National Park Service
U.S. Department of the Interior

Fire Island National Seashore
New York

Fire Island National Seashore

Draft White-tailed Deer Management Plan and Environmental Impact Statement

July 2014

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Lead Agency: National Park Service (NPS), U.S. Department of the Interior
Cooperating Agencies: New York State Department of Environmental Conservation (NYS-DEC) and Animal and Plant Health Inspection Service (APHIS), U.S. Department of Agriculture

This *Draft White-tailed Deer Management Plan and Environmental Impact Statement* (plan/EIS) describes four alternatives for the management of white-tailed deer at Fire Island National Seashore (the Seashore), as well as the environment that would be affected by the alternatives and the environmental consequences of implementing these alternatives.

The purpose of the plan/EIS is to develop a deer management strategy that supports protection, preservation, regeneration, and restoration of native vegetation and other natural and cultural resources at the Seashore and reduces undesirable human-deer interactions in the Fire Island communities. The plan/EIS is also intended to promote public understanding of the complex relationship between deer and Seashore resources, tick-borne diseases, people, and human infrastructure. Action is needed at this time to address impacts associated with changes in white-tailed deer abundance, distribution, