underwood 1991; Henderson et al. 2000), individuals translocated to the Fire Island Wilderness would experience the stress of establishing fidelity to a new home range and interacting with unfamiliar resident deer (Miller 1997; Porter, Mathews, and Underwood 1991). Deer have been known to travel far distances across Fire Island (O'Connell and Sayre 1988), and translocated deer would exhibit some degree of

dispersal from the release site (Jones, Mathews, and Porter 1997), leaving the possibility that individuals may leave the Fire Island Wilderness altogether as they seek out a new home range. Alternately, they may attempt to return to their original home range. Beringer et al. (2002) found that translocated white-tailed deer exhibited broader home range sizes compared to resident deer, implying that, for translocated deer, ranges may extend beyond the boundaries of the Fire Island Wilderness into developed areas of the neighboring Davis Park towards the west and Smith Point County Park towards the east. Jones, Mathews, and Porter (1997) found no differences in the social behavior and home range sizes of resident deer in reaction to translocated deer, which suggests that measurable adverse impacts on resident deer may not occur at the Fire Island Wilderness from the introduction of translocated deer.

The increase in deer numbers at the Fire Island Wilderness from the translocated deer, however, would cause a slight, temporary increase in deer browsing pressure in that area potentially affecting the availability of browse and overall habitat quality for deer. Biologists have concluded that the slight population increase at the Fire Island Wilderness from the added translocated deer would fall within the range of natural population fluctuations. Impacts on the deer population at the Fire Island Wilderness may be adverse due to the added competition for food sources. Nonetheless, those impacts, however small, would occur until the translocated and resident female deer are treated with a fertility control agent and a reduction in the overall population density would occur. Overall, the translocation of deer to the Fire Island Wilderness is not expected to have adverse impacts on the Seashore deer population. In time as those translocated deer with the highest propensity to approach humans die from natural causes, the deer population would begin to comprise individuals more inclined to behave as part of the natural environment rather than the human environment. Accidental injury to deer during capture is possible, as well as unintended mortality from myopathy. Assuming proper capture techniques are used, a 2%–6% mortality rate from handling deer would be expected (Peterson et al. 2003; Mathews, Paul-Murphy, and Frank 2005; Kreeger and Armeno 2012). Studies demonstrate that post-release mortality of translocated deer is consistently higher than mortality rates of resident deer (O'Bryan and McCullough 1985; Jones and Witham 1990; Jones, Mathews, and Porter 1997; Beringer et al. 2002; Parker et al. 2007), particularly the first year. Mathews, Paul-Murphy, and Frank (2005) found a mortality rate of 6.1% during capture and release associated with a capture-sterilization-release project at an urban park in Illinois. In addition to these losses, under this alternative, post-release mortality can be expected for deer translocated to the Fire Island Wilderness.

Future changes to the natural environment at the Seashore from climate change and sea-level rise are expected to impact habitat used by deer. Because alternative B would reduce deer numbers resulting in less competition for resources and improved overall deer condition, the deer population would better withstand stresses from habitat damage caused by dramatic weather occurrences attributable to climate change such as a higher frequency of storm events, higher storm intensity, and storm flooding and overwashes. The lower deer browsing pressure on the vegetation would also allow faster vegetation recovery after storm damage, which would benefit deer habitat.

If an acceptable fertility control agent does not become available for the first 10 years, the impacts related to use of such an agent would also be delayed. This includes alterations in deer behavior described above caused by the agent and use of baiting and trapping for inoculation. Other operational improvements to enhance educational outreach would begin immediately, resulting in lower incidences of negative human-deer interactions such as hand feeding of deer as described earlier. At the William Floyd Estate, a 10-year delay in implementation of fertility control would require deer to be moved out of the fenced areas. Deer removed from the fenced areas then would have been displaced in smaller areas for a longer period of time (23 years or longer) before population density could be decreased, potentially causing severe nutritional stress, low fawn

survival rates, and malnutrition. Once the population density is reached in approximately 23 years, the fencing would be removed, and the deer would have the freedom to roam through the improved habitat throughout the lower acreage. This would result in beneficial impacts on the deer population at the William Floyd Estate beyond the 23-year timeframe.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions at the Seashore with the potential to impact white-tailed deer include the following activities: the tick monitoring and management program, use of 4-Poster devices, deer hunting and deer damage permits, a William Floyd Estate cultural landscape report and treatment plan, and enhanced monitoring and management of invasive plant species, as described under alternative A. The impact of these past, present, and reasonably foreseeable future actions would be both beneficial and adverse. When combining the impacts of these actions with the impacts of alternative B, alternative B is expected to contribute appreciably to the overall beneficial cumulative impact on the white-tailed deer population.

### **Conclusion**

Alternative B would include operational changes at the Seashore (hiring new personnel, coordination with Fire Island communities, public education/interpretation) intended to reduce the instances of negative human-deer interactions. These actions would provide beneficial impacts on the deer population by managing deer as part of the natural environment rather than the human environment. This alternative would reduce deer density throughout the Seashore using an agent with criteria established by National Park Service. The initial target deer density would be 20–25 deer per square mile for the entire Seashore.

Fertility control would be expected to have both adverse and beneficial impacts on deer behavior. Baiting of deer for inoculation during the fall season would be required resulting in adverse impacts on the deer population by promoting artificial feeding and causing alterations in deer foraging behavior. Because of fertility control, males would experience an increased rutting period causing higher energy exertion through the fall and winter months, and females would see an overall improvement in health and longevity with the absence of pregnancy. Treating female deer with a fertility control agent would require multiple treatments on nearly all females in the population. Adverse impacts on female deer would be expected resulting in stress and injury from capturing and treating animals with the fertility control agent, potential infection from treatments, and unintentional mortality during handling and post-release. If an acceptable fertility control agent is not available, these impacts could be delayed for up to 10 years (until an agent becomes available for implementation).

Reduction in the population density is expected to provide beneficial impacts on the deer herd with fewer individuals competing for resources and an improvement in overall deer condition. In addition, during the first year, this alternative would capture approximately 20–25 deer that approach humans and reside in the Fire Island communities, and translocate those deer to the Fire Island Wilderness. This would cause a slight impact on the deer at the Fire Island Wilderness due to increased competition for food sources. Translocated deer may experience stresses of being placed in an unfamiliar area, and would need to establish new and familiar home ranges, resulting in adverse behavior impacts on those deer. However, adverse behavior impacts are not expected to deer already residing at the Fire Island Wilderness.

Fencing would be used to protect vegetation at the Sunken Forest and portions of the William Floyd Estate. Rotational fencing at the William Floyd Estate would continue until vegetation and deer

density targets have been met. Adverse impacts are expected on deer from fencing because of disruptions to deer movements and home ranges and potential nutritional stress where animals are concentrated until the deer density is lowered via fertility control. Until fertility control lowers the density, impacts on the deer population at the William Floyd Estate would occur because of the smaller space per animal, higher competition for resources, and the potential depletion of natural food supplies causing malnutrition. Beneficial impacts would eventually occur once the vegetation and density targets are met because fewer deer would be residing at the William Floyd Estate competing for resources, and habitat quality would improve with the recovery of understory vegetation available for foraging. This alternative would take the longest time to reach the desired population target but would have beneficial impacts on the overall deer herd in perpetuity from a reduced population size. When combining the impacts of these cumulative actions with the impacts of alternative B, alternative B would contribute appreciably to the overall beneficial cumulative impact on the white-tailed deer population by improving habitat quality and greater food resources available per capita, decreasing frequency of human-deer interactions but maintaining adverse biological and behavioral impacts associated with fertility control treatments.

Adverse impacts on the white-tailed deer population under alternative B are not significant because management actions, although some alteration in natural behavior will occur, human intervention would be part of a comprehensive plan to otherwise preserve and restore natural dynamics of the native ecosystem. Further, the NPS intervention in the current population dynamics would allow Seashore managers to conserve and preserve natural features as called for the Seashore's enabling legislation. Beneficial impacts would not be significant because while a lower population would provide a more natural dynamic, the deer population has been thriving in both natural and developed habitats without human intervention to this point.

## **IMPACTS OF ALTERNATIVE C**

### **Impact Analysis**

Alternative C would reduce deer numbers at the Seashore using direct reduction methods (i.e., sharpshooting, capture and euthanasia, and hunting). The initial target density would be 20–25 deer per square mile for Fire Island and the William Floyd Estate with the expectation of reaching vegetation targets within 8–10 years. If vegetation recovery does not occur as planned based on the target deer density, the Seashore would implement adaptive management to further reduce the deer population in order to proportionally reduce deer browsing pressure until vegetation recovery occurs. This alternative would achieve the targeted population density at a rapid rate. Bait stations would be placed at various locations across the Seashore to attract deer for removal and to ensure that the removal rate is relatively uniform throughout all areas. Deer that approach humans within the Fire Island communities would be captured and euthanized. An exclusion fence would be erected around the Sunken Forest similar to alternative B to provide permanent protection from deer browse.

Deer mortality would be expected to increase greatly the first two to three years under alternative C due to implementation of direct reduction methods. Deer would be removed regardless of age or sex, but the overall balance of age classes and sex ratio would remain. To reach the target deer density, alternative C would remove approximately 220–235 deer the first two years of the plan at Fire Island, and approximately 90–95 deer would be removed from the William Floyd Estate over the course of the first two to three years. This equates to an annual mortality rate of 65% in year 1 and 44% in year 2 at Fire Island. By comparison, the harvest rate from hunting of the statewide deer population in New York was estimated at 21%–26% between 2003 through 2007 (USDA 2009).

When adding the unreported mortality from vehicle collisions and deer damage permits to the hunting harvest rate, the statewide mortality rate would be higher than the reported 21% to 26%. Nevertheless, alternative C would result in a higher than normal deer population mortality rate, estimated to be 2–3 times greater than the statewide mortality rate from hunting, resulting in adverse impacts on the deer population during the first two years of the plan compared to other deer populations across the state of New York.

Once the initial reduction is achieved, however, annual removals would occur at a rate of approximately 30 individuals for Fire Island and 15 individuals at the William Floyd Estate to maintain the population in the range of 20–25 deer per square mile. This represents an annual mortality rate of 23% for Fire Island and 13% for the William Floyd Estate, which is lower or within the range of the mortality rate for the deer population across the state of New York. Thus, after year 2, no adverse impacts on the overall deer population would be expected to result from deer removal for target density maintenance. In perpetuity, the continued removal of deer would maintain the lower deer density necessary for vegetation recovery, create improved habitat quality, and ultimately lead to the beneficial impacts on deer due to less competition among individuals, improved forage availability, and improved deer health conditions.

Under this alternative, changes in deer behavior are possible as a result of implementing deer removal, particularly with hunting. For sharpshooting and capture/euthanasia, increased deer movement may result as Seashore staff travel to and from bait sites, occupy shooting areas, discharge firearms, and conduct trapping activities. These actions are expected to take place across a relatively small area at any one time and be of short duration, several weeks each year. Furthermore, hunting may alter deer movements in the Fire Island Wilderness. Williams, DeNicola, and Ortega (2008) studied deer behavior responses when subjected to a controlled hunt and found that deer exhibited an increase in home range size during the hunting season as deer seek refuge from hunters. Based on this study, deer exposed to hunting at Fire Island Wilderness may broaden their movements and seek refuge outside the limits of hunting, towards Davis Park and Smith Point County Park, potentially causing deer to move into populated areas and resulting in adverse impacts on deer as more human-deer interactions may occur in those areas.

Alternative C would include the same actions and impacts on the deer population as described for alternative B related to hiring additional staff, coordination with the Fire Island communities, public education/interpretation related to deer access to human food, higher level of enforcement, and improved garbage management. In addition, this alternative would include capture and euthanasia of deer that approach humans within the Fire Island communities. By removing those deer, this alternative would reduce the incidences of negative human-deer interactions resulting in beneficial impacts on the deer population. Deer not removed from the population would be less attracted to the Fire Island communities because of lower human food availability, and the number of deer injuries from boardwalks and fence-jump attempts would be reduced within the Fire Island communities.

Under alternative C, vegetation recovery and habitat improvements would be realized from reduced deer browsing pressure with the rapid reduction in deer numbers. This action would provide beneficial impacts on the deer population by promoting the growth of native vegetation available for foraging, and thus improving the physical condition of the deer herd. These actions would help to offset any future impacts on the deer herd resulting from damage to habitats caused by sea-level rise and increased frequency of storm events from higher temperatures due to climate change. The Seashore would expect increases in native understory density and species richness within the maritime forests on Fire Island and the deciduous forests at the William Floyd Estate, providing increased habitat quality for deer.

Erection of a fence around the Sunken Forest would have similar adverse impacts on deer, including noise during construction and loss of habitat, as described in alternative B.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions at the Seashore with the potential to impact white-tailed deer include the following activities: the tick monitoring and management program, use of 4-Poster devices, hunting and nuisance permits, a William Floyd Estate cultural landscape report and treatment plan, and enhanced monitoring and management of invasive plant species, as described under alternative A. The impact of these past, present, and reasonably foreseeable future actions would generally be both beneficial and adverse. When combining the impacts of these actions with the impacts of alternative C, alternative C is expected to contribute appreciably to the overall beneficial cumulative impact on the white-tailed deer population.

### **Conclusion**

Alternative C would include the rapid reduction of deer numbers at the Seashore through use of direct reduction methods. Once the target deer density is reached, the deer population also would be maintained using direct reduction methods. The mortality rate of the deer population during the first two to three years of this alternative would be higher than normal, resulting in adverse impacts on the Seashore deer population. However, once the target deer density is reached, the expected rate of deer removal (mortality rate) would be less than or near the same as other deer populations across the state of New York. Beneficial impacts would occur on the Seashore deer population because the population reduction would provide a recovery of heavily browsed vegetation throughout the Seashore that would enhance the overall habitat value for deer.

As with all action alternatives, alternative C would implement park operation actions (hiring new personnel, coordination with Fire Island communities, public education/interpretation) intended to reduce the instances of negative human-deer interactions. These actions would provide beneficial impacts on the deer population by managing for deer as part of the natural environment rather than the human environment. While deer may be subjected to fewer human food sources resulting in impacts on deer health within the Fire Island communities, deer health Fire Island-wide would be expected to improve as deer gain access to improved habitat quality and experience less competition for resources. These benefits would be realized more rapidly than alternative B. Alternative C would result in beneficial impacts on the deer populations within the Fire Island communities by removing those deer that approach humans and thereby reducing undesirable human-deer interactions. At the Fire Island Wilderness, deer are expected to alter movement patterns and increase their home range sizes in reaction to hunting as a means to seek refuge from hunters. This may result in adverse impacts on the deer population in that region of the Seashore as deer exert more energy seeking refuge. Furthermore, deer seeking refuge from hunting may wander into unfamiliar areas such as the neighboring Davis Park or Smith Point County Park causing increased human-deer interactions.

When combined with the cumulative impacts of alternative C, alternative C is expected to contribute appreciably to the overall beneficial cumulative impact on the white-tailed deer population.

Adverse impacts on the white-tailed deer population under alternative C are not significant because, although the population would see a rapid decrease, human intervention would be part of a comprehensive plan to otherwise preserve and restore natural dynamics of the native ecosystem. Further, the NPS intervention in the current population dynamics would allow Seashore managers to conserve and preserve natural features as called for in the Seashore's enabling legislation. Beneficial impacts would not be significant because while a lower population would provide a more natural

dynamic, the deer population has been thriving in both natural and developed habitats without human intervention to this point.

## **IMPACTS OF ALTERNATIVE D**

### **Impact Analysis**

Alternative D would include the use of direct reduction methods (i.e., sharpshooting and/or hunting) to rapidly reduce deer numbers to the target density, and Seashore managers would use the same direct reduction methods and/or fertility control to maintain the target density. Capture and euthanasia of deer that approach humans in the Fire Island communities would take place to reduce human-deer interactions. The intent of this alternative is to rapidly reduce the deer density to allow for the recovery of native vegetation impacted by deer browse and to reduce human-deer interactions. An exclusion fence would be installed around the Sunken Forest to eliminate all deer for vegetation recovery as described in alternatives B and C. The historic core at the William Floyd Estate would be protected from deer using a fence as described for alternative B.

Impacts on deer under alternative D would be the same as those described for alternative C with regard to the use of direct reduction methods. The number of deer estimated to be removed is the same as for alternative C. Impacts include initial high mortality rates the first few years of the population reduction period and potential behavior changes such as broadened home range movements as described for alternative C. Bait stations would be established across the Seashore to attract deer to areas for removal, which may cause adverse impacts on the population from disturbances by Seashore staff to create, maintain, and travel to and from stations. Once the population is stabilized at or below the target density, the same fertility control techniques described in alternative B could be implemented to replace or supplement direct reduction methods. If fertility control is implemented, deer would be captured, tagged, and inoculated for the first chemical treatment, and treatments would continue indefinitely approximately every three years for each female. Adverse impacts on the deer population from fertility control would be the same as those described under alternative B, including the possibility of extended breeding seasons and late fawning. Assuming a fertility control agent is not available for up to 10 years after plan implementation, use of direct reduction methods would continue to be used as the primary tools for maintaining the population at the desired density level.

As in alternative C, deer that approach humans within the Fire Island communities would be subject to capture via an anesthetic and euthanized under this alternative. In addition, the Seashore would enhance operations such as hiring new staff, and expanding public education/interpretation within the Fire Island communities and at federal areas of high visitation (e.g., Sailors Haven and Watch Hill) to reduce undesirable human-deer interactions. By reducing the incidences of negative human-deer interactions, this alternative would result in beneficial impacts on the deer population.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions at the Seashore with the potential to impact white-tailed deer include the following: the tick monitoring and management program, use of 4-Poster devices, deer hunting and deer damage permits, a William Floyd Estate cultural landscape report and treatment plan, and enhanced monitoring and management of invasive plant species, as described under alternative A. The impact of these past, present, and reasonably foreseeable future actions would be long term and both beneficial and adverse. When combining the impacts of these actions with the impacts of alternative D, alternative D is expected to contribute appreciably to the overall beneficial cumulative impact on the white-tailed deer population.

## Conclusion

Similar to alternative C, alternative D also would result in beneficial impacts on the deer population at the Seashore. The population reduction would provide for the recovery of heavily browsed vegetation and would enhance the overall habitat value for deer resulting in long-term beneficial impacts on the deer population. Overall, deer condition would be expected to improve as habitat quality improves and deer have access to higher quality forage. Deer condition also would improve as a result of less competition for resources as the population density is lowered. Adverse impacts on the deer population would occur in the initial two to three years of this alternative due to the higher than normal mortality from the rapid population control. However, the beneficial impacts described above would continue indefinitely as the population is maintained at the target deer density using direct reduction methods and/or fertility control (once an agent is available). Deer that approach humans residing within the Fire Island communities would be captured and euthanized resulting in fewer undesirable human-deer interactions, and the Seashore would expand operations to promote changes in negative human behaviors affecting deer such as feeding deer by hand and leaving garbage open and available for deer to easily access. These actions would result in beneficial impacts on the deer population because it would incur lower incidences of negative human-deer encounters, and deer would become more habituated to the natural environment rather than the human environment. When combining the impacts of the cumulative actions with the impacts of alternative D, alternative D is expected to contribute appreciably to the overall beneficial cumulative impact on the white-tailed deer population.

Impacts on the white-tailed deer population under alternative D are not significant because, although the population would see a rapid decrease, human intervention would be part of a comprehensive plan to otherwise preserve and restore natural dynamics of the native ecosystem. Further, the NPS intervention in the current population dynamics would allow Seashore managers to conserve and preserve natural features as called for the Seashore's enabling legislation. Beneficial impacts would not be significant because while a lower population would provide a more natural dynamic, the deer population has been thriving in both natural and developed habitats without human intervention to this point.

## IMPACTS ON OTHER WILDLIFE AND WILDLIFE HABITAT

The Seashore is an important source of wildlife habitat for area birds, mammals, and reptiles set against a backdrop of suburban sprawl throughout Long Island. Habitats include oceanfront beaches and dunes, maritime forests, freshwater wetlands, tidal marshes, and deciduous hardwood forests. The Seashore is particularly important as habitat for migratory birds along the Atlantic flyway accommodating numerous species of passerines, shorebirds, and waterfowl. The alternatives being reviewed in this plan would result in varying degrees of impacts on other animal species and their habitats. This section compares those impacts between the no-action alternative and the three action alternatives.

## METHODOLOGY

This section will analyze impacts on other wildlife and wildlife habitat as a result of the alternatives. General information about wildlife at the Seashore is provided in chapter 3 of this document. The assessment in this section is based on a qualitative evaluation of wildlife presence, habitat quality, and how those habitats would be impacted negatively or positively by proposed actions. Impact assessments were made using professional experience, an understanding of the natural processes at the Seashore, and the scientific literature.



Resource-specific context for other wildlife and wildlife habitat is as follows:

- Directives include “preserving and restoring the natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal populations and the communities and ecosystems in which they occur; restoring native plant and animal populations in parks when they have been extirpated by past human-caused actions; and minimizing human impacts on native plants, animals, populations, communities, and ecosystems, and the processes that sustain them.” (NPS 2006a, section 4.4.1).
- The enabling legislation of 1964 established Fire Island National Seashore “for the purpose of conserving and preserving for the use of future generations certain relatively unspoiled and undeveloped beaches, dunes, and other natural features within Suffolk County, New York, which possess high values to the Nation as examples of unspoiled areas of great natural beauty in close proximity to large concentrations of urban population.”
- The Seashore is particularly important as habitat for migratory birds along the Atlantic flyway.

## IMPACTS OF ALTERNATIVE A

### Impact Analysis

Under alternative A, the deer population would remain uncontrolled resulting in high densities across Fire Island and the William Floyd Estate as described in chapter 3. Seashore staff would continue monitoring deer numbers using distance sampling techniques (Buckland et al. 1993) within the Fire Island communities, Sailors Haven, Fire Island Wilderness, and William Floyd Estate; and the Seashore would continue providing technical guidance to Fire Island community residents on a limited basis through public education/interpretation about deer management, reducing artificial food supplies, and offering suggestions for planting native ornamental species.

High deer densities have been documented as negatively affecting other wildlife. In a Pennsylvania study, deCalesta (1994) determined that deer densities reaching 64.5 deer per square mile caused a 27% reduction in avian richness and abundance of intermediate canopy nesting species and a 37% decline in species abundance. Species such as the eastern wood pewee (*Contopus virens*), indigo bunting (*Passerina cyanea*), least flycatcher (*Empidonax minimus*), yellow-billed cuckoo (*Coccyzus americanus*), and the cerulean warbler (*Dendroica cerulea*) were not observed when deer density exceeded 20.5 deer per square mile, and the eastern phoebe (*Sayornis phoebe*) and American robin (*Turdus migratorius*) were not observed at 64.5 deer per square mile. McShea and Rappole (2000) in northern Virginia similarly found that bird usage of deer exclosure areas was higher where vegetative layers and structure were protected from deer browse compared to foraged areas of high deer density where vegetative structure and density were lower. Avian species richness did not change to a large extent following erection of deer exclosures because some species were replaced by other species over time as vegetation underwent successional changes. In Delaware, Tymkiw, Bowman, and Shriver (2013) found that areas of high deer density (i.e.,  $\geq 51$  deer per square mile or 20 per square kilometer) had fewer species of shrub nesting birds, low-canopy foraging birds, and neotropical migrants compared to areas with deer densities lower than 25.9 deer per square mile (10 per square kilometer). The authors concluded that areas in Delaware with deer densities less than 51 deer per square mile (20 per square kilometer) have the greatest avian richness and abundance. Changes in habitat structure from deer can also lead to impacts on invertebrates. Allombert, Stockton, and Martin (2005) measured an eightfold decrease in insect abundance and a sixfold decrease in species density within a forested community experiencing heavy deer browse compared

to an area without deer. Vegetation-dwelling insects were most affected due to the removal of habitat by deer.

Heavy browsing by deer can also cause adverse impacts on habitat used by small mammals. Byman (2011) erected deer exclosures in heavily browsed habitats in Pennsylvania and began capturing small mammals over 10 years. The author found higher numbers of southern red-backed vole (*Myodes gapperi*), woodland vole (*Microtus pinetorum*), and the northern short-tailed shrew (*Blarina brevicauda*) using the exclosure areas, concluding that deer browse was affecting habitat quality for these small mammals.

Cook and others (2010a, 2010b) documented a decline in the reptile populations at the Seashore since the 1970s, particularly at the William Floyd Estate. Exact reasons for the decline are unknown, but the authors speculated that the use of DDT pesticides during the 1950s, saltwater intrusion, and development on adjacent properties were potential causes. Browsing impacts on vegetation caused by the high deer density were not examined by Cook et al. (2010b) as a reason for decline in reptile populations, but could possibly be a contributor to the decline of terrestrial reptiles that rely on vegetation as a major portion of their diet (e.g., box turtle). Most amphibians reside within or adjacent to aquatic habitats and impacts by deer under this alternative are not expected to occur to these species.

Alternative A would continue current management actions for deer at the Seashore. Under this alternative, no mechanism would be in place that would reduce deer numbers, and the high density of deer would continue. Impacts on other wildlife most likely began decades ago as deer reached high densities and began impacting understory vegetation across the Seashore. Under this alternative, heavy browsing by deer would continue to cause degradation to the understory of natural areas at Fire Island and the William Floyd Estate resulting in ongoing changes to vegetation (Underwood 2005) that would have long-lasting adverse effects on wildlife and wildlife habitat at the Seashore. These impacts would be exacerbated by effects on wildlife habitats from climate change, such as increased frequency of overwashes, shoreline erosion, and vegetation inundation. Vegetation density would be reduced from deer browse within forested areas resulting in an anticipated decline in shrub nesting and foraging use by songbirds, as well as impacts on insect populations reliant upon vegetation as a key element to their habitat. Similarly at the William Floyd Estate, small mammals (e.g., voles and shrews, and herbivores such as the cottontail rabbit) and possibly reptiles using the deciduous hardwood forests would experience habitat degradation resulting from heavy deer browsing, which in turn would cause decreased survival rates among these species due to low food supplies and loss of protective cover from predators.

With the perpetuation of high deer numbers within the Fire Island communities under this alternative, residents would continue to use fencing as the major technique to protect property and ornamental plants or landscaping from deer. Fencing would fragment habitats available for use by other wildlife and impede the ability of some species to freely move about in search of habitats to sustain their needs.

Another way in which deer could impact habitat value for other species includes the heavy browsing of native species, opening habitats for invasive plants to proliferate. Knight et al. (2009) observed an abundance of invasive plants outside of exclosure fences in a Pennsylvania forest. Their data support the hypothesis that invasive species success is due in part to preferential foraging of native herbs and the creation of open patches from deer browse. Eschtruth and Battles (2009) also found that browsing was important in contributing to the success of invasive species. William, Ward, and Ramakrishnan (2008) found that deer were a key dispersal agent of consumed seeds from nonnative invasive plants. Based on these studies, it is expected that alternative A would contribute to the spread of invasive species caused by deer browse over the long term, resulting in adverse impacts on

habitat for other wildlife. The high density of deer under this alternative would place noticeable stress on Seashore ecosystems that would in turn provide means for invasive species to spread aggressively beyond the Seashore's ability to control, resulting in long-term adverse impacts on other wildlife.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions at the Seashore affecting other wildlife under alternative A would include the following: the tick monitoring and management program, use of 4-Poster devices, deer hunting and deer damage permits, waterfowl hunting, a William Floyd Estate cultural landscape report and treatment plan, and enhanced monitoring and management of invasive plant species. Collectively, these actions result in adverse and beneficial impacts on other wildlife species and their habitats. Beneficial impacts on other wildlife include deer hunting and deer damage permits, a William Floyd Estate cultural landscape report and treatment plan, and the enhanced monitoring and management of invasive plant species. These actions would provide long-term beneficial impacts on other wildlife by reducing deer density, decreasing invasive species plant populations, and improving local habitats as part of the cultural landscape, respectively

For each alternative, 4-Poster devices would continue to be used in Saltaire and Fair Harbor. As an artificial food source that exceeds several tons per year, the 4-Poster devices attract wildlife species other than deer, potentially causing adverse impacts on these species due to the insecticide reaching unintentional recipients (i.e., birds and small mammals). The 4-Poster devices would also continue attracting pest species (e.g., rats, mice, and other rodents) to feeding stations in concentrated numbers, a factor that may impact nearby residents.

The impact of these past, present, and reasonably foreseeable future actions would be both beneficial and adverse. When combining the impacts of these actions with the impacts of alternative A, alternative A would contribute noticeably to the overall adverse cumulative impact on other wildlife and wildlife habitat.

### **Conclusion**

Under alternative A, high deer populations and heavy browsing would continue to cause reductions in vegetation richness and plant abundance needed to supply food, cover, and nesting habitat for many songbirds and insects. Climate change-induced sea-level rise and projected increases in flood damage from major storm events would collectively add to the impacts on wildlife. Alternative A would likely cause a decline in invertebrates and bird populations at the Seashore that rely on intermediate forest layers as habitat for foraging and nesting. Heavy browsing from high deer densities would also cause vegetation voids at the Seashore that would impact small mammals and possibly reptiles. Preferential foraging by deer would reduce native plant regeneration and provide a competitive advantage to nonnative invasive plants resulting in reduction of habitat quality for other wildlife. Alternative A would contribute noticeably to the overall adverse cumulative impact on other wildlife and wildlife habitat.

The adverse impacts on other wildlife and wildlife habitat under alternative A would be significant because no comprehensive plan would be enacted to preserve the natural abundances, diversities, dynamics, and distributions of native animal populations, communities, and ecosystems. Natural processes left to proceed without human intervention would allow current adverse impacts to continue, whereas the enabling legislation for the Seashore calls for conservation and preservation of natural features. Efforts to maintain quality habitat for migratory birds along the Atlantic flyway would take place outside of a comprehensive deer management plan.

## IMPACTS OF ALTERNATIVE B

### Impact Analysis

Alternative B would use fertility control to reduce and maintain deer numbers and human-deer interactions across the Seashore indefinitely. This alternative assumes the use of an available fertility control chemical agent for the Seashore that meets NPS criteria. Deer that approach humans within the Fire Island communities would be captured and translocated to the Fire Island Wilderness. This alternative would reduce deer numbers slowly with an expectation that the target density would not be reached until 13 years or longer after implementation. Fencing would be implemented to exclude deer from the Sunken Forest in perpetuity, and portions of the William Floyd Estate would be fenced until desired deer density and vegetation conditions are met.

With the exception of the Sunken Forest and portions of the William Floyd Estate under a fencing regime, this alternative would result in the continuation of impacts on other wildlife and wildlife habitat similar to those described under alternative A until such time that the deer density would be reduced by fertility control (approximately 13 years) and vegetation recovery could begin. The expected period for achieving vegetative recovery would be approximately 8–10 years past the time the deer density target is reached, assuming a fertility control agent is immediately available. In total, this would take approximately 21 to 23 years. During the 21 to 23-year fertility control and vegetation recovery period, unfenced habitat at other natural areas on Fire Island would be subjected to the loss of understory vegetation from heavy browsing by deer. Impacts would include the loss of native understory vegetation palatable to deer and the spread of unpalatable invasive species making it difficult to manage for native vegetation recovery in later years. These impacts would affect songbird, invertebrate, and small mammal habitat (deCalesta 1994; Byman 2011; Allombert, Stockton, and Martin 2005; Tymkiw, Bowman, and Shriver 2013) by removing key vegetation constituents important to other wildlife as food sources, protective cover from predators, and reproduction.

Under this alternative, the 44-acre Sunken Forest and approximately 145 acres of forest at the William Floyd Estate (80 acres of forest at the historic core area and 65 acres in the lower acreage) would immediately be fenced to exclude deer, resulting in beneficial impacts on habitat for other wildlife within the fenced areas. Vegetation recovery to herbs, forbs, shrubs, and tree saplings would occur that would be used as habitat for ground and shrub nesting songbirds, insects reliant upon vegetation for their life cycle, and mammalian herbivores. Higher densities of birds, small mammals, and insects from improved habitat could also increase food supplies for predators such as screech owls (*Megascops asio*), hawks (*Buteo* sp., *Accipiter* sp.), and snakes (*Thamnophis sirtalis*, *Elaphe* spp.). However, for some predator species, an increased density of vegetation within forest understories would likely affect their ability to move freely, thereby decreasing success at capturing prey.

Adverse impacts on other wildlife due to fencing are expected under this alternative. Installation of fencing would cause noise disturbance and vegetation removal necessary to erect the fences. Once installed, fencing could interrupt movements by other mammals such as foxes (*Vulpes vulpes*) and raccoons (*Procyon lotor*), as well as flight movements by birds that prefer ground and shrub layers. Other animals would be disturbed and/or frightened during the deer drive to remove all deer from the Sunken Forest once the fence is installed. By excluding deer from portions of the William Floyd Estate, deer densities would increase elsewhere as deer are congregated outside of fenced areas. The increase in deer densities would cause higher browsing pressure on vegetation and impact habitat for other wildlife species in perimeter areas until the deer density is lowered using fertility control. If a fertility control agent is not available for up to 10 years, damage to habitat caused by the increased

deer density outside of the exclusion fencing would continue for an additional 10 years, resulting in loss vegetation and a decline in habitat quality for other wildlife.

This alternative would include the capture of deer that approach humans within the Fire Island communities, and the subsequent release of those animals at the Fire Island Wilderness. An expected 20–25 deer would be moved in the first year of the plan, and fewer deer that approach humans would remain within the Fire Island communities in subsequent years resulting in fewer translocations. Deer numbers would slightly rise at the Fire Island Wilderness from the translocation of deer, thereby increasing deer browsing pressure during the first 5–6 years of the plan. During this time, nesting and foraging songbirds, as well as insects reliant upon vegetation, would incur slight decreases in habitat quality from deer browse. Once fertility control begins to lower the deer population, impacts on habitat for other wildlife caused by deer would diminish providing beneficial impacts on other wildlife for years.

The Seashore would implement a vegetation monitoring plan that would measure the scale of vegetation and habitat recovery efforts after the target deer density is reached. If habitat improvements are not satisfactorily realized 8–10 years into the plan, adaptive management would be implemented to incrementally lower the deer population further until vegetation recovery goals are met. This action would provide beneficial impacts on wildlife and other wildlife habitats.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions at the Seashore affecting other wildlife under alternative B would include the following: the tick monitoring and management program, 4-Poster device, deer hunting and deer damage permits, waterfowl hunting, a William Floyd Estate cultural landscape report and treatment plan, and enhanced monitoring and management of invasive plant species, as described under alternative A. The impact of these past, present, and reasonably foreseeable future actions would generally be long-term and both beneficial and adverse. When combining the impacts of these actions with the impacts of alternative B, alternative B would contribute noticeably to the beneficial cumulative impact on other wildlife and wildlife habitat.

### **Conclusion**

Alternative B would reverse the trend in habitat decline for other wildlife species caused by heavy deer browsing, resulting in beneficial impacts on other wildlife and wildlife habitat. These actions may help to offset projected impacts on wildlife habitats from climate change and sea-level rise such as loss of wetlands and dunes from storm overwashes. Intermediate forest layers at the Seashore would experience increases in plant species abundance and richness that would be used by songbirds for nesting, foraging, and cover. Small mammals would benefit from this alternative by increases in vegetation at the forest floor as deer browse is reduced. This alternative would take the longest time, up to 22 to 33 years, for habitat recovery to occur because of the lag time for fertility control to reduce deer numbers and the time it would take for the recovery of vegetation once the deer target is reached. Fencing would be used at the Sunken Forest and William Floyd Estate to protect areas from deer browse indefinitely, and that fencing would be installed immediately upon implementation of the plan regardless of availability of a fertility control agent. Although there is a risk of continued adverse impacts, similar to those described under alternative A, especially in the case that an acceptable fertility control method is not available immediately, the Seashore would undertake fencing and expects to reduce the deer population to a point at which habitat for other wildlife can successfully regenerate after approximately 23 years (or up to 33 years if an acceptable fertility control agent is not available immediately). Temporary impacts on other wildlife species

would occur during the installation of the fences, and wildlife would experience disruptions to natural movement behavior caused by fencing. Alternative B would contribute noticeably to the overall cumulative beneficial impact on other wildlife and wildlife habitat.

The adverse impacts associated with fence construction would not be significant because they would be limited in scale and would generally result only in temporary disturbance. Adverse impacts associated with the relatively long time period for habitat recover have a risk of reaching significant levels if the delay causes substantial shifts in natural abundances, diversities, diversities, dynamics, and distributions of native plant populations, communities, and ecosystems; however, ultimately, the beneficial impacts on other wildlife and wildlife habitat under alternative B are expected to be significant because the Seashore would implement a comprehensive plan to preserve the natural abundances, diversities, dynamics, and distributions of native plant populations, communities, and ecosystems. The NPS intervention in the current natural processes would allow Seashore managers to conserve and preserve the natural features as called for the Seashore's enabling legislation. Actions taken to conserve habitat incorporated into the comprehensive deer management plan would be especially important for migratory birds using the Atlantic flyway.

## **IMPACTS OF ALTERNATIVE C**

### **Impact Analysis**

Alternative C proposes the use of direct reduction methods (i.e., sharpshooting, capture and euthanasia, and hunting) to rapidly reduce deer numbers and maintain the population at the desired level. Fencing would be used to protect the vegetation at the Sunken Forest until desired conditions are reached. Once the vegetation and deer density targets are met, the fence would be removed. Only small-scale fencing around specific plants important to the cultural landscape would be implemented at the William Floyd Estate under this alternative.

The rapid reduction in deer numbers across the Seashore would cause immediate beneficial responses to vegetation critical for other wildlife. Understory herbs, forbs, shrubs, and saplings would begin a recovery process, which in turn would provide enhanced vegetative layers for songbird nesting, foraging, and cover. Increases in ground cover would also improve habitat for insects and small mammals similar to alternative B, but at a faster rate. Fencing of the Sunken Forest would also benefit other wildlife as described in alternative B. Since rotational fencing is not being used under this alternative at the William Floyd Estate, recovery of understory habitat for other wildlife may take a slightly longer period of time compared to alternative B where rotational fences would be used to provide complete and immediate protection to vegetation.

The rapid reduction in deer numbers would also provide an immediate reduction in the potential for spread of invasive species caused by deer browsing (Williams, Ward, and Ramakrishnan 2008; Eschtruth and Battles 2009; Knight et al. 2009). With lower deer numbers and the reduction in deer preferential browsing pressure, native species would not experience as much of a competitive disadvantage with invasive species and would begin to recover providing improvements to habitats for other wildlife and wildlife habitat.

This alternative would use sharpshooting on federally owned lands across the Seashore in combination with hunting in the Fire Island Wilderness. Sharpshooting and hunting would introduce a level of human intervention in the natural areas causing disturbances to natural behavior of other wildlife from noise and the human presence. This alternative would rely on bait stations designed to attract deer for sharpshooting. Bait stations would serve as an artificial food source to

other wildlife species such as birds and rodents that would result in food-conditioning behaviors as animals become more reliant on the bait as a food supply. Disturbance impacts on other wildlife from bait stations, sharpshooting, and hunting would be temporary, occurring only a few weeks each year.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions at the Seashore affecting other wildlife under alternative B would include the following: the tick monitoring and management program, 4-Poster device, deer hunting and deer damage permits, waterfowl hunting, a William Floyd Estate cultural landscape report and treatment plan, and enhanced monitoring and management of invasive plant species, as described under alternative A. The impact of these past, present, and reasonably foreseeable future actions would be both beneficial and adverse. When combining the impacts of these actions with the impacts of alternative C, alternative C would contribute noticeably to the overall beneficial cumulative impact on other wildlife and wildlife habitat.

### **Conclusion**

Alternative C calls for the use of direct reduction methods to reduce the deer population to the initial target 20–25 deer per square mile. These methods would continue to be used to maintain the deer population at or below the target density. This alternative is expected to have long-term beneficial impacts on other wildlife and wildlife habitats including insects, songbirds, small mammals, and predator species due to improved habitat quality in the absence of high deer browse. This benefit would be realized in a short timeframe, 8–10 years, since the target deer density is expected to be reached within 2 years. An exception would be the Sunken Forest where exclusion fencing would begin an immediate recovery of vegetation and wildlife habitat. At the William Floyd Estate where the deer population would be reduced and vegetation allowed to recover, habitat improvements would benefit invertebrates and migratory and resident songbirds that use the forest understory for nesting, foraging, and protective cover. The reduction in deer numbers would also promote native species regeneration and decrease the potential for the spread of invasive species. Adverse impacts on other wildlife may include disturbances by humans during sharpshooting and hunting, as well as the placement of artificial food sources at bait stations. Alternative C would likely help to offset projected impacts on other wildlife from climate change and sea-level rise at the Seashore. Alternative C would contribute noticeably to the cumulative beneficial impact on other wildlife and wildlife habitat.

Adverse impacts would not be significant because they would be limited in scale and would generally result only in temporary disturbance. Beneficial impacts on other wildlife and wildlife habitat under alternative C are expected to be significant because the Seashore would implement a comprehensive plan to preserve the natural abundances, diversities, dynamics, and distributions of native plant populations, communities, and ecosystems. The NPS intervention in the current natural processes would allow Seashore managers to conserve and preserve the natural features as called for the Seashore's enabling legislation. Actions taken to conserve habitat incorporated into the comprehensive deer management plan would be especially important for migratory birds using the Atlantic flyway.

## IMPACTS OF ALTERNATIVE D

### Impact Analysis

As described for alternative C, alternative D includes the removal of deer using direct reduction methods to reach the initial target of 20–25 deer per square mile density. However, alternative D includes the option to use fertility control in conjunction with or in place of direct reduction methods to maintain the population at or below the target density. The expected timeline for achieving the target deer density is two years. If no fertility control agent is available after the target deer density is reached, sharpshooting and hunting would continue as the technique for maintaining the deer population. An exclusion fence would be placed around the Sunken Forest to enable this area to remain free from all deer until the vegetation has recovered, and a fence would be installed to protect the historic core area at the William Floyd Estate. This alternative would not employ rotational fencing at the William Floyd Estate.

Impacts on other wildlife and wildlife habitat would generally be the same as those described under alternative C. Habitats for other wildlife species would experience improvements once the target deer density is reached after a two-year deer reduction period. The Sunken Forest would be fenced, and habitat improvements for other wildlife would be expected from the absence of deer browse. Impacts on other wildlife from fencing the Sunken Forest would include disturbances to vegetation for the installation of the fence, noise disturbance from humans during the fence installation, and disruptions to natural animal movement patterns as described for alternatives B and C. Similarly, the reduction in deer numbers and deer browse is expected to promote the recovery of native understory vegetation at the William Floyd Estate as described for alternative C resulting in long-term benefits to other wildlife, such as songbirds, reptiles, insects, and small mammals, and their habitats. Furthermore, the competitive advantage of invasive species due to heavy browsing of native understory vegetation would be reduced thereby facilitating the recovery of native plants. This would also provide long-term beneficial impacts on other wildlife and wildlife habitats.

### Cumulative Impact Analysis

Past, present, and reasonably foreseeable future actions at the Seashore affecting other wildlife under alternative D would include the following activities: the tick monitoring and management program, 4-Poster device, deer hunting and deer damage permits, waterfowl hunting, a William Floyd Estate cultural landscape report and treatment plan, and enhanced monitoring and management of invasive plant species, as described under alternative A. The impact of these past, present, and reasonably foreseeable future actions would be both beneficial and adverse. When combining the impacts of these actions with the impacts of alternative D, alternative D would contribute noticeably to the beneficial cumulative impact on other wildlife and wildlife habitat.

### Conclusion

Alternative D calls for the direct reduction of the deer population to meet the initial target 20–25 deer per square mile, and the use of direct reduction methods and/or fertility control to maintain the deer population at or below the target density. As described for alternative C, improvements to wildlife habitat would be realized in a short timeframe since the target deer density is expected to be reached within two years. An exception would be the Sunken Forest where exclusion fencing would begin an immediate recovery of vegetation and wildlife habitat. At the William Floyd Estate where the deer population is reduced and vegetation is allowed to recover, habitat improvements would benefit invertebrates and migratory and resident songbirds that use the forest understory for nesting, foraging, and protective cover. The reduction in deer numbers would also promote the



regeneration of native species and decrease the potential for the spread of invasive species. Benefits would occur regardless of the method of deer density maintenance chosen by Seashore managers (i.e., direct reduction and/or fertility control). Indirect adverse impacts on other wildlife may include disturbances by humans during use of direct reduction and/or fertility control methods, as well as the placement of artificial food sources at bait stations. Alternative D would contribute noticeably to the cumulative beneficial impact on other wildlife and wildlife habitat.

Adverse impacts would not be significant because they would be limited in scale and would generally result only in temporary disturbance. Beneficial impacts on other wildlife and wildlife habitat under alternative D are expected to be significant because the Seashore would implement a comprehensive plan to preserve the natural abundances, diversities, dynamics, and distributions of native plant populations, communities, and ecosystems. The NPS intervention in the current natural processes would allow Seashore managers to conserve and preserve the natural features as called for in the Seashore's enabling legislation. Actions taken to conserve habitat incorporated into the comprehensive deer management plan would be especially important for migratory birds using the Atlantic flyway.

## IMPACTS ON WILDERNESS

### METHODOLOGY

The impact analysis for wilderness assumes that actions conducted in connection with this plan would adhere to applicable federal, state, and local laws and policies, including the following:

- The Wilderness Act (PL 88-577)
- Otis Pike Fire Island High Dune Wilderness Act (PL 96-585)
- NPS *Management Policies 2006* (NPS 2006a)

Any action proposed to take place in congressionally designated wilderness is subject to a minimum requirement analysis as described in the minimum requirements decision guide (developed by the interagency Arthur Carhart National Wilderness Training Center and available on [wilderness.net](http://wilderness.net)) and NPS *Management Policies 2006* (NPS 2006a, section 6.3.5). This concept is applied as a two-step process that determines (1) whether or not the proposed action is appropriate or necessary for administration of the area as wilderness and does not cause significant impact on wilderness resources and character, in accordance with the Wilderness Act, and (2) the techniques and types of equipment needed to ensure that impacts on wilderness resources and character are minimized (NPS 2006a).

The Interagency Wilderness Character Monitoring Team, which represents the Bureau of Land Management, U.S. Fish and Wildlife Service, National Park Service, U.S. Geological Survey, and U.S. Forest Service, offers an interagency strategy to monitor trends in wilderness character across the National Wilderness Preservation System in the handbook *Keeping It Wild: An Interagency Strategy to Monitor Trends in Wilderness Character across the National Wilderness Preservation System* (Landres et al. 2008). Based on the statutory language of the Wilderness Act, the interagency team identified four qualities of wilderness character that should be used in wilderness planning, stewardship, and monitoring. The National Park Service also has developed an agency-specific guide to managing wilderness called *Keeping it Wild in the National Parks* (NPS 2013b), which described a fifth quality. These five qualities were used to describe impacts of the alternatives on wilderness character and are as follows:

- Untrammeled—Wilderness is essentially unhindered and free from modern human control or manipulation.
- Natural—Wilderness ecological systems are substantially free from the effects of modern civilization.
- Undeveloped—Wilderness retains its primeval character and influence and is essentially without permanent improvement or modern human occupation.
- Solitude or a primitive and unconfined type of recreation—Wilderness provides outstanding opportunities for solitude or primitive and unconfined recreation.
- Other features of value—Wilderness preserves other tangible features that are of scientific, educational, scenic, or historical value. This quality captures important elements of wilderness that may not be covered in the other four qualities.

These five qualities are used in this EIS to evaluate the extent to which wilderness values are either preserved, restored, or diminished under each alternative.

In addition to assessing the impacts on the five wilderness qualities described above, the following resource-specific context was considered when assessing the impacts of the alternatives on wilderness:

- The National Park Service will manage wilderness areas for the use and enjoyment of the American people. Management will include the protection of these areas and the preservation of their wilderness character, and the gathering and dissemination of information regarding their use and enjoyment as wilderness.
- The Wilderness Act allows wilderness managers to impact a wilderness resource and/or character if such an impact is necessary to preserve one or more qualities of wilderness character. Such impacts must be evaluated and documented as described in the minimum requirements decision guide.

## **IMPACTS OF ALTERNATIVE A**

### **Impact Analysis**

Under the no-action alternative, existing vegetation and deer management and monitoring efforts throughout the Fire Island Wilderness would continue. These existing management and monitoring efforts with the potential to impact the Fire Island Wilderness include fencing of sensitive species, an experimental deer enclosure (13 feet by 13 feet), and vegetation monitoring plots. These actions may result in a temporary reduction in qualities of wilderness character. While management actions are being undertaken, Seashore managers would be imposing modern human control over ecological systems. Seashore managers would interfere with the primeval quality and/or influence of the natural resources within the Fire Island Wilderness. As long as Seashore managers continue these efforts, the untrammeled, natural, and undeveloped qualities of wilderness would be diminished. The presence of these management activities within the Fire Island Wilderness also would diminish opportunities for solitude. As Seashore management moves the Fire Island Wilderness ecosystem towards the desired conditions, the natural wilderness quality would be restored over the long term.

Recreational uses of the Fire Island Wilderness, such as camping and hunting, would continue. This offers visitors opportunities for solitude and a primitive and unconfined type of recreation. Other features of value such as scientific, educational, scenic, or historical values would be retained. There are no impacts on other features of value expected under this alternative.

Under the no-action alternative, no deer density targets would be established. No comprehensive deer management plan would be implemented. As discussed under the “Vegetation, Unique Vegetation Communities, and Special-status Plant Species” and “Other Wildlife and Wildlife Habitat” impact topics, deer population density within the Fire Island Wilderness could diminish the natural quality if population density grows to the point where heavy browsing may cause an ecological system imbalance.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions have the potential to impact the Fire Island Wilderness. These actions include waterfowl hunting. Waterfowl hunting takes place annually and allows the use of firearms, with restrictions. During this season, use of firearms may diminish opportunities for solitude within the Fire Island Wilderness, but it also provides an avenue for hunters to experience an unconfined type of recreation. Hunters are encouraged to follow “Leave No Trace” policies. As such, the other qualities of wilderness character remain relatively intact.

The impact of these past, present, and reasonably foreseeable future actions would generally be beneficial. When combining the impacts of these projects with the impacts of alternative A, the cumulative impact would be beneficial. Alternative A would contribute a noticeable adverse increment to the cumulative impact on the Fire Island Wilderness.

### **Conclusion**

Overall, the qualities of wilderness character would remain unchanged under alternative A; however, alternative A could eventually result in an adverse impact on the Fire Island Wilderness due to diminished natural quality of wilderness character if the deer density within the Fire Island Wilderness reaches a point that deer browse causes vegetation regeneration to be noticeably inhibited. Such an impact would reflect an ecosystem imbalance; however, NPS mandates to manage wilderness would call for measures to correct this imbalance when possible. Alternative A would contribute noticeably to the cumulative impact on the Fire Island Wilderness. The adverse impact on wilderness has the potential to approach the level of significance if deer browse pressures increased to a point where the natural quality of wilderness character is diminished; however, the existing impacts on the Fire Island Wilderness are not significant. The National Park Service would continue to manage wilderness areas for the use and enjoyment of the American people. Ongoing management actions may temporarily diminish wilderness character, but these actions would be implemented in order to manage and protect wilderness character in the long term and would be subject to the minimum requirement decision guide. Management includes the protection of these areas and the preservation of their wilderness character, and the gathering and dissemination of information regarding their use and enjoyment as wilderness.

## **IMPACTS OF ALTERNATIVE B**

### **Impact Analysis**

Under alternative B, the management activities to protect special-status species described under alternative A (i.e., fencing of sensitive species) would continue to diminish the undeveloped, natural, and untrammled qualities temporarily. These management actions may also diminish opportunities for solitude within the Fire Island Wilderness. As Seashore management moves the Fire Island Wilderness ecosystem towards the desired conditions, the natural wilderness quality would be restored over the long term. Some additional permanent fencing may be established under

alternative B for vegetation monitoring; however, the impacts described under alternative A would still apply to alternative B.

In addition to the monitoring and education actions included under alternative A, alternative B would incorporate fertility control actions to gradually reduce the deer population in the Seashore. Deer that approach humans observed within the Fire Island communities would be targeted for translocation to the Fire Island Wilderness as long as additional deer would not result in heavy browsing of the wilderness vegetation. The minimum requirement decision guide would be completed prior to implementation of the plan and would be used to determine whether this activity is appropriate and what mitigation methods might be warranted prior to it taking place. As discussed under the “Vegetation, Unique Vegetation Communities, and Special-status Plant Species” and “Other Wildlife and Wildlife Habitat” impact topics, deer population density within the Fire Island Wilderness could diminish the natural quality if population density grows to the point where heavy browsing may cause an ecological system imbalance. If this point is reached, it would be a temporary condition that would be remedied over the long term due to the use of fertility controls to reduce and/or maintain the deer population at a sustainable density.

The fertility control actions to be used within the Fire Island Wilderness include the use of a chemical reproductive control agent, which would gradually reduce and then maintain the deer population at an appropriate density. The use of a chemical reproductive control agent would impose modern human control over the deer population and would therefore diminish the untrammled quality of the Fire Island Wilderness on a recurring basis. Use of these methods would require that animals that have undergone some type of treatment be marked and/or tracked in some way (e.g., radio collars, ear tags, or dye markings). Translocated animals also would be marked and/or tracked. Use of such visible evidence of human-imposed management of the deer population could reduce opportunities for solitude within the Fire Island Wilderness. Although these qualities would be diminished, the natural quality of wilderness would be maintained or restored over the long term through maintenance of the deer population.

This alternative is not expected to noticeably detract from other features of value within the Fire Island Wilderness.

If an acceptable fertility control agent is not available for up to 10 years following implementation of this plan, other actions such as translocation may take place, but no deer population reduction steps would be taken until such a time as an acceptable agent became available. Without a method of deer population control within the Fire Island Wilderness, the risk for ecosystem imbalance is higher, but deer not treated with a fertility agent would not need to be marked and would continue to have natural reproductive cycles.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions have the potential to impact the Fire Island Wilderness. These actions include waterfowl hunting, as described under alternative A. The impact of these past, present, and reasonably foreseeable future actions would generally be beneficial. When combining the impacts of these projects with the impacts of alternative B, the cumulative impact would be long-term beneficial. Alternative B would contribute a noticeable adverse increment to the cumulative impact on the Fire Island Wilderness.

### **Conclusion**

Overall, alternative B management actions would have an adverse impact on the Fire Island Wilderness due to the potential to diminish the four primary qualities of wilderness character to

some extent; the fifth would not be impacted. However, these actions would be part of a comprehensive plan to manage the potential for deer overpopulation within the Fire Island Wilderness. Although deer management actions (i.e., use of a chemical reproductive control agent) may temporarily diminish wilderness character on a recurring basis, these actions would be implemented in order to manage and protect wilderness character in the long term and would be subject to the minimum requirements decision guide. In the case that an acceptable fertility control agent is not available for up to 10 years following implementation of this plan, the natural quality of wilderness would be at risk, as described under alternative A, but the untrammelled quality would be less diminished. Alternative B would contribute noticeably to the cumulative impact on the Fire Island Wilderness.

The beneficial impact on wilderness would not be significant because the qualities of wilderness character would be preserved in the long term. The National Park Service would manage wilderness areas for the use and enjoyment of the American people. Management would include the protection of these areas and the preservation of their wilderness character, and the gathering and dissemination of information regarding their use and enjoyment as wilderness. The adverse impact on wilderness would be significant because the use of fertility control would be an active management strategy that would impose human control over natural deer biology, leave evidence of human intervention (i.e., marked deer), and would interfere intermittently with the opportunity for solitude. Such impacts must be evaluated and documented as described in the minimum requirements decision guide.

## **IMPACTS OF ALTERNATIVE C**

### **Impact Analysis**

Under alternative C, the management activities to protect special-status species described under alternative A (i.e., fencing of sensitive species) would continue to diminish the undeveloped, natural, and untrammelled qualities temporarily. These management actions may also diminish opportunities for solitude within the Fire Island Wilderness. As Seashore management moves the Fire Island Wilderness ecosystem towards the desired deer density, the natural wilderness quality would be restored over the long term. Additionally, if management goals for special-status species protection are attained and management actions are no longer necessary, all wilderness qualities would be restored in the long term. As under alternative B, some additional permanent fencing may be established under alternative C for vegetation monitoring; the impacts described under alternatives A and B also would apply to alternative C.

The primary difference between alternatives B and C is the use of direct reduction methods of deer management under alternative C. Instead of translocating deer that approach humans to the Fire Island Wilderness as proposed under alternative B, these deer would be targeted for capture and euthanasia, taking place outside of the wilderness. Use of sharpshooting would be expected to control the deer population much more quickly than fertility control methods such as those proposed under alternative B. Direct reduction would more quickly reduce the chance that deer density would grow to a point where heavy browsing may cause an ecological system imbalance. Therefore, it is less likely that the natural quality of wilderness character would be diminished due to deer browse under this alternative than under alternative B.

Population reduction and maintenance would be implemented through a combination of sharpshooting, capture and euthanasia of individual deer, and hunting within the Fire Island Wilderness. The use of these methods would impose modern human control over the deer

population and would therefore diminish the untrammelled quality of the Fire Island Wilderness. Use of visible and audible evidence of human-imposed management of the deer population also could reduce opportunities for solitude within the Fire Island Wilderness for visitors not participating in the hunt. The hunt is likely to take place during a time when visitation is very low, during winter months; therefore, impacts on opportunities for solitude for other visitors would be minimized. On the other hand, hunters would have an improved opportunity for solitude during the hunt within the wilderness.

Although some of the above qualities of wilderness would be diminished, the natural quality of wilderness would be maintained or restored over the long term through maintenance of the deer population. This alternative is not expected to noticeably detract from other features of value within the Fire Island Wilderness.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions have the potential to impact the Fire Island Wilderness. These actions include waterfowl hunting, as described under alternative A. The impact of these past, present, and reasonably foreseeable future actions would generally be beneficial. When combining the impacts of these projects with the impacts of alternative C, the cumulative impact would be long-term beneficial. Alternative C would contribute a noticeable adverse increment to the cumulative impact on the Fire Island Wilderness.

### **Conclusion**

Overall, alternative C management actions would have an adverse impact on the Fire Island Wilderness due to the potential to diminish the four primary qualities of wilderness character to some extent; however, these actions would be part of a comprehensive plan to manage the potential for deer overpopulation within the Fire Island Wilderness, which would strive to sustain the natural distribution, numbers, population composition, and interaction of indigenous species within the Fire Island Wilderness. Although deer management actions (e.g., sharpshooting and hunting) may temporarily diminish wilderness character on a recurring basis, these actions would be implemented in order to manage and protect wilderness character in the long term and would be subject to the minimum requirements decision guide. Alternative C would contribute noticeably to the cumulative impact on the Fire Island Wilderness.

Neither beneficial nor adverse impacts on wilderness would be significant because hunting would provide hunters with an opportunity for unconfined recreation while the qualities of wilderness character would be preserved in the long term; otherwise, no noticeable change in the qualities of wilderness character is expected. The National Park Service would manage wilderness areas for the use and enjoyment of the American people. Management would include the protection of these areas and the preservation of their wilderness character, and the gathering and dissemination of information regarding their use and enjoyment as wilderness.

## **IMPACTS OF ALTERNATIVE D**

### **Impact Analysis**

Alternative D would combine management efforts discussed under the other alternatives. The management activities to protect special-status species described under alternative A (i.e., fencing of sensitive species) would continue to diminish the undeveloped, natural, and untrammelled qualities temporarily. These management actions may also diminish opportunities for solitude within the Fire

Island Wilderness. As Seashore management moves the Fire Island Wilderness ecosystem towards the desired conditions, the natural wilderness quality would be restored over the long term. Additionally, if management goals for special-status species protection are attained and management actions are no longer necessary, all wilderness qualities would be restored in the long term. As under alternatives B and C, some additional permanent fencing may be established under alternative D for vegetation monitoring; the impacts described under alternatives A, B, and C would apply to alternative D.

Deer management actions would include use of direct reduction methods to directly reduce the deer population and could also use fertility control to maintain the deer population at an appropriate deer density. The same methods of population reduction would be used under this alternative as described under alternative C (i.e., sharpshooting and hunting), and the fertility control methods described under alternative B could also be used (in conjunction with or in place of direct reduction methods) for population maintenance. As described under alternative C, deer that approach humans would be targeted for capture and euthanasia, as opposed to the alternative B proposal of translocation to the Fire Island Wilderness.

The impacts on qualities of wilderness characters from the actions described above would be roughly the same as those described under alternative C, although if the Seashore chooses to implement fertility control measures for population maintenance, impacts related to these action would be the same as described under alternative B. Using direct reduction methods would control the deer population within two years (much more quickly than using fertility control for initial population reduction). Use of direct reduction methods would lower the chance that deer density would grow to a point where heavy browsing may cause an ecological system imbalance. Therefore, it is less likely that the natural quality of wilderness character would be diminished due to deer browse under this alternative than under alternative B.

The use of the methods described above would impose modern human control over the deer population and would therefore diminish the untrammeled quality of the Fire Island Wilderness. Use of visible and audible evidence of human-imposed management of the deer population also could reduce opportunities for solitude within the Fire Island Wilderness. Although these qualities would be diminished, the natural quality of wilderness would be maintained or restored over the long term through maintenance of the deer population.

This alternative is not expected to noticeably detract from other features of value within the Fire Island Wilderness.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions have the potential to impact the Fire Island Wilderness. These actions include waterfowl hunting, as described under alternative A. The impact of these past, present, and reasonably foreseeable future actions would generally be beneficial. When combining the impacts of these projects with the impacts of alternative D, the cumulative impact would be long-term beneficial. Alternative D would contribute a noticeable adverse increment to the cumulative impact on the Fire Island Wilderness.

### **Conclusion**

Overall, alternative D management actions would have adverse impacts on the Fire Island Wilderness due to the potential to diminish the four primary qualities of wilderness character to some extent; however, these actions would be part of a comprehensive plan to manage the potential

for deer overpopulation within the Fire Island Wilderness, which would strive to sustain the natural distribution, numbers, population composition, and interaction of indigenous species within the Fire Island Wilderness. Although deer management actions (i.e., sharpshooting, hunting, and/or a fertility control agent) may temporarily diminish wilderness character on a recurring basis, these actions would be implemented in order to manage and protect wilderness character in the long term and would be subject to the minimum requirements decision guide. These actions would be undertaken to correct influences originating outside of wilderness boundaries. Alternative D would contribute noticeably to the cumulative impact on the Fire Island Wilderness if fertility control is used.

The beneficial impact on wilderness would not be significant because the qualities of wilderness character would be preserved in the long term. The National Park Service would manage wilderness areas for the use and enjoyment of the American people. Management would include the protection of these areas and the preservation of their wilderness character, and the gathering and dissemination of information regarding their use and enjoyment as wilderness. The adverse impact on wilderness would be significant if fertility control is used because the use of fertility control would be an active management strategy that would impose human control over natural deer biology, leave evidence of human intervention (i.e., marked deer), and would interfere intermittently with the opportunity for solitude. Such impacts must be evaluated and documented as described in the minimum requirements decision guide.

## **IMPACTS ON CULTURAL LANDSCAPES**

### **METHODOLOGY**

Potential impacts on cultural landscapes, topography, landforms, and vegetation were analyzed in terms of potential changes resulting from implementation of the alternatives. These potential impacts include anticipated changes to land use, vegetation patterns, circulation systems, and small-scale features such as the High Board Fence and graveyard markers. As described in “Chapter 3: Affected Environment,” the impact analysis focuses only on the cultural landscape at the William Floyd Estate. Although other cultural landscapes exist in the Seashore, only the cultural landscape at the William Floyd Estate is potentially affected by the proposed actions.

The resource-specific context for assessing impacts on cultural landscapes is:

- The ability of the Seashore to preserve a landscape indicative of the 240 years during which the Floyd family managed the William Floyd Estate. This includes human-induced changes to the landscape over time for the purposes of agriculture, ornamentation, and conservation, which have created historic patterns of vegetation growth that should be preserved.

### **IMPACTS OF ALTERNATIVE A**

#### **Impact Analysis**

Under alternative A, monitoring efforts and existing vegetation and deer management would continue; however, the current effort is limited to monitoring and some limited fencing. Deer presence within the William Floyd Estate would continue unabated, because the current perimeter fence is not deer-proof. The well-established locust, basswood, and beech trees planted around the main house would be maintained and monitored for general health and integrity. Ornamental and



orchard tree and shrub plantings around the main house, which reflect the period during which the Floyd family used the estate for seasonal vacation and recreational use, would continue to be adversely affected by heavy deer browse. Deer browse would also continue to affect the dwarf Crabapple trees and plant varieties that were planted in the West Garden and orchard during the 1960s, replacing an early 20th century garden. The continual loss of the ornamental plants that are important features of the garden makes it difficult to fully interpret the landscape because the features are missing. Even though plantings would be continually monitored and replaced as necessary and feasible, the recurring loss of vegetative features would result in an adverse impact on the cultural landscape. The current garden restorative and expansion efforts, including those for the well-documented West Garden, would continually be thwarted by browsing. Although not directly impacted by deer, the Brick Walk and High Board fence would be maintained and repaired as needed, as would the trails and pathways that currently traverse the William Floyd Estate grounds.

In the lower acreage, the vista, which was pruned back to its historic edge in 2003 under the guidance of the Olmsted Center for Landscape Preservation, would continue to be maintained in order to preserve the historic view. The open fields used by the Floyd family during the 20th century for hunting would be mowed on at least an annual basis in order to control woody successional growth. In the surrounding woodland, regeneration of the natural forest and shrub understory layers would be hindered by the repeated browsing of the tender oak and hickory saplings. The reduction in growth of the native oak and hickory constituent species would lead to the growing abundance of exotic invasive species, as has been witnessed by Seashore staff. This combination of factors would impede the ability of the woodland to sustain the natural vegetative forest stratification, and as such, alternative A would have an adverse effect on the cultural landscape. Eventually the characteristic oak forest that largely contributes to the historic character of the lower acreage would become less recognizable, as growing invasive species become more prominent and change the nature of the vegetation.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions have the potential to impact cultural landscapes. These actions include the issuance of deer hunting and deer damage permits, implementation of a William Floyd Estate cultural landscape report and treatment plan, and enhanced monitoring and management of invasive plant species.

Issuance of hunting and deer damage permits in areas adjacent to the William Floyd Estate are expected to remain fairly constant. Such activities would help keep the deer population somewhere near the current levels, thereby preventing an increased level of damage to the vegetative landscape features by deer browsing in this localized area.

The National Park Service anticipates preparing a cultural landscape report and treatment plan for the William Floyd Estate in the reasonably foreseeable future. Preparation of a cultural landscape report and implementation of a treatment plan would provide a comprehensive approach to restoring and maintaining the cultural landscape. The ability to implement the treatment plan fully may be limited however, when combined with alternative A, because the unabated deer browse would result in a continuous loss of garden plantings in the historic core of the William Floyd Estate and discourage more ambitious treatment options, such as the restoration of the West Garden.

In the foreseeable future, the National Park Service would also develop a comprehensive invasive species management plan that would enhance work to control nonnative invasive plant and animal species that pose a specific threat to native species and other natural resources within the Seashore. Enhanced efforts towards invasive species control may reduce the risk of invasive species spreading

and becoming established at the William Floyd Estate, which would reduce the chance that undesirable species would interfere with the cultural landscape of the William Floyd Estate.

The impact of these past, present, and reasonably foreseeable future actions would generally be beneficial. When combining the impacts of these actions with the impacts of alternative A, however, the overall cumulative impact would be adverse. The issuance of hunting and damage permits would likely reduce the risk of additional damage to the cultural landscape vegetative features. A William Floyd Estate cultural landscape report and treatment plan would benefit the Seashore, although if no action is taken to get the deer browsing under control, the ability to fully implement the recommendations would be limited. Efforts to control nonnative plant species would be beneficial by preserving the native cultural landscape of the lower acreage. Alternative A, though, would contribute an appreciable adverse increment to the cumulative impact on cultural landscapes as no action would be taken to control the deer population size.

## **Conclusion**

Under alternative A, maintenance of current cultural landscape elements would continue. The recently restored vista would provide a view from the Mastic House to the water, and the fields added by the Floyd family to the lower acreage would continue to be mowed in order to maintain the field and forest pattern as much as possible. However, deer browse would continue to decimate the ornamental and formal garden plantings around the Mastic House, resulting in the loss of important elements of the landscape. This would severely limit the interpretation possibilities of this important, well-documented landscape area and discourage the restoration of the West Garden. In addition, the natural forest of the lower acreage continues to be susceptible to nonnative species because of deer feeding preferences. The relative effectiveness of the anticipated William Floyd Estate cultural landscape report and treatment plan would be constrained in its implementation by current deer browse conditions. Alternative A would contribute an appreciable adverse increment to the overall cumulative impact on cultural landscapes. Alternative A would have an adverse significant impact on the cultural landscape of the William Floyd Estate because deer browse of vegetation would hinder the ability of the Seashore to preserve a landscape indicative of the 240 years during which the Floyd family managed the William Floyd Estate.

## **IMPACTS OF ALTERNATIVE B**

### **Impact Analysis**

Under this alternative, the existing perimeter fence would be deer-proofed as much as possible by the use of cattle guards at the gates. An additional fence would roughly follow the south boundary of the historic core, running the entire width of the William Floyd Estate and following a straight northeast/southwest line approximately 200 feet southeast of the Pightle (refer to figure 4). Excluding deer from the historic core would allow augmented planting and maintenance of the garden areas surrounding the main house, which are currently subject to heavy deer browse and require continuous replanting. The exclusion of deer would have a beneficial impact on the interpretation of the historic core by facilitating the establishment, growth, and maintenance of these ornamental plantings. Circulation routes and small-scale features within the historic core would be unaffected. However, there would be an adverse impact associated with the installation of the fence in the cultural landscape of the William Floyd Estate. This would introduce a large-scale nonhistoric feature into the cultural landscape of the historic core, creating a physical and visual boundary that did not exist during the Floyd family residence and management of the estate. In addition, this fence would stretch across the vista, intruding into a character-defining feature of the landscape that was established and is maintained to provide an uninterrupted view of the bay from the main house.

Although circulation within the historic core would be preserved, the circulation between the core and the lower acreage, via paths southeast and southwest of the Pightle, would be interrupted. The adverse impact of fencing the historic core could potentially be minimized by considering a selection of colors and materials that help camouflage its visibility from portions of the estate, though alternative B would still introduce an extensive permanent barrier, which could affect the integrity of the landscape established by the Floyd family during its residence.

Under alternative B, approximately 130 acres of the lower acreage would be fenced in two phases, each expected to last approximately 10 years depending on the rate of forest regeneration. Each phase would enclose approximately 65 acres, in four fenced areas. Access to fenced areas would be limited to Seashore staff when necessary for monitoring, excluding visitors during the approximately 10 years each area is enclosed. Efforts would be made to avoid areas with archaeological features and recognizable Lopped Tree Line remnants, and fence lines would be routed around the perimeter of the fields established by the Floyd family, limiting visual impact. Eliminating the potential for deer browse would allow healthy saplings of oak and hickory to become established and grow above the height of deer browsing, greatly enhancing the long-term viability and health of the existing forest. The vitality of the forest is important to the pattern of fields and woodland in the lower acreage, a character-defining feature of the cultural landscape. The beneficial impact of successful forest regeneration would be accompanied by the adverse impact of the extensive fencing on circulation and sight lines. During the approximately 20–30 years that large-scale fencing is anticipated in the lower acreage, the fence would be visible along the vista, and potentially visible from the trails and the borders around the open space fields. This would create a multiple-decade introduction of wire fencing into an area prized and enhanced by the Floyd family for open space and recreation. As in the historic core, the visibility of the fencing may be minimized by the choice of colors and materials, but the potential for up-close viewing of the fences is high in the lower acreage, which is traversed by the vista and crisscrossed by recreational trails. In addition, the deer population is expected to decrease to preferred levels over a course of 13 years (although this decrease may be delayed by up to 10 years if an acceptable fertility control agent is not available immediately), and during that period, fencing the historic core and lower acreage would force the deer population into a smaller area. An initial increase in deer browsing in unfenced areas is possible, extending the length of time needed for the recovery of the characteristic vegetation of the cultural landscape.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions have the potential to impact cultural landscapes. These actions include deer hunting and deer damage permits, a William Floyd Estate cultural landscape report and treatment plan, and enhanced monitoring and management of invasive plant species as described under alternative A. The addition of exclusionary fencing of the historic core and within the lower acreage of the William Floyd Estate introduces long-term physical and visual barriers that did not exist during the Floyd family ownership and operation of the property, affecting the integrity of the historic landscape. However, it also greatly increases the potential reach of the landscape maintenance and restoration efforts, allowing for the expansion of the Mastic House gardens and the long-term viability of the lower acreage woodlands. The impact of these past, present, and reasonably foreseeable future actions would generally be beneficial. When combining the impacts of these actions with the impacts of alternative B, the cumulative impact would be beneficial. Alternative B would contribute a noticeable beneficial increment to the cumulative impact on cultural landscapes.

## Conclusion

Alternative B would result in beneficial impacts on the cultural landscape of the William Floyd Estate. The historic core fencing included under alternative B would allow for a broader, more comprehensive interpretive program at the William Floyd Estate, including more of the well-documented gardens enjoyed by the Floyd family during their use of the property as a recreational retreat. With the removal of the threat of deer browse, current plantings could be better maintained, and the restoration of the West Garden could be considered as an immediate, feasible initiative as part of the planned William Floyd Estate cultural landscape report and treatment plan. In addition, rotating exclusionary fencing in the lower acreage would allow the regeneration and viability of the native woodland, assisted by a decrease in the deer population that would benefit the unfenced areas of the lower acreage over the long term. Benefits associated with deer enclosure fencing would take place regardless of availability of an acceptable fertility control agent.

Fencing included in alternative B would also introduce physical and visual large-scale elements into the cultural landscape that were not a part of the property as the Floyd family experienced it. However, these visual elements could be largely mitigated by camouflaging the fencing within the tree line and by the avoidance of cultural landscape elements such as the Lopped Tree Lines during installation and monitoring. By enhancing the fencing around the historic core, the landscape within this area could be kept free of new, visually intrusive plants. The addition of fencing also invites an educational opportunity to explain its purpose to visitors.

Alternative B would contribute a noticeable beneficial increment to the overall beneficial cumulative impact on the cultural landscape of the William Floyd Estate. The beneficial impacts of alternative B would be significant because reduction of deer browse of vegetation (primarily through exclusionary fencing) would improve the ability of the Seashore to preserve a landscape indicative of the 240 years during which the Floyd family managed the William Floyd Estate. Adverse impacts would not be significant because they would not prevent such preservation.

## IMPACTS OF ALTERNATIVE C

### Impact Analysis

Alternative C would include the reduction of the deer throughout Fire Island National Seashore in order to meet density goals. This alternative also involves efforts to deer-proof the perimeter fencing at the William Floyd Estate as well as the introduction of fencing around select areas on the William Floyd Estate. Under this alternative, small-scale fencing would be installed around specific cultural landscape elements in the historic core of the William Floyd Estate in order to protect them from deer browsing. This fencing would be used seasonally in order to minimize visual intrusion.

Although the specific locations for this fencing have not yet been established, it is anticipated they would be concentrated in the ornamental landscape associated with the main house. When the Floyd family used the property as a seasonal home during the late 19th century and into the 20th century, formal gardens were established around the house for the family to enjoy. Efforts would be made to avoid physically impacting archeological features and small-scale and circulation character-defining features located in the vicinity of the house, including the Brick Walk and the High Board Fence.

The targeted use of seasonal fencing would be beneficial to the cultural landscape in that it would allow a portion of the garden area to be sustainably managed, while successfully allowing the Seashore to preserve a landscape indicative of the period of use of the gardens by the Floyd family. Seasonally introduced fence within the historic core landscape would allow some small-scale expansion of the formal and ornamental garden landscape around the Mastic House. However, the

restoration of the garden area would be limited, as even a reduced deer population presents a risk to ornamental and garden plantings. The fencing would also have an adverse indirect impact, in that nonhistoric visual components would disrupt the integrity of the landscape surrounding the house. In addition, isolated disruptions of the circulation pattern within the targeted areas may occur.

The lower acreage forest suffers from a lack of forest regeneration at least partially due to deer browsing, in conjunction with the spread of exotic invasive species. This has the potential to adversely affect the forest and field patterns established by the Floyd family for hunting in the mid-20th century by diminishing the contrast between the dense woods and the open fields as the forest is reduced in vitality. Under alternative C, the deer population would be subjected to direct reduction until the density target is reached. Regeneration of the forest under this alternative would take 8–10 years, but the decrease in deer browsing would immediately allow regeneration to commence at the beginning of the life of this plan. This would have a beneficial impact on the lower acreage, as it would encourage the long-term viability of the forest and the pattern of forest and fields could be maintained into the future.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions have the potential to impact cultural landscapes. These actions include deer hunting and deer damage permits, a William Floyd Estate cultural landscape report and treatment plan, and enhanced monitoring and management of invasive plant species, as described under alternative A. The impact of these past, present, and reasonably foreseeable future actions would generally be beneficial. While the William Floyd Estate would certainly benefit from the development of a cultural landscape report, the actions implemented would be limited to those likely to succeed under continual pressure from deer browsing. The ability to manage nonnative species would benefit from the enhanced viability of the native forest in the lower acreage, largely facilitated by control of the deer population. When combining the impacts of these projects with the impacts of alternative C, the cumulative impact would be beneficial. Alternative C would contribute a noticeable beneficial increment to the cumulative impact on cultural landscapes.

### **Conclusion**

Alternative C would result in beneficial impacts on the cultural landscape of the William Floyd Estate. The use of selective fencing within the historic core of the William Floyd Estate would protect small areas of the formal gardens that have been preserved and/or restored. In addition, the use of deer population controls to reach target density early in the plan allows regeneration of the entire lower acreage forest to begin sooner than under alternative B. There would be adverse impacts as well, because the selective fencing introduces visual intrusive elements into the landscape of the historic core even as it protects portions of it from deer. This can be mitigated by seasonal use of this fencing, but its selective nature also would limit the potential scope of planned future initiatives at the William Floyd Estate, including the possible restoration of the West Garden. Unprotected areas of the gardens would still be vulnerable to deer browse, and even a reduced number of deer can decimate formal plantings. Alternative C would contribute a noticeable beneficial increment to the overall beneficial cumulative impact on the lower acreage. The beneficial impacts of alternative C likely would be significant because reduction of deer browse of vegetation in conjunction with some small-scale fencing would noticeably improve the ability of the Seashore to preserve a landscape indicative of the 240 years during which the Floyd family managed the William Floyd Estate. Adverse impacts would not be significant because they would not prevent such preservation.

## **IMPACTS OF ALTERNATIVE D**

### **Impact Analysis**

Alternative D is similar to alternative B, with the major difference being the methods of deer control. Under alternative D, direct reduction would be employed in order to quickly reduce the deer population to the initial target density for vegetation regeneration, after which reproductive control also could be used (in conjunction with or in place of) to maintain the population at the desired level. In addition, while fencing of the historic core is the same as under alternative B, rotational fencing of the lower acreage is excluded from alternative D.

The improvements to the existing perimeter fencing within the historic core of the William Floyd Estate, and the addition of a new historic core fence would be the same as in alternative B, with the same anticipated impacts. However, the deer density targets would be reached more quickly than in alternative B, in 2 years compared to 13 years, which would not require rotational fencing in the lower acreage. Faster reduction in the deer population is anticipated to have a correlative increase in forest regeneration, which would begin more quickly than under alternative B. Threats to the oak and hickory forest, which characterized the lower acreage during the latter portion of the Floyd family's use of the estate, would be removed more quickly than under alternative B. This would have a beneficial impact on preservation of the characteristic forest and field pattern, regardless of the method(s) used for population density maintenance.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions have the potential to impact cultural landscapes. These actions include deer hunting and deer damage permits, a William Floyd Estate cultural landscape report and treatment plan, and enhanced monitoring and management of invasive plant species, as described under alternative A. Enhanced fencing of the historic core would allow for an ambitious planting and interpretation program to be explored in a cultural landscape report, including the restoration of the West Garden. Controlling the deer population immediately promotes regeneration of the lower acreage forest. The impact of these past, present, and reasonably foreseeable future actions would generally be beneficial. When combining the impacts of these projects with the impacts of alternative D, the cumulative impact would be beneficial. Alternative D would contribute a noticeable beneficial increment to the cumulative impact on cultural landscapes.

### **Conclusion**

Alternative D would have many of the same benefits of alternative B. Removal of deer from the historic core and protection of this area by fencing encourages large-scale, enterprising plans for the restoration of the gardens around the Mastic House. The adverse impacts of the introduction of extensive fencing at the south end of the historic core could be largely mitigated by careful placement of the fence within existing tree lines. Use of this fence presents an opportunity to educate the public about the impacts of deer browse. In addition, deer population controls that allow the target density to be reached in a short amount of time eliminate the need for rotational fencing in the lower acreage, greatly limiting the introduction of new fencing elements into the visual landscape while restoring the long-term viability of the native forest. This would allow the planned William Floyd Estate cultural landscape report and treatment plan to explore a wider range of restoration and interpretation options and supplement the effects of the invasive species control program. Alternative D would contribute a noticeable beneficial increment to the overall cumulative beneficial impacts on the cultural landscape. The impacts of alternative D would be significant because reduction of deer browse of vegetation would improve the ability of the Seashore to

preserve a landscape indicative of the 240 years during which the Floyd family managed the William Floyd Estate. Adverse impacts would not be significant because they would not prevent such preservation.

## **IMPACTS ON VISITOR USE AND EXPERIENCE/RECREATION**

### **METHODOLOGY**

The area of analysis for visitor use and experience/recreation is the boundary of the Seashore. This section summarizes the impacts on visitor use and experience/recreation from the actions that would potentially occur in the area of analysis under each alternative. The potential for changes to visitor use and experience/recreation was evaluated by assessing the limitations and assumed changes to visitor access and associated visitor uses related to the proposed alternatives, and determining whether these projected changes would affect the visitor experience and/or recreational opportunities. Past visitor use data and comments from the public also were used to estimate the effects of the alternative actions on visitors.

Resource-specific context for assessing impacts of the alternatives to visitor use and experience/recreation includes:

- Visitors come to the Seashore for a variety of reasons and value Seashore resources differently. According to a 2008 survey of Seashore visitors, approximately 50% of the respondents felt that close contact with deer or other wildlife added to their Seashore experience, 20% felt the presence of deer or other wildlife had no effect on their experience, and 2% felt the deer detracted from their experience (NPS 2009b).
- The Seashore was established “for the purpose of conserving and preserving for the use of future generations certain relatively unspoiled and undeveloped beaches, dunes, and other natural features. . . which possess high values to the Nation as unspoiled areas of great natural beauty in close proximity to large concentrations of urban population” (PL 88-587).
- One of the Seashore’s goals is to educate visitors, through interpretation of the landscape, about the 240 years during which the Floyd family managed the William Floyd Estate.

### **IMPACTS OF ALTERNATIVE A**

#### **Impact Analysis**

Under alternative A, existing deer management and monitoring efforts throughout the Seashore would continue. These actions include continued public education/interpretation efforts, vegetation monitoring, and deer population surveys. The Seashore would continue to have no jurisdiction within the Fire Island communities to enforce human-deer interaction regulations. Residents of Fire Island communities would continue to have positive and negative sentiments towards the deer population. Visitors would continue to view and interact with the growing deer population. As mentioned in chapter 3, a visitor survey conducted in the summer of 2008 found that approximately 50% of the respondents felt close contact with deer or other wildlife added to their Seashore experience, 20% felt the presence of deer or other wildlife had no effect on their experience, and 2% felt the deer detracted from their experience. An additional 29% of visitors reported no contact with deer or other wildlife (NPS 2009b). Visitor use and experience/recreation would continue to be impacted by deer on Fire Island and in the William Floyd Estate.

Human-deer interaction management would remain unchanged. Some visitors enjoy the opportunity to observe and interact with the deer. However, some interactions reduce both visitor enjoyment and visitor safety. The number of incidents between humans and deer would remain the same or could increase. Potential risks associated with the deer population, including Lyme disease, are expected to remain the same and are discussed in the section “Impacts on Public Health and Safety.”

Other visitor activities would be impacted by an unmanaged deer population. Deer would continue to trample and browse existing vegetation throughout Fire Island. Visitors who come to the Seashore for recreational or cultural activities would continue to note changes in the landscape. As the deer population increases, they could reduce the habitat and vegetation available for other Seashore fauna, thereby reducing the potential for Seashore visitors to view wildlife besides deer. Visitors who participated in guided tours would become more aware of the degradation of the natural communities, and the absence of the full suite of vegetative and faunal species that should be present adversely affects visitors who wish to experience the natural environment. Deer-related impacts on vegetation would be most noticeable at the William Floyd Estate, where vegetation is a part of the cultural landscape. The Seashore could not replant the gardens in the William Floyd Estate without selected fencing because of continual deer browse, and visitor understanding of the cultural landscape would continue to be diminished.

The presence of deer in the Seashore is apparent, and as the unmanaged deer population continues to grow, deer sightings would likely become more frequent. Visitors have varying sentiments toward deer; therefore, additional sightings could improve or diminish their experience of the Seashore. Additionally, an increased deer population could diminish the health and appearance of the herd; the sight of ill or emaciated deer could detract from visitor experience.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions have the potential to impact visitor use and experience/recreation. These actions include the following activities: the tick monitoring and management program, use of 4-Poster devices, deer hunting and deer damage permits, waterfowl hunting, a William Floyd Estate cultural landscape report and treatment plan, and enhanced monitoring and management of invasive plant species.

The National Park Service would continue to monitor tick issues and provide education to visitors regarding ticks, tick-borne illnesses, and preventive measures that visitors can take to avoid exposure to ticks and tick bites and what to do in response to tick bites. Primary tick surveillance and management efforts would continue to take place at the William Floyd Estate. These efforts would provide an improvement in visitor experience because it would mitigate public displeasure at being exposed to ticks and potentially tick-borne diseases. The use of 4-Poster devices may indirectly reduce exposure to ticks and potentially tick-borne diseases. Cumulative impacts on public health and safety are discussed under that impact topic.

Deer hunting and use of deer damage permits on nonfederal lands could cause a local reduction in deer density, which could result in a reduction in negative human-deer interaction. The Seashore would continue to permit waterfowl hunting in select areas annually. Many Seashore visitors enjoy participating in this hunt each year as a form of recreation, while some others may find that the hunt detracts from their enjoyment of the Seashore experience due to noise and a perceived safety risk. Some visitors are opposed to hunting at the Seashore.



The National Park Service anticipates preparing a William Floyd Estate cultural landscape report and treatment plan in the reasonably foreseeable future. Implementation of a Treatment Plan would improve visitor understanding of the cultural landscape, which would increase enjoyment for those visitors wishing to experience the William Floyd Estate. It should be noted, however, that as described in the analysis above, the ability to implement the plan, and thus, interpret the cultural landscape accurately and completely, is limited by the continuing damage and loss from deer browsing.

The National Park Service would continue work to control nonnative invasive plant and animal species that pose a specific threat to native species and other natural resources within the Seashore. Enhanced efforts towards invasive species control would improve the natural setting of the Seashore, a beneficial impact for visitors wishing to experience a natural ecosystem during their visit to the Seashore.

The impact of these past, present, and reasonably foreseeable future actions would generally be beneficial, although some of the items above would also impact visitor use and experience/recreation adversely. When combining the impacts of these projects with the impacts of alternative A, the cumulative impact would be beneficial. Alternative A would contribute a noticeable adverse increment to the cumulative impact on visitor use and experience/recreation.

## **Conclusion**

Overall, alternative A would result in increased human-deer interactions and would result in adverse impacts on visitor use and experience/recreation because of continued negative impacts on the Seashore's natural ecosystem and cultural landscape vegetation from deer browse. Although some visitors may enjoy an increased chance of observing deer, some visitors may be disappointed in the altered ecosystem and the missed opportunity to experience a more intact cultural landscape at the William Floyd Estate. Alternative A would contribute noticeably to the cumulative impact on visitor use and experience/recreation. Neither adverse nor beneficial impacts on visitor use and experience/recreation would be significant because the Seashore would continue to offer relatively unspoiled and undeveloped beaches, dunes, and other natural features where visitors can interact with wildlife and learn about the William Floyd Estate.

## **IMPACTS OF ALTERNATIVE B**

### **Impact Analysis**

Under alternative B, the Seashore would incorporate fertility control actions to reduce undesirable human-deer interactions, protect native plant communities and cultural plantings, promote forest regeneration, and gradually reduce the deer population in the Seashore. Additionally, educational/interpretive efforts would be expanded to reduce undesirable human-deer interactions.

The Seashore would implement enhanced programs to educate visitors about the purpose of deer management and how to avoid negative interactions and partner with communities to restrict deer access to human food. As a result, human-deer interactions would become less frequent. As the deer population gradually decreases, the perceived and actual risks associated with deer are also likely to decrease. These risks are discussed in the section "Impacts on Public Health and Safety."

The Seashore would implement additional vegetation protection measures, and visitors likely would be aware of these efforts. Deer access to vegetation would decrease due to new fencing, which would be noticeable to Seashore visitors. The condition of vegetation inside the fenced areas would

improve, and visitor experience could improve as a result, especially for those visitors seeking to experience a more natural ecosystem, including other wildlife species that may otherwise be displaced by heavy deer browse.

The fencing provides a tangible resource for educating visitors about the deer management program and for improving visitor understanding about the impact of deer on vegetation. However, the fencing would detract from natural views and cultural landscapes. The diminished views and cultural landscapes would be particularly noticeable at the William Floyd Estate in the historic core and adjacent areas where deer would be excluded to promote vegetation regeneration, although this may be mitigated somewhat by incorporating fencing into tree lines, where available. As the condition of the maintained gardens improves, so would visitor understanding of the historic setting of the William Floyd Estate. Visitors would not have access inside the rotational fenced areas at the lower acreage of the William Floyd Estate. The Sunken Forest fence would diminish the natural views somewhat, and because deer would be completely excluded from this fenced area, visitors would not be able to experience deer viewing in this area. Visitor access would be inhibited during fence construction and installation, but following initial construction and installation, fences and gates or doors would allow access for visitors to the Sunken Forest. Signs would be added near the gates or doors to remind visitors to securely close the gate or door in order to promote vegetation regeneration.

Fertility control of the deer population would result in changes to visitor experience. Visitors could be aware of the treatment activities, which may detract from a natural experience. Chemical reproductive control agents have the potential to alter deer behavior, which could be noticeable to visitors and could impact visitor sentiment toward the deer. Translocated deer would be tracked with collars, and visitors wishing to experience a natural setting may find their experience diminished by the sight of the collars. The gradual decline in the deer population over a period of approximately 13 years would reduce visitor opportunities to view deer, and the smaller deer population could result in the growth of other wildlife populations and increased opportunities for visitors to view other wildlife species. These changes in wildlife viewing opportunities could improve or diminish visitor experience, depending on visitor sentiment toward particular species. Awareness of management practices could detract from the perceived natural experience in a unit of the National Park System; this is most relevant to the Sunken Forest and Fire Island Wilderness, which are often sought out as natural areas.

If an acceptable fertility control agent is not available for use immediately upon implementation of this plan, impacts on visitor use and experience related to reduced deer numbers and the treatment of deer with such an agent would be delayed for up to 10 years. The ongoing impacts on visitor use and experience/recreation would be similar to those described under alternative A; however, some actions such as education/interpretation and fencing would be implemented immediately and would have the impacts described above.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions have the potential to impact visitor use and experience/recreation. These actions include the tick monitoring and management program, use of 4-Poster devices, deer hunting and deer damage permits, waterfowl hunting, a William Floyd Estate cultural landscape report and treatment plan, and enhanced monitoring and management of invasive plant species, as described under alternative A. The impact of these past, present, and reasonably foreseeable future actions would generally be long-term and both beneficial and adverse. When combining the impacts of these projects with the impacts of alternative B, the cumulative

impact would be long-term beneficial. Alternative B would contribute a noticeable beneficial increment to the cumulative impact on visitor use and experience/recreation.

## **Conclusion**

Overall, alternative B would result in beneficial impacts on visitor use and experience/recreation due to decreased human-deer interactions, a more balanced Seashore ecosystem, and a more intact cultural landscape due to a gradual decrease in the deer population. The gradual reduction in deer population would take place over approximately 13 years (although this could be delayed by an additional 10 years if an acceptable fertility control agent is not available immediately). Some visitors may be disappointed with a decreased chance of observing deer. The visitor experience within the Seashore would be more consistent with the purpose for which the Seashore was established due to the restoration of a more natural ecosystem. The Seashore would be able to more effectively interpret the relatively intact cultural landscape at the William Floyd Estate. If an acceptable fertility control agent is not available immediately upon implementation of this plan, some of the beneficial impacts associated with reduced deer population would be delayed for up to 10 years; however, other benefits associated with fencing would continue as described. Alternative B would contribute noticeably to the cumulative impact on visitor use and experience/recreation. Neither adverse nor beneficial impacts on visitor use and experience/recreation would be significant because the Seashore would continue to offer relatively unspoiled and undeveloped beaches, dunes, and other natural features where visitors can interact with wildlife and learn about the William Floyd Estate.

## **IMPACTS OF ALTERNATIVE C**

### **Impact Analysis**

Under alternative C, the Seashore would incorporate actions to reduce undesirable human-deer interactions, protect native plant communities and cultural plantings and quickly reduce the deer population in the Seashore. Population reduction and maintenance would be implemented through a combination of sharpshooting, capture and euthanasia of individual deer, and hunting within the Fire Island Wilderness. Additionally, educational/interpretive efforts would be expanded to reduce undesirable human-deer interactions. Visitor experience would improve as the deer population decreases, other fauna populations increase, and vegetation populations regenerate.

Impacts under alternative C would be similar to those described under alternative B, although the educational material would be different due to the different management methods. The Seashore would implement enhanced programs to educate visitors about the purpose of deer management and how to avoid negative human-deer interactions. Visitor experience could be beneficially or adversely impacted if educational programming includes information on the methods of deer reduction. Visitors could be comforted by the facts that sharpshooters are professionally trained and work at night and that the deer meat would be donated. Conversely, some visitors would be uncomfortable with any method of direct reduction for various reasons, including the humaneness of the method, moral opposition, and perceived safety risks. In the case of a hunt, visitors could take advantage of an additional recreational activity at the Seashore. As the deer population decreases, the potential for risks associated with deer is also likely to decrease. These risks are discussed in the section “Impacts on Public Health and Safety.”

The Seashore would implement additional vegetation protection measures similar to those described under alternative B, and visitors likely would be aware of these efforts. Deer access to vegetation would decrease due to new fencing, which would be noticeable to Seashore visitors. The condition of vegetation inside the fenced areas would improve, and visitor experience could

improve as a result. However, the fencing would diminish views and cultural landscapes. The diminished views and cultural landscapes would be particularly noticeable at the William Floyd Estate in the historic core and adjacent areas where deer would be excluded to promote vegetation regeneration. However, fencing and protective barriers at the William Floyd Estate would be smaller and less intrusive than fencing proposed under alternative B. As the condition of the maintained gardens improves, so would visitor understanding of the historic setting of the William Floyd Estate. Exclosures in the Sunken Forest would diminish the natural viewsheds somewhat, and because deer would be completely excluded from this fenced area, visitors would not be able to experience deer viewing in this area. In the short term, fence construction and installation would inhibit visitor access; however, in the long term, although access would be provided through fences and gates or doors, access for visitors would be reduced when compared to alternative A (no fencing). Signs would be added near the gates or doors to remind visitors to securely close the gate or door in order to promote vegetation regeneration.

Instead of the fertility control proposed under alternative B, alternative C would use direct reduction methods listed above to decrease and maintain deer densities. This approach would result in changes to visitor experience. Most sharpshooting would take place between dusk and dawn or when areas are closed to visitors. The public would be notified of any Seashore closures and deer management activities in advance via media release and alerts posted to the Seashore's website and social media venues, with printed notification posted at Seashore visitor contact stations and bulletin boards, and on public billboards located within the Fire Island communities. Noise suppression devices and night vision equipment would be used to reduce disturbance to the public and Seashore neighbors. Additionally, visitor access of the Seashore could be restricted when sharpshooting is occurring, which also could impact visitor experience. The decline in the deer population would reduce visitor opportunities to view deer, and the smaller deer population could result in the growth of other wildlife populations and increased opportunities for visitors to view other wildlife species. These changes in wildlife viewing opportunities could improve or diminish visitor experience, depending on visitor sentiment toward particular species. Awareness of management practices could detract from the perceived natural experience in a unit of the National Park System.

In limited situations where access to a carcass would be difficult or in a less visible area, surface disposal may be acceptable. In these circumstances, every effort would be made to reduce the visibility of the carcass to visitors or Seashore neighbors. Because the priority would be to donate meat, surface disposal would include only a few carcasses, under exceptional circumstances. Whenever several deer were unsuitable for donation to charities, the carcasses would be collected and disposed of by a contractor. Carcasses would be removed quickly, to avoid visibility to visitors. Therefore, few, if any, visitors would be exposed to deer remains or disposal activities.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions have the potential to impact visitor use and experience/recreation. These actions include the tick monitoring and management program, use of 4-Poster devices, deer hunting and deer damage permits, waterfowl hunting, a William Floyd Estate cultural landscape report and treatment plan, and enhanced monitoring and management of invasive plant species, as described under alternative A. The impact of these past, present, and reasonably foreseeable future actions would generally be long-term and both beneficial and adverse. When combining the impacts of these projects with the impacts of alternative C, the cumulative impact would be long-term beneficial. Alternative C would contribute a noticeable beneficial increment to the cumulative impact on visitor use and experience/recreation.

## **Conclusion**

Overall, alternative C would result in beneficial impacts on visitor use and experience/recreation due to decreased human-deer interactions, a more balanced Seashore ecosystem, and a more intact cultural landscape. The decrease in deer population would take place more quickly under this alternative than under alternative B; therefore, adverse impacts on visitor use and experience/recreation associated with implementation of deer population control methods may take place for a shorter amount of time than under alternative C. In the long term, the impacts on visitor use and experience/recreation would be the same as under alternative B. Some visitors may be disappointed with a decreased chance of observing deer. The visitor experience within the Seashore would be more consistent with the purpose for which the Seashore was established due to the restoration of a more natural ecosystem. The Seashore would be able to more effectively interpret the relatively intact cultural landscape at the William Floyd Estate. Alternative C would contribute noticeably to the cumulative impact on visitor use and experience/recreation. Neither adverse nor beneficial impacts on visitor use and experience/recreation would be significant because the Seashore would continue to offer relatively unspoiled and undeveloped beaches, dunes, and other natural features where visitors can interact with wildlife and learn about the William Floyd Estate.

## **IMPACTS OF ALTERNATIVE D**

### **Impact Analysis**

Under alternative D, the Seashore would incorporate a combination of actions to reduce undesirable human-deer interactions and quickly reduce the deer population in the Seashore. As under alternatives B and C, educational/interpretive efforts would be expanded to reduce undesirable human-deer interactions. Deer management actions would include enclosure fencing of the historic core of the William Floyd Estate and at the Sunken Forest, use of direct reduction methods to reduce the deer population density, and use of direct reduction methods and/or fertility control to maintain the deer population at an appropriate deer density. Visitor experience would improve as the deer population decreases, other fauna populations increase, and vegetation populations regenerate.

The Seashore would implement enhanced programs to educate visitors about the purpose of deer management and how to avoid negative human-deer interactions. Visitor experience could be beneficially or adversely impacted if educational programming includes information on the direct reduction methods of deer management. Visitors could be comforted by the facts that sharpshooters are professionally trained and work at night and that the deer meat would be donated. Conversely, some visitors would be uncomfortable with any form of direct reduction for various reasons, including the humaneness of the method, moral opposition, and perceived safety risks. In the case of a hunting, visitors could be encouraged to take advantage of an additional recreational activity at the Seashore but could be deterred by the permitting process and/or cost. Because hunting would take place during the day, other visitors' experience could be impacted by the restriction of their use of the wilderness. As the deer population decreases, the potential for risks associated with deer is also likely to decrease. These risks are discussed in the section "Impacts on Public Health and Safety."

The Seashore would implement additional vegetation protection measures similar to those described under alternative B, and visitors likely would be aware of these efforts. The impacts related to this aspect of the plan would be the same as under alternative B, including visitor

awareness of the fencing, altered access, and improved visitor enjoyment and understanding of cultural landscapes resulting from improved condition of vegetation within the fencing.

Alternative D includes both direct reduction actions and fertility control as options to maintain the deer population following initial population reduction (using direct reduction methods described under alternative C). Use of direct reduction methods would result in the same changes in visitor experience described under alternative C, and use of fertility control for population maintenance would have the same impacts on visitor experience as described under alternative B.

Similar to alternative C, in limited situations where access to a carcass would be difficult or in a less visible area, surface disposal may be acceptable. In these circumstances, every effort would be made to reduce the visibility of the carcass to visitors or Seashore neighbors. Because the priority would be to donate meat, surface disposal would include only a few carcasses, under exceptional circumstances. Whenever several deer were unsuitable for donation to charities, the carcasses would be collected and disposed of by a contractor. Carcasses would be removed quickly, to avoid visibility to visitors. Therefore, few, if any, visitors would be exposed to deer remains or disposal activities. If fewer deer are euthanized under this alternative, this impact on visitor experience would be smaller than the impact under alternative C.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions have the potential to impact visitor use and experience/recreation. These actions include the tick monitoring and management program, use of 4-Poster devices, deer hunting and deer damage permits, waterfowl hunting, a William Floyd Estate cultural landscape report and treatment plan, and enhanced monitoring and management of invasive plant species, as described under alternative A. The impact of these past, present, and reasonably foreseeable future actions would generally be long-term and both beneficial and adverse. When combining the impacts of these projects with the impacts of alternative D, the cumulative impact would be long-term beneficial. Alternative D would contribute a noticeable beneficial increment to the cumulative impact on visitor use and experience/recreation.

### **Conclusion**

Overall, alternative D would result in beneficial impacts on visitor use and experience/recreation due to decreased human-deer interactions, a more balanced Seashore ecosystem, and a more intact cultural landscape. The decrease in deer population would take place more quickly under this alternative than under alternative B; therefore, adverse impacts on visitor use and experience/recreation associated with implementation of deer population control methods may take place for a shorter amount of time than under alternative B. In the long term, the impacts on visitor use and experience/recreation would be the same as under alternative B, and if fertility control is used, the impacts of such use on visitor use and experience/recreation would be the same as described under alternative C. Some visitors may be disappointed with a decreased chance of observing deer, but opportunities to view deer would still exist. The visitor experience within the Seashore would be more consistent with the purpose for which the Seashore was established due to the restoration of a more natural ecosystem. The Seashore would be able to more effectively interpret the relatively intact cultural landscape at the William Floyd Estate, especially at the historic core following exclusion of deer. Alternative D would contribute noticeably to the cumulative impact on visitor use and experience/recreation. Neither adverse nor beneficial impacts on visitor use and experience/recreation would be significant because the Seashore would continue to offer relatively unspoiled and undeveloped beaches, dunes, and other natural features where visitors can interact with wildlife and learn about the William Floyd Estate.

## **IMPACTS ON FIRE ISLAND COMMUNITIES AND ADJACENT LANDOWNERS**

### **METHODOLOGY**

Although the National Park Service does not have jurisdiction to manage resources outside its boundaries, many natural resources transcend man-made boundaries such as property lines. The Seashore's management policies acknowledge that the Seashore does not exist as an isolated entity, and a goal of Seashore management is to promote and enhance a harmonious relationship between Fire Island communities and the National Park Service.

The area of analysis for Fire Island communities and adjacent landowners encompasses all communities on Fire Island. This section summarizes the impacts on Fire Island communities and adjacent landowners from the actions that would potentially occur in the area of analysis under each alternative. The potential for changes to Fire Island communities and adjacent landowners was evaluated by assessing the current deer-related issues within Fire Island communities and adjacent lands against the proposed alternatives, and determining whether these projected changes would affect the Fire Island communities and adjacent landowners. Past survey data and comments from the public also were used to estimate the effects of the alternative actions on local communities and landowners. The experience that people have within the Seashore (regardless of whether they travelling from local communities or from more distant locations) is addressed under the impact topic of visitor use and experience/recreation.

Resource-specific context for assessing impacts of the alternatives on Fire Island communities and adjacent landowners includes the following:

- Fire Island is composed of a matrix of public and private lands, including the 17 private communities and towns, Smith County Park, Robert Moses State Park (an adjacent landowner composed of nonfederal land), and three municipal beaches.
- The deer population on Fire Island moves between the Seashore and private communities.
- The Seashore has received an increasing number of complaints regarding the current deer population, many of which come from residents of the Fire Island communities.
- Residents of Fire Island communities interacted with deer on a regular basis. The majority either enjoyed deer but worried about deer-related problems in Fire Island communities or did not enjoy deer (Siemer et al. 2007). Deer-related problems in communities include deer browse of gardens and ornamental plantings and access to unsecured trash. Most participants indicated that National Park Service should be managing deer-related impacts at the Seashore and many felt that such management activities would have a positive impact both on the Seashore and the communities (Siemer et al. 2007).
- A recent study implies that most residents and visitors to Fire Island are either 'satisfied' or 'highly satisfied' with the general quality of life on Fire Island (Nelessen 2012).

### **IMPACTS OF ALTERNATIVE A**

#### **Impact Analysis**

Under alternative A, existing deer management and monitoring efforts throughout the Seashore would continue, and some of these actions would have the potential to impact Fire Island

communities and adjacent landowners. These actions include continued public education/interpretation efforts and deer population surveys.

Human-deer interaction would remain an issue. As occurs within the Seashore, the number of incidents between humans and deer in adjacent communities would remain the same or could increase. Incidents between humans and deer would continue to be reported to and managed by the New York State Department of Environmental Conservation. These incidents would have an adverse impact on the Fire Island communities and adjacent landowners. Potential risks associated with the deer population, including Lyme disease, are expected to remain the same, and are discussed in the section “Impacts on Public Health and Safety.”

The presence of deer on Fire Island is apparent, and as the unmanaged deer population continues to grow, deer sightings would likely become more frequent in the communities. Residents have varying sentiments toward deer, and they would respond differently to increased deer sightings. Some community members would continue to feel positively toward deer and would persist in treating them similarly to pets. Deer that are fed by humans are encouraged to return to the communities, which would benefit the community members who enjoy the deer and would adversely impact the community members who do not want deer in the communities.

Deer would continue to use Fire Island communities for foraging habitat and for shelter. Deer have been known to use areas under the houses on Fire Island for shelter. At an increasing rate, deer would continue to trample and browse existing vegetation throughout Fire Island. Residents’ gardens and plantings would continue to be browsed by the deer. The damaged vegetation could impact community aesthetics. Residents whose yards are damaged would continue to feel negatively about deer presence in the communities; this sentiment could intensify as the deer population grows. Deer would continue to spill and/or feed from unsecured garbage cans. Spilled garbage would inconvenience community members and would impact residents by diminishing the appearance of the communities.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions have the potential to impact Fire Island communities and adjacent landowners. These actions include the use of 4-Poster devices and deer hunting and deer damage permits. The 4-Poster devices use permethrin to treat deer for ticks, which may reduce exposure to ticks and thus tick-borne diseases in the Fire Island communities. Deer hunting and use of deer damage permits on nonfederal lands modestly reduces the local deer population.

The impact of these past, present, and reasonably foreseeable future actions would be beneficial. When combining the impacts of these projects with the impacts of alternative A, the cumulative impact would be beneficial. Alternative A would contribute imperceptively to the cumulative impact on Fire Island communities and adjacent landowners.

### **Conclusion**

Overall, under alternative A, the Fire Island communities and adjacent landowners would remain subject to adverse impacts associated with an increasing deer population and ongoing issues associated with deer, including browse and trampling of vegetated landscapes, use of houses for shelter, and foraging in garbage cans. Complaints about deer would continue to increase. A greater proportion of Fire Island community residents may worry about deer related problems or not enjoy deer in their community. Alternative A would contribute imperceptively to the cumulative impact



on Fire Island communities and adjacent landowners. Neither beneficial nor adverse impacts on Fire Island communities and adjacent landowners would be significant because deer would continue to move between the matrix of public and private lands where residents have mixed feelings about deer, but most residents would continue to be satisfied to some extent with the general quality of life on Fire Island.

## **IMPACTS OF ALTERNATIVE B**

### **Impact Analysis**

Under alternative B, the Seashore would incorporate fertility control actions to gradually reduce the deer population over approximately 13 years. Additionally, educational/interpretive efforts would be expanded to reduce undesirable human-deer interactions. Generally, Fire Island communities would experience improved conditions as the deer population decreases and planted vegetation sustains less damage.

The number of human-deer interactions would be expected to decrease as a result of the enhanced educational efforts by the Seashore in combination with the gradual reduction in the deer population over time. The Seashore would implement improved educational programs to educate community members about the purpose of deer management and how to avoid negative interactions. Programs could include information on the consequences of feeding wildlife, strategies for securing garbage containers, and the collaboration between the New York State Department of Environmental Conservation and the National Park Service. These programs would encourage community participation in order to foster a sense of responsibility and increase the effectiveness of management efforts. As the deer population decreases, the potential for risks associated with deer would also be expected to decrease. The risk of Lyme disease is discussed in the section “Impacts on Public Health and Safety.”

Under alternative B, the local deer population would decrease over time due to fertility control management employed by the Seashore. The decline in the deer population within the communities would reduce opportunities to view deer and increase the viability of community vegetation. The decrease in viewing opportunities could improve or diminish community member experience, depending on individual sentiments toward deer; however, other community members would appreciate the reduced level of deer browse on gardens and other plantings. Community members would benefit from improved condition and appearance of community vegetation as a result of the decreased presence of deer in the communities. However, deer exclosures within the Seashore could encourage some deer to stray into nearby communities. This displacement and associated issues may be noticeable during the first few years of the plan, but continued management of the deer population would be expected to minimize any adverse impacts on Fire Island communities.

In addition to use of fertility control, the Seashore would translocate deer that approach humans to the Fire Island Wilderness. This is intended to substantially decrease human-deer interactions in addition to also reducing deer browse of community vegetation. Translocated deer would be tracked with collars, which would reassure community members who do not want deer that approach humans in the communities that the Seashore is monitoring translocated deer. Additionally, community members would likely notice deer without collars as individuals who strayed into the communities from another area of the Seashore. Community members could be aware of the sedation and capturing of deer for translocation and would likely be affected by such translocation depending on their individual attitudes.

Deer population management efforts could impact the relationship between the communities and the Seashore. Community members could be aware of management activities (i.e., fertility control and translocation); they could appreciate Seashore management efforts or could take issue with the management methods. Fertility control has the potential to alter deer behavior, which could be noticeable to community members and could impact community sentiment toward the deer and the Seashore. For instance, interviewees in the 2005 study (Leong and Decker 2007) expressed concern about fawns being born out of season would not survive the winter.

If an acceptable fertility control agent is not available immediately, other items such as education/interpretation and translocation could take place, but the issues associated with deer density would continue until an agent became available (within 10 years) for population reduction. The experience of residents of and visitors to Fire Island administered areas within the Seashore, including the impacts of proposed vegetation management, is addressed under the impact topic of visitor use and experience/recreation.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions have the potential to impact Fire Island communities and adjacent landowners. These actions include use of 4-Poster devices and deer hunting and deer damage permits, as described under alternative A. The impact of these past, present, and reasonably foreseeable future actions would be beneficial. When combining the impacts of these projects with the impacts of alternative B, the cumulative impact would be beneficial. Alternative B would contribute noticeably to the cumulative impact on Fire Island communities and adjacent landowners.

### **Conclusion**

Overall, under alternative B, Fire Island communities and adjacent landowners would experience beneficial impacts due to a decreasing deer population and reduced issues associated with deer, including browse and trampling of vegetated landscapes, use of houses for shelter, and foraging in garbage cans. Complaints about deer would decrease. Members of the Fire Island communities and adjacent landowners who enjoy deer but worry about deer-related problems in Fire Island communities may be reassured by the Seashore's management program. In the case that an acceptable fertility control agent is not available immediately, adverse impacts associated with deer density and the lack of NPS management would continue for up to 10 years. Alternative B would contribute noticeably to the cumulative impact on Fire Island communities and adjacent landowners. Neither beneficial nor adverse impacts are expected to be significant because deer would continue to move between the matrix of public and private lands where residents have mixed feelings about deer, but most residents would continue to be satisfied with the general quality of life on Fire Island.

## **IMPACTS OF ALTERNATIVE C**

### **Impact Analysis**

Under alternative C, the Seashore would incorporate actions to reduce undesirable human-deer interactions, same as alternative B, and quickly reduce the deer population in the Seashore. The more rapid population reduction would be achieved with different management methods under this alternative than proposed under alternative B. Population reduction and maintenance would be implemented through a combination of sharpshooting, capture and euthanasia of individual deer, and the permitting of hunting within the Fire Island Wilderness. The same expanded

educational/interpretive efforts as proposed under alternative B would be implemented under this alternative to reduce undesirable human-deer interactions. Fire Island communities and adjacent landowners would see improvements as the deer population decreases, other fauna populations increase, and vegetation populations regenerate.

The number of human-deer interactions would be reduced because of expanded educational/interpretive efforts. The impacts of this outreach would be the same as described under alternative B; however, the reduction would occur more quickly. Again, the risk of Lyme disease is discussed in the section “Impacts on Public Health and Safety.”

Under alternative C, the local deer population would decrease due to direct reduction techniques employed by the Seashore. Although the method of deer management would be different, the effects would be similar to those described under alternative B with a few differences. The population would reduce more quickly under this alternative.

Community members could be beneficially or adversely impacted by an awareness of methods used to remove deer. Some community members would appreciate the implementation of an effective method of deer population control. Some could be reassured by safety measures such as the facts that sharpshooters are professionally trained and work at night. Some may also appreciate that the deer meat would be donated. Conversely, other community members would be uncomfortable with any methods for various reasons, including the humaneness of the method, moral objection, and perceived safety risks. One study analyzed the beliefs and attitudes of residents surrounding Cuyahoga Valley National Park towards lethal reduction of deer at the park (Fulton et al. 2004). The results of this study indicated that a minority of residents (15%–20%) would consider lethal control very unacceptable as a management strategy for addressing abundant deer populations. These respondents felt this way despite the reasons for which the strategy would be implemented. The study also indicated that those individuals may experience negative emotional impacts. Some Fire Island community members may feel the same; however, a majority of community members have indicated a need to reduce adverse impacts of deer.

Deer behavior has the potential to change as a result of management actions; communities could be adversely impacted by changes in deer behavior. Deer may flee sharpshooting zones, which could temporarily result in higher deer densities within the communities. However, following reduction in the deer population within the Seashore, it is expected that the deer density within the communities would decrease as well.

The experience of residents of and visitors to Fire Island communities within the Seashore, including the impacts of proposed vegetation management, is addressed under the impact topic of visitor use and experience/recreation.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions have the potential to impact Fire Island communities and adjacent landowners. These actions include use of 4-Poster devices and deer hunting and deer damage permits, as described under alternative A. The impact of these past, present, and reasonably foreseeable future actions would be beneficial. When combining the impacts of these projects with the impacts of alternative C, the cumulative impact would be beneficial. Alternative C would contribute noticeably to the cumulative impact on Fire Island communities and adjacent landowners.

## **Conclusion**

Overall, under alternative C, the different methods used to reduce the deer population would result in a decreased density more rapidly than under alternative B. Otherwise, impacts on Fire Island communities and adjacent landowners would be similar to those impacts described under alternative B. Fire Island communities and adjacent landowners would experience beneficial impacts due to a decreasing deer population and reduced issues associated with deer, including browse and trampling of vegetated landscapes, use of houses for shelter, and foraging in garbage cans. Complaints about deer would be expected to decrease. Members of the Fire Island communities and adjacent landowners who enjoy deer but worry about deer-related problems in Fire Island communities may be reassured by the Seashore's management program. Alternative C would contribute noticeably to the cumulative impact on Fire Island communities and adjacent lands. Neither beneficial nor adverse impacts are expected to be significant because deer would continue to move between the matrix of public and private lands where residents have mixed feelings about deer, but most residents would continue to be satisfied with the general quality of life on Fire Island.

## **IMPACTS OF ALTERNATIVE D**

### **Impact Analysis**

Under alternative D, the Seashore would incorporate a combination of actions to reduce undesirable human-deer interactions and quickly reduce the deer population in the Seashore. Educational/interpretive efforts would be expanded to reduce undesirable human-deer interactions, incorporating elements from both alternatives B and C. Under alternative D, deer management would include direct reduction of the deer population and use of direct reduction and/or fertility control to maintain the deer population at an appropriate density. Fire Island communities and adjacent landowners would experience benefits as the deer population decreases.

As under the other action alternatives, the number of human-deer interactions would be reduced. The impacts of this outreach would be the same as described under alternative C because direct reduction would be one of the management techniques employed. The risk of Lyme disease is discussed in the section "Impacts on Public Health and Safety."

Impacts of the deer management proposed under alternative D is a combination of those described under alternatives B and C. As under alternative C, the impacts associated with a reduction in deer population (e.g., reduced viewing opportunities, reduced deer browse and trampling of vegetation, and other deer-related nuisances) would take place more quickly than under alternative B, due to the initial population reduction. However, following the initial population reduction, the Seashore could use fertility control treatments in addition to or in place of direct reduction methods for long-term population maintenance. As under alternatives B (fertility control) and C (direct reduction methods), community members may appreciate or take issue with the management methods.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions have the potential to impact Fire Island communities and adjacent landowners. These actions include the use of 4-Poster devices and deer hunting and deer damage permits, as described under alternative A. The impact of these past, present, and reasonably foreseeable future actions would be beneficial. When combining the impacts of these projects with the impacts of alternative D, the cumulative impact would be

beneficial. Alternative D would contribute noticeably to the cumulative impact on Fire Island communities and adjacent landowners.

## Conclusion

Overall, under alternative D, the Fire Island communities and adjacent landowners would experience beneficial impacts due to a rapidly decreasing deer population and reduced issues associated with deer, including browse and trampling of vegetated landscapes, use of houses for shelter, and foraging in garbage cans. Complaints about deer would be expected to decrease. Members of the Fire Island communities and adjacent landowners who enjoy deer but worry about deer-related problems may be reassured by the Seashore's management program although specific opinions may vary depending upon the methods used for population density maintenance (i.e., direct reduction and/or fertility control). Alternative D would contribute noticeably to the cumulative impact on Fire Island communities and adjacent landowners. Neither beneficial nor adverse impacts are expected to be significant because deer would continue to move between the matrix of public and private lands where residents have mixed feelings about deer, but most residents would continue to be satisfied with the general quality of life on Fire Island.

## IMPACTS ON PUBLIC HEALTH AND SAFETY

### METHODOLOGY

NPS *Management Policies 2006* states that, "while recognizing that there are limitations on its capability to totally eliminate all hazards, the Service . . . will seek to provide a safe and healthful environment for visitors and employees." The policies also state, "the Service will reduce or remove known hazards and apply other appropriate measures, including closures, guarding, signing, or other forms of education" (NPS 2006a).

The safety of both visitors and NPS employees at the Seashore could be affected by implementation of the proposed deer management actions. Impacts on visitor and employee safety would be related to the perceived risk of tick-borne illness under all alternatives, the presence of fences in the action alternatives, and use of firearms under alternatives C and D. The purpose of this impact analysis is to identify the level of impact that implementing each of the proposed alternatives would have on the safety of visitors and employees at the Seashore.

Resource-specific context for assessing impacts of the alternatives on public health and safety include:

- Fire Island is composed of a matrix of public and private lands, including the 17 private communities and towns, Smith County Park, Robert Moses State Park, and three municipal beaches.
- The Seashore strives to provide a safe and healthful environment for visitors and employees by removing known hazards and applying appropriate measures (NPS 2006a).

## **IMPACTS OF ALTERNATIVE A**

### **Impact Analysis**

Under alternative A, existing deer management and monitoring efforts throughout the Seashore would continue. These actions include continued public education/interpretation efforts and deer population surveys. The Seashore would continue to have no jurisdiction in the Fire Island communities to enforce human-deer interaction regulations. Public health and safety would continue to be at risk of adverse impacts.

Human-deer interaction management would remain unchanged. The Seashore would continue to disseminate information related to human-deer issues using a variety of means. Interpretive exhibits, waysides, and print media regarding natural resources and resource issues such as keeping wildlife wild, Lyme disease, and other topics would continue to be offered at visitor contact locations and would be made available to Fire Island communities where possible. The number of incidents between humans and deer would remain the same or could increase. Incidents between humans and deer would continue to be reported to and managed by the New York State Department of Environmental Conservation. These incidents would have an adverse impact on public health and safety. Deer would continue to approach humans, which is a safety concern for many residents, particularly in confined spaces (e.g., boardwalks). Deer that are fed by humans are encouraged to approach them, which creates perceived and actual safety hazards for people who do not initiate contact. If the deer population continues to grow to the point at which deer compete for food resources, public safety, particularly in developed areas, could be further impacted. Potential indirect risks of tick-borne diseases (e.g., Lyme disease) associated with the deer population are expected to remain the same.

The Seashore's vegetation monitoring and management efforts would continue. The deer population would remain unmanaged. Current vegetation management efforts are not likely to impact public health and safety.

As the deer population continues to grow, risks to public health and safety associated with deer could become increasingly likely. Deer would continue to feed from unsecured trash containers, which may cause the containers to spill, spreading refuse. The presence of uncontained garbage could indirectly lead to public health hazards. Tick-borne diseases would continue to be a public health concern under the unmanaged and growing deer population. The indirect relationship between deer presence and incidence of tick-borne illness is of particular concern at the William Floyd Estate. Additionally, an increased deer population could diminish the health and appearance of the herd; there could well be a perceived risk to public health and safety if the population appears to be in poor health.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions have the potential to impact public health and safety. These actions include the tick management and monitoring program, deer hunting and deer damage permits, and the use of 4-Poster devices.

The National Park Service would continue to monitor tick issues throughout the Seashore and provide education to visitors regarding ticks, tick-borne illnesses, and preventive measures that visitors can take to avoid exposure to ticks and tick bites and what to do in response to tick bites. The 4-Poster devices use permethrin to treat deer for ticks. Although this treatment takes place outside federal lands, treated deer may travel between the communities and the Seashore. Both of

these actions reduce the risk to public health and safety from exposure to ticks and thus tick-borne diseases. Deer hunting and use of deer damage permits on nonfederal lands modestly reduces the local deer population, which could further reduce the potential for negative human-deer interactions.

The impact of these past, present, and reasonably foreseeable future actions would be beneficial. When combining the impacts of these projects with the impacts of alternative A, the cumulative impact would be beneficial. Alternative A would contribute imperceptively to the cumulative impact on public health and safety.

## **Conclusion**

Overall, under alternative A, adverse impacts on public health and safety would persist due to the risk of human-deer interactions and indirect increases in health risks associated with ticks and uncontained garbage. These risks could increase in the long term as the deer population increases. These risks would continue to be associated with deer on both public and private lands. The National Park Service would continue current efforts to educate the public both within the Seashore and beyond on methods for avoiding hazardous situations. Alternative A would contribute imperceptively to the cumulative impact on public health and safety. Adverse impacts would not be significant because the Seashore would continue to provide a safe and healthful environment for visitors to and employees of the Seashore as well as for residents of the other communities on Fire Island and adjacent to the William Floyd Estate by applying appropriate prevention measures.

## **IMPACTS OF ALTERNATIVE B**

### **Impact Analysis**

Under alternative B, the Seashore would use fertility control to gradually reduce the deer population. The Seashore also would expand educational/interpretive efforts from those proposed under alternative A. Both of these actions would decrease human-deer interactions. Public health and safety would improve as the deer population and its associated risks decrease.

Human-deer interaction management would improve through enhanced educational efforts and reduced risks of interaction. In addition to the items described under alternative A, Seashore staff would enhance public educational/interpretive efforts within Fire Island communities and communities adjacent to the William Floyd Estate to raise awareness of the role of humans in deer-related issues. Programs could include information on the consequences of feeding wildlife, strategies for securing garbage containers, and the collaboration between the New York State Department of Environmental Conservation and the National Park Service. These programs would foster a sense of responsibility in the public and increase the effectiveness of management efforts. Increased education within the communities would likely lead to fewer deer that approach humans in the Seashore. Additionally, fencing of the William Floyd Estate and a large area of the Sunken Forest would exclude deer, which would further reduce the potential for human-deer interactions in these locations. As the deer population decreases gradually over a period of approximately 13 years outside the deer exclosures, the potential for risks associated with deer is also likely to decrease. Incidents between humans and deer would likely decrease, thereby improving public health and safety. A smaller deer population would lead to fewer hosts for ticks, and the risk of tick-borne diseases could decrease.

Deer would be excluded from certain areas of the Seashore. Although exclosures could cause deer to migrate to other areas, these management efforts are not likely to noticeably impact public health and safety.

Deer population management efforts also could impact public health and safety. Use of a fertility control agent has the potential to alter deer behavior, and people who notice changes in deer behavior could fear a safety risk. The immediate decline in the deer population within the communities as a result of translocation of deer that approach humans would improve public health and safety.

In the case that an acceptable fertility control agent is not available immediately, risks associated with current deer densities described under alternative A would continue for up to 10 years in areas outside of deer exclosures. The fencing and enhanced educational efforts would take place immediately upon implementation of the plan, regardless of the availability of an acceptable fertility control agent.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions have the potential to impact public health and safety. These actions include the tick monitoring and management program, deer hunting and deer damage permits, and the use of 4-Poster devices, as described under alternative A. The impact of these past, present, and reasonably foreseeable future actions would be beneficial. When combining the impacts of these projects with the impacts of alternative B, the cumulative impact would be beneficial. Alternative B would contribute noticeably to the cumulative impact on public health and safety.

### **Conclusion**

Overall, alternative B would have beneficial impacts on public health and safety because of the reduced risk of deer and human incident as well as indirect health risks associated with ticks and uncontained garbage as the deer population is reduced over approximately 13 years. Additional benefits would result from outreach on how to reduce and/or avoid human-deer incidents is expanded. Although decreased, risks would continue to be associated with deer on both public and private lands. The National Park Service would enhance efforts to educate the public both within the Seashore and beyond on methods for avoiding hazardous situations, and would make an active effort to remove deer that approach humans and reduce the population in general. In the case that an acceptable fertility control agent is not available immediately, adverse impacts associated with current deer densities would continue for up to 10 years before the population could be reduced; however, benefits associated with deer exclosure fencing and enhanced education would take place in the interim. Alternative B would contribute noticeably to the cumulative impact on public health and safety. Adverse impacts would not be significant because the Seashore would make strides towards removing known hazards and applying appropriate measures to provide a safe and healthful environment for visitors to and employees of the Seashore as well as for residents of the other communities on Fire Island and adjacent to the William Floyd Estate. Beneficial impacts would not be significant because the Seashore already takes many steps to provide a safe and healthful environment for visitors and employees by removing known hazards and applying appropriate measures.



## **IMPACTS OF ALTERNATIVE C**

### **Impact Analysis**

Under alternative C, the Seashore would use direct reduction methods to rapidly reduce the deer population. The Seashore also would expand educational/interpretive efforts, as under alternative B. Both of these actions would decrease human-deer interactions. Public health and safety would improve as the deer population and its associated risks decrease.

Impacts associated with improved human-deer interaction management and improved vegetation monitoring and management efforts under this alternative would be very similar to those described under alternative B. Human-deer interaction management would improve through enhanced educational efforts and reduced risks of interaction. Expanded educational programs would foster a sense of responsibility in the public and increase the effectiveness of management efforts. Increased education within the communities would likely lead to fewer deer that approach humans in the Seashore. A smaller deer population would lead to fewer hosts for ticks, and the risk of tick-borne diseases could decrease. Unlike alternative B, there could be a perceived safety risk associated with the methods of deer population management, but Seashore programs would strive to mitigate this concern. Additionally, fencing of the Sunken Forest and some limited fencing at the William Floyd Estate would further reduce the potential for human-deer interactions in these locations.

As under alternative B, deer would be excluded from certain areas of the Seashore. Though exclosures could cause deer to migrate to other areas, these management efforts are not likely to noticeably impact public health and safety.

Removal of deer under this alternative could result in perceived impacts on public health and safety. Although areas of sharpshooting would be closed off, the public could be uncomfortable with reduction of the population through sharpshooting. Deer behavior has the potential to change as a result of management actions; public safety could be adversely impacted by changes in deer behavior. Deer may flee sharpshooting zones, which could result in higher deer densities in developed areas than in the Seashore. These deer could become habituated and may approach humans in the communities and could pose public health and safety concerns.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions have the potential to impact public health and safety. These actions include the tick monitoring and management program, deer hunting and deer damage permits, and the use of 4-Poster devices, as described under alternative A. The impact of these past, present, and reasonably foreseeable future actions would be beneficial. When combining the impacts of these projects with the impacts of alternative C, the cumulative impact would be beneficial. Alternative C would contribute noticeably to the cumulative impact on public health and safety.

### **Conclusion**

Overall, alternative C would have beneficial impacts on public health and safety due to reduced risk of deer and human incident, as well as indirect reductions in health risks associated with ticks and uncontained garbage. These impacts would be experienced over the long-term as the deer population is reduced and as outreach on how to reduce and/or avoid human-deer incidents is expanded. The deer population would decrease more rapidly under this alternative than under alternative B. Some short-term increase in risk may occur within the communities as a result of

sharpshooting; however, use of sharpshooting would result in a more rapid decrease in deer population, which would result in a reduction of risk, a beneficial impact on public health and safety. Although decreased, risks would continue to be associated with deer on both public and private lands. The National Park Service would enhance efforts to educate the public both within the Seashore and beyond on methods for avoiding hazardous situations, and would make an active effort to remove deer that approach humans and reduce the population in general. Alternative C would contribute noticeably to the cumulative impact on public health and safety. Adverse impacts would not be significant because the Seashore would make strides towards removing known hazards and applying appropriate measures to provide a safe and healthful environment for visitors to and employees of the Seashore as well as for residents of the other communities on Fire Island and adjacent to the William Floyd Estate. Beneficial impacts would not be significant because the Seashore already takes many steps to provide a safe and healthful environment for visitors and employees by removing known hazards and applying appropriate measures.

## **IMPACTS OF ALTERNATIVE D**

### **Impact Analysis**

Under alternative D, the Seashore would use direct reduction methods to rapidly reduce the deer population. Following this initial reduction, the Seashore could use fertility control in addition to or in place of continued direct reduction. The Seashore also would expand educational/interpretive efforts, as under alternative B. These actions would decrease human-deer interactions. Public health and safety would improve as the deer population and its associated risks decrease.

Impacts associated with improved human-deer interaction management and improved vegetation monitoring and management efforts under this alternative would be very similar to those described under alternative C. The primary difference would be the inclusion of fertility control methods of deer management in addition to all other elements described under alternative C. As under the other action alternatives, the potential for risks associated with deer is also likely to decrease as the deer population decreases. Incidents between humans and deer would likely decrease, thereby improving public health and safety. A smaller deer population would lead to fewer hosts for ticks, and the risk of tick-borne diseases could decrease.

Deer population management efforts would have the potential to impact public health and safety. The impacts of this alternative reflect a combination of impacts discussed under alternatives B and C. Fertility control treatment has the potential to alter deer behavior, and people who notice changes in deer behavior could fear a safety risk. Sharpshooting also could result in perceived impacts on public health and safety. Even though areas where sharpshooting is taking place would be closed off, the public could be uncomfortable with reduction of the population using this method.

Deer may flee sharpshooting zones and would be excluded from some areas of the Seashore through establishment of enclosure fencing. This could result in relatively higher deer densities in developed areas than in the Seashore. These deer could become habituated and may approach humans in the communities and could pose public health and safety concerns; however, deer observed approaching humans could be targeted for capture and euthanasia to reduce this risk.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions have the potential to impact public health and safety. These actions include the tick monitoring and management program, deer hunting and

deer damage permits, and the use of 4-Poster devices, as described under alternative A. The impact of these past, present, and reasonably foreseeable future actions would be beneficial. When combining the impacts of these projects with the impacts of alternative D, the cumulative impact would be beneficial. Alternative D would contribute noticeably to the cumulative impact on public health and safety.

## **Conclusion**

Overall, alternative D would have beneficial impacts on public health and safety due to reduced risk of deer and human incident, as well as indirect reductions in health risks associated with ticks and uncontained garbage. These impacts would be experienced over the long-term as the deer population is reduced and as outreach on how to reduce and/or avoid human-deer incidents is expanded. Some temporary increase in risk may occur within the communities as a result of deer densities increase due to construction of deer exclosures and use of sharpshooting; however, use of direct reduction would result in a more rapid decrease in deer population, which would result in a reduction of risk, a beneficial impact on public health and safety. This benefit would be sustained through deer population density maintenance by the Seashore (using direct reduction and/or fertility control). Although decreased, risks would continue to be associated with deer on both public and private lands. The National Park Service would enhance efforts to educate the public both within the Seashore and beyond on methods for avoiding hazardous situations, and would make an active effort to remove deer that approach humans and reduce the population in general. Alternative D would contribute noticeably to the cumulative impact on public health and safety. Adverse impacts would not be significant because the Seashore would make strides towards removing known hazards and applying appropriate measures to provide a safe and healthful environment for visitors to and employees of the Seashore as well as for residents of the other communities on Fire Island and adjacent to the William Floyd Estate. Beneficial impacts would not be significant because the Seashore already takes many steps to provide a safe and healthful environment for visitors and employees by removing known hazards and applying appropriate measures.

## **IMPACTS ON SEASHORE OPERATIONS**

### **LAWS AND POLICIES**

Direction for management and operations at the Seashore is set forth in *NPS Management Policies 2006* (NPS 2006a), the Seashore's business plan (NPS 2007), and the Seashore's general management plan (NPS 1977, 2013c). The 2007 business plan identifies and describes the roles of each of the Seashore's five operational functions: management and administration, facility operations and maintenance, law enforcement and visitor safety, resource management, and visitor experience and recreation.

### **METHODOLOGY**

The area of analysis for Seashore operations is the boundary of the Seashore. The discussion of impacts on Seashore operations focuses on (1) the number of staff available to manage the program and ensure visitor and resident safety, and (2) the ability of Seashore staff to protect and preserve resources given current funding and staffing levels. This section includes an analysis of the projected need for staff time and materials in relationship to each of the alternatives. Seashore staff were consulted regarding expected staffing and funding needs under each alternative. The impact analysis

is based on the current description of Seashore operations presented in “Chapter 3: Affected Environment” and are based on the assumptions documented in chapter 2 regarding the estimated cost of each alternative. The analysis also assumes that adequate funding would be received before implementation of the plan. The required level of effort is discussed in terms of full-time equivalent, or FTE, which represents the hours worked by staff. One FTE equals 2,080 hours, the equivalent of one person working full time year-round, or two part-time staff each working six months of the year. FTE estimates provided in this section reflect anticipated levels of staffing for specific activities associated with each alternative.

Resource-specific contexts for assessing impacts on Seashore operations include the following:

- Seashore staff is responsible for ensuring a safe and enjoyable visitor experience, protection of Seashore resources, maintenance of Seashore facilities, and Seashore administration throughout the entire Seashore.
- The Seashore currently employs approximately 40 FTE and up to 60 seasonal part-time equivalent positions annually (NPS 2012c).
- Units of the national park system must operate within the constraints of the unit-specific budget and number of staff positions that have been allocated by Congress and the NPS Director’s office. While funding for the plan would be received before implementation, there would be an increased burden on Seashore staff responsible for administering the plan.
- The Seashore was established “for the purpose of conserving and preserving for the use of future generations certain relatively unspoiled and undeveloped beaches, dunes, and other natural features. . . which possess high values to the Nation as unspoiled areas of great natural beauty in close proximity to large concentrations of urban population” (PL 88-587).

## IMPACTS OF ALTERNATIVE A

### Impact Analysis

Under alternative A, there would be no changes to current Seashore operations. The Seashore would continue to employ approximately 40 permanent FTE staff, and up to 60 seasonal and intern staff, to serve the four main functional areas: visitor experience and enjoyment, resource management, maintenance, and management/administration (NPS 2012c).

Seashore staff would continue to spend approximately 270–300 hours per year on deer-related community outreach, including planning, correspondence, transportation, Junior Ranger programming, public programming, informal interpretation, publications, and implementation of deer-related programming. Seashore staff would continue to manage reports of negative human-deer interactions and complete Case Incident Reports at current rates, approximately 185 hours annually. Management of these reports would continue to take time away from other activities. The Seashore’s deer population would continue to grow over time, although numbers would fluctuate annually due to temperatures, snow depths, and duration of winter and food quality and quantity. If efforts related to deer management increased substantially, funds and personnel from other Seashore divisions might have to be reallocated from other activities.

The work performed by these staff would include coordinating and performing deer and vegetation monitoring. The Seashore also would continue limited use of fencing to protect sensitive species and landscapes, and would continue to monitor deer populations and vegetation. Staff time related to maintenance and repair of fencing would be limited, requiring approximately four hours per year at

the William Floyd Estate and 32 hours, 16 hours each for two staff, on Fire Island. The vegetation monitoring program would continue to be conducted every five years, requiring five dedicated staff for four months, a total of 460 hours.

Deer monitoring would continue annually on Fire Island in general, requiring approximately 120 hours for three staff. Additionally, monitoring would take place every three years within the Fire Island Wilderness and at the William Floyd Estate. Monitoring in the wilderness would require approximately 25 hours of time from two staff every three-year cycle. Monitoring at the William Floyd Estate requires 25 hours from three staff every three-year cycle. Current deer management would continue as a recurring component of the Seashore's resource management activities because adverse impacts on forest health would continue indefinitely.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions have the potential to impact Seashore operations. These actions include the tick monitoring and management program, deer hunting and deer damage permits, waterfowl hunting, a William Floyd Estate cultural landscape report and treatment plan, and enhanced monitoring and management of invasive plant species.

The National Park Service would continue to monitor tick issues throughout the Seashore and provide education to visitors regarding ticks, tick-borne illnesses, and preventive measures that visitors can take to avoid exposure to ticks and tick bites and what to do in response to tick bites. The Seashore estimates that this effort requires eight hours per month for a six-month period. The ongoing hunting of deer and implementation of deer damage permits would continue to modestly decrease deer density and could therefore decrease the need for Seashore staff to invest time dealing with deer-related issues.

Permitting and overseeing the annual waterfowl hunt would continue to require a modest amount of staff time during the hunting season. Preparation of a William Floyd Estate cultural landscape report and treatment plan would require input and potentially some research by Seashore staff, and some change in maintenance routines would likely take place. Lastly, enhanced monitoring and management of invasive plant species could include a comprehensive invasive species management plan for the Seashore that addresses prevention, surveillance, and management priorities. Staff time would be required to prepare this plan and possibly to implement improved management strategies; however, Seashore property and infrastructure may be better protected under a comprehensive plan.

The impact of these past, present, and reasonably foreseeable future actions would be adverse. When combining the impacts of these projects with the impacts of alternative A, the cumulative impact on Seashore operations would be adverse. Alternative A would contribute imperceptively to the cumulative impact on Seashore operations.

### **Conclusion**

Overall, alternative A would result in indirect adverse impacts on Seashore operations. This alternative would not cause any direct change in the current level of effort to ensure a safe and enjoyable visitor experience, protect Seashore resources, maintain Seashore facilities, and administer the Seashore. However, not developing a long-range comprehensive plan to manage vegetation and white-tailed deer may indirectly increase the burden placed on Seashore staff to maintain visitor safety and to protect natural resources due to the level of effort required for items such as responses to deer-related incidents. Such an increase in FTE needed to respond to a possible rise in deer population and its associated impacts could detract from FTE needed for

other Seashore operations; units of the National Park System must operate within the constraints of their unit-specific budget. Seashore managers would continue to manage the Seashore in a manner consistent with the purposes for which the Seashore was established. Alternative A would contribute imperceptively to the cumulative impact on Seashore operations. Adverse impacts on Seashore operations would not be significant because any change in the level of effort needed to manage the Seashore (management includes ensuring a safe and enjoyable visitor experience, protection of Seashore resources, maintenance of Seashore facilities, and Seashore administration) would be gradual and would not cause a noticeable change in administrative and supervisory responsibilities.

## **IMPACTS OF ALTERNATIVE B**

### **Impact Analysis**

Under alternative B, increased staff and budget would be required to coordinate and implement human-deer interaction management. Visitor and community education/interpretation, which would be a key component of this alternative, would be implemented to provide information related to why deer management is needed, why it is occurring, and what steps should be taken to reduce potential for negative human-deer interactions. The Seashore would also compile and circulate a list of native deer-resistant or less desirable plant species to reduce deer presence within the communities. Although the efforts would be slightly different than current conditions, the required Seashore staff time would be comparable. However, if the Seashore undertakes efforts to engage the communities in developing strategies for reducing negative human-deer interactions, it is anticipated that at least one new FTE staff position, Seashore liaison to the Fire Island communities, would be required. Further, if the Seashore obtains jurisdiction to manage human-deer interactions in the communities, additional staff would be required. This new staff position would be dedicated to the enforcement of deer-related restrictions, such as ticketing residents for feeding deer, providing shelter for deer, or improperly storing garbage bins. In the long term, implementation of human-deer management efforts would result in fewer human-deer interactions, therefore, requiring less Seashore staff time to handle Case Incident Reports, currently estimated at 185 hours annually. It is estimated that enhanced public educational/interpretation efforts would require approximately 270–300 hours, as under alternative A, with an additional 180 hours for developing lesson plans for local schools and additional programs and interpretation.

Coordination and implementation of vegetation protection efforts associated with alternative B, such as fencing of the Sunken Forest, fencing of the historic core of the William Floyd Estate, and rotational fencing at the lower acreage of the William Floyd Estate would likely require increased staff time and budget. It is anticipated that impacts on staff time and budget would be greatest at the onset of vegetation protection efforts, and would stabilize over time. Vegetation monitoring would continue under this alternative, as described for alternative A and in chapter 3, but would require that two additional vegetation surveys, for a total of five surveys, be conducted within the life of the plan/EIS. These surveys would include data collection and analysis and require 320 hours by one FTE and 640 hours each for five seasonal staff. Although the vegetation management elements of alternative B would primarily be conducted by existing staff, a temporary silviculturist position could be required to treat the William Floyd Estate if regeneration is not occurring after other management efforts have been implemented.

Deer management under alternative B also would require an increase in Seashore staff time and budget. Seashore efforts would be most intensive at the onset of deer population management but would likely decline or stabilize over time. Deer management efforts proposed under alternative B

would include coordination and implementation of fertility controls, including capture, treatment, and tracking of deer, and hazing to remove deer from within fenced areas in Sunken Forest and at the William Floyd Estate.

A long-term increase in staff and budget would be required to implement application of an acceptable fertility control agent. Costs are uncertain at this time and would be determined at a later date depending upon the agent that becomes available. A temporary increase in staff and budget would also be required to translocate deer from the Fire Island communities to the Fire Island Wilderness. This would require not only time to actually translocate the deer, but also to coordinate the translocation with the communities, capture the deer, treat the deer with the fertility control agent, and track the movement of these deer to ensure that they do not return to Fire Island communities. Tracking is estimated to require 16 hours per month for two staff for the first three years of the plan. Capture and euthanasia would be considered for translocated individuals that consistently return to Fire Island communities and/or continue to approach humans.

If an acceptable fertility control agent is not available following implementation of this plan, the increase in staff and budget needed for implementation would be delayed until such an agent is available (assumed to become available within 10 years).

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions have the potential to impact Seashore operations. These actions include the tick monitoring and management program, deer hunting and deer damage permits, waterfowl hunting, a William Floyd Estate cultural landscape report and treatment plan, and enhanced monitoring and management of invasive plant species, as described under alternative A. Under the action alternatives, the ongoing hunting of deer and implementation of deer damage permits could supplement Seashore efforts to decrease deer density. This action could modestly decrease the need for Seashore staff to invest time dealing with deer-related issues. The overall impact of these past, present, and reasonably foreseeable future actions would be adverse. When combining the impacts of these projects with the impacts of alternative B, the cumulative impact would be adverse. Alternative B would contribute noticeably to the cumulative impact on Seashore operations.

If an acceptable fertility control agent is not available for immediate implementation, the burden such an implementation would place on Seashore operations would be delayed for up to 10 years; however, the indirect impacts on Seashore resources and the need to manage them (as discussed under alternative A) would persist.

### **Conclusion**

Overall, alternative B would have an adverse impact on Seashore operations due to the increase in the level of time and materials to enhance public educational/interpretive efforts, improve vegetation management, manage deer population, maintain Seashore facilities, and administer the Seashore associated with this alternative. While it is assumed that adequate funding would be established to support this effort, overseeing this program would place an additional burden on Seashore staff responsible for overseeing implementation of the plan. Seashore managers would continue to manage the Seashore in a manner consistent with the purposes for which the Seashore was established. If an acceptable fertility control agent is not available immediately, Seashore staff would be relieved of that operational burden for up to 10 years but would continue to manage the resource issues associated with current deer densities. Alternative B would contribute noticeably to the cumulative impact on Seashore operations. Adverse impacts on Seashore operations would be

significant because considerable funding beyond current levels would be required for Seashore staff to ensure a safe and enjoyable visitor experience, protection of Seashore resources, maintenance of Seashore facilities, and Seashore administration.

## **IMPACTS OF ALTERNATIVE C**

### **Impact Analysis**

Under alternative C, increased staff and budget would be required to coordinate and implement human-deer interaction management in the same ways as described under alternative B. It is estimated that enhanced public education/interpretation efforts would require approximately 270–300 hours, as under alternative A, with an additional 180 hours for developing lesson plans for local schools and additional programs and interpretation.

Coordination and implementation of vegetation protection efforts associated with alternative C, such as fencing the Sunken Forest, would likely require increased staff time and budget. The actions and associated time and materials required would be similar to those as described under alternative B; however, less fencing would be installed (and subsequently maintained) under this alternative. It is anticipated that impacts on staff time and budget would be greatest at the onset of vegetation protection efforts and would stabilize over time.

Similarly, deer management under alternative C would require an increase in Seashore staff time and budget. Seashore efforts would be most intensive at the onset of deer population management, but would likely decline or stabilize over time. Deer management efforts proposed under alternative C would include coordination and implementation of deer removal, including the use of sharpshooting and hunting.

Unlike under alternative B, there would be no translocation of deer to Fire Island Wilderness; instead, deer that approach humans would be captured and euthanized. This treatment would be more cost-effective than the translocation and follow-up monitoring required under alternative B.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions have the potential to impact Seashore operations. These actions include the tick monitoring and management program, deer hunting and deer damage permits, waterfowl hunting, a William Floyd Estate cultural landscape report and treatment plan, and enhanced monitoring and management of invasive plant species, as described under alternative A. The impact of these past, present, and reasonably foreseeable future actions would be adverse. When combining the impacts of these projects with the impacts of alternative C, the cumulative impact would be adverse. Alternative C would contribute noticeably to the cumulative impact on Seashore operations.

### **Conclusion**

Overall, alternative C would have an adverse impact on Seashore operations due to an increase in the level of time and materials to enhance public educational/interpretive efforts, improve vegetation management, manage deer population, maintain Seashore facilities, and administer the Seashore. While it is assumed that adequate funding would be established to support this effort, overseeing this program would place an additional burden on Seashore staff responsible for overseeing implementation of the plan. Such an increase in responsibilities could detract from time needed to supervise other Seashore operations. Seashore managers would continue to manage the



Seashore in a manner consistent with the purposes for which the Seashore was established. Alternative C would contribute noticeably to the cumulative impact on Seashore operations. Adverse impacts on Seashore operations would be significant because considerable funding beyond current levels would be required for Seashore staff to ensure a safe and enjoyable visitor experience, protection of Seashore resources, maintenance of Seashore facilities, and Seashore administration.

## **IMPACTS OF ALTERNATIVE D**

### **Impact Analysis**

Under alternative D, increased staff and budget would be required to coordinate and implement human-deer interaction management in the same ways as described under alternative B. It is estimated that enhanced public education/interpretation efforts would require approximately 270–300 hours, as under alternative A, with an additional 180 hours for developing lesson plans for local schools and additional programs and interpretation.

Vegetation protection efforts associated with alternative D, such as fencing of the Sunken Forest and fencing of the historic core of the William Floyd Estate, would likely require increased staff time and budget. The actions and associated time and materials required would be similar to those described under alternative B but with reduced efforts due to the lack of rotational fencing of the William Floyd Estate lower acreage.

Deer management under alternative D also would require an increase in Seashore staff time and budget. Seashore efforts would be most intensive at the onset of deer population management but would likely decline and stabilize over time. Deer management efforts proposed under alternative D would include coordination and implementation of direct reduction methods followed by maintenance of the deer population through use of a reproductive control in addition to or in place of direct reduction methods. The costs to implement this alternative would include the same elements as those described under alternative C; however, if fertility control is used to maintain the population, the cost to use fertility control would be less than described under alternative B because its use would be limited to population maintenance (a less intensive use than when using it for population reduction alone). Unlike under alternative B, there would be no translocation of deer to Fire Island Wilderness; instead, deer that approach humans would be captured and euthanized. This treatment would be more cost-effective than the translocation and follow-up monitoring required under alternative B.

### **Cumulative Impact Analysis**

Past, present, and reasonably foreseeable future actions have the potential to impact Seashore operations. These actions include the tick monitoring and management program, deer hunting and deer damage permits, waterfowl hunting, a William Floyd Estate cultural landscape report and treatment plan, and enhanced monitoring and management of invasive plant species, as described under alternative A. The impact of these past, present, and reasonably foreseeable future actions would be adverse. When combining the impacts of these projects with the impacts of alternative D, the cumulative impact would be adverse. Alternative D would contribute noticeably to the cumulative impact on Seashore operations.

## **Conclusion**

Overall, alternative D would have an adverse impact on Seashore operations because of an increase in the level of time and materials to enhance public educational/interpretive efforts, improve vegetation monitoring, manage deer population, maintain Seashore facilities, and administer the Seashore. While it is assumed that adequate funding would be established to support this effort, overseeing this program would place an additional burden on Seashore staff responsible for overseeing implementation of the plan. Such an increase in responsibilities could detract from time needed to supervise other Seashore operations. Seashore managers would continue to manage the Seashore in a manner consistent with the purposes for which the Seashore was established. Alternative D would contribute noticeably to the cumulative impact on Seashore operations. Adverse impacts on Seashore operations would be significant because considerable funding beyond current levels would be required for Seashore staff to ensure a safe and enjoyable visitor experience, protection of Seashore resources, maintenance of Seashore facilities, and Seashore administration.

## **SUMMARY OF IMPACT ANALYSIS**

### **SUSTAINABILITY AND LONG-TERM MANAGEMENT**

The National Park Service is required to consider the relationship between short term uses of the environment and the maintenance and enhancement of long-term productivity (NEPA, section 102[2][c][iv]). In doing so, the National Park Service considers the long-term impacts of its actions and whether its actions involve tradeoffs between immediate use of resources and long-term productivity and sustainability of resources.

Alternative A would likely be the least sustainable option because it does not establish a long-term deer management strategy. The Seashore would continue current monitoring activities and take actions to protect resources on an as-needed basis, but the deer population would be likely to continue to grow and cause increasingly adverse impacts on the Seashore's ecology through direct reduction of natural vegetation regeneration and indirect changes to habitat for other wildlife.

The action alternatives would be more sustainable than the no-action alternative because all three would establish a long-term deer management strategy. Ultimately, all three of the action alternatives are expected to provide protection for the local ecosystem through reduced deer browsing on native vegetation and the indirect protection of the habitat this vegetation provides for other wildlife. There is one primary difference between the alternative B approach to managing the deer population and the approach of alternatives C and D when discussing sustainability. That difference is the time needed to reduce the deer population density to a point at which the ecosystem is anticipated to be most balanced. Under alternative B, it is estimated that the use of fertility control alone to reduce the deer population would require a minimum of 13 years, potentially much longer, to reach a density at which ecosystem balance is restored. Under alternatives C and D, use of sharpshooting and hunting is expected to reduce the deer population to the same density in approximately two years. Although all methods of reduction result in a more sustainable deer population level that allows for long-term ecosystem productivity, the latter alternatives reach that level more quickly.

## **IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES**

The National Park Service is required to consider if its actions involve an irreversible or irretrievable commitment of resources (NEPA, section 102[c][v]). Irreversible impacts are those effects that cannot be changed over the long term or are permanent. An impact on a resource is irreversible if the resource cannot be reclaimed, restored, or otherwise returned to its condition before the disturbance. An irretrievable commitment of resources refers to the impacts on resources that, once gone, cannot be replaced.

All alternatives would result in some low level of irreversible commitment of resources associated with carrying out Seashore management activities, such as limited amounts of fuel and materials consumption. Alternative A also risks an increasingly imbalanced ecosystem in which impacts on the rare ecosystem of the Sunken Forest could result in irreversible impacts on vegetation, unique vegetation communities, and special-status plant species, as well as other wildlife and wildlife habitat. Due to the time needed to effectively reduce the deer population under alternative B, this alternative also carries a risk of irreversible impacts on vegetation, unique vegetation communities, and special-status plant species, as well as other wildlife and wildlife habitat as heavy deer browse continues throughout the Seashore. No irreversible or irretrievable commitment of resources, besides the fuel use incurred by Seashore operations, would take place under alternatives C and D.

## **UNAVOIDABLE ADVERSE IMPACTS**

The National Park Service is required to consider if the alternative actions would result in impacts that could not be fully mitigated or avoided (NEPA, section 102[c][ii]).

Under alternative A, there would be the potential for unavoidable adverse impacts on vegetation, unique vegetation communities, and special-status plant species; the white-tailed deer population; other wildlife and wildlife habitat; and wilderness due to the continued increase in the deer population over time and the associated damage to Seashore vegetation. There would be long-term, unavoidable, adverse effects on historic structures and archeological resources due to trampling and erosion. There would also be unavoidable adverse impacts on cultural landscapes because deer browse would prevent a more full restoration of the cultural landscape; restoration of the garden as it existed previously would not be possible with the current level of deer browse. There would also be unavoidable adverse impacts on visitor use and experience/recreation because of the lack of vegetation and the associated wildlife and scenery that Seashore visitors enjoy. The Seashore would also be prevented from fully interpreting the William Floyd Estate for visitors. There would be long-term, unavoidable, adverse impacts on Fire Island communities and adjacent landowners, as well as public safety, as the deer population would continue to grow or stabilize at a high density. This population would continue to browse on the gardens and ornamental plantings within communities and in lands adjacent to the William Floyd Estate. Deer would continue to approach humans and would continue to have access to unsecured garbage containers. The public would continue to associate the deer population with a risk of exposure to tick-borne illness and would perceive an increased risk associated with high deer density.

Unavoidable adverse impacts would continue on Seashore operations, due to the demand on Seashore staff related to continued deer monitoring and resource management.

Over the next 15 years, alternative B would include most of the unavoidable adverse impacts described for alternative A because the benefits of reproductive control would not be realized until much later. Unavoidable adverse impacts on some plant species could be mitigated, but not eliminated, by the use of rotational fencing. Adverse impacts would be avoided within permanent fencing established around the Sunken Forest and William Floyd Estate. Reproductive controls may have some unavoidable

adverse impacts if the actions were visible or audible to Seashore visitors. Reproductive controls may adversely impact deer population behavior. Providing interpretive materials may help mitigate some of this effect; however, reproductive control as proposed under this alternative would likely occur during relatively high visitor use periods and would require a substantial effort to treat the required number of deer. Unavoidable adverse impacts on Seashore operations would remain relatively the same as alternative A, as the fence construction and reproductive control implementation would be completed by a contractor or other federal employees.

Unavoidable adverse impacts under alternatives C and D would be greatly reduced when compared to alternatives A and B. The reduction in deer numbers would occur relatively rapidly and the Seashore's vegetation would begin to recover within the life of the plan. This would mitigate adverse impacts on vegetation, unique vegetation communities, and special-status plant species; the white-tailed deer population; other wildlife and wildlife habitat; and the cultural landscape at the William Floyd Estate. Some wildlife that prefer more open habitat would be unavoidably impacted as the vegetation recovered. There may be some unavoidable adverse impacts on visitors associated with the implementation of the direct reduction. Conducting direct reduction at night and providing interpretive materials would help mitigate some adverse effects. Unavoidable adverse impacts on operations and management would remain relatively the same as alternative A, as the direct reduction would be administered by a contractor or other federal employees.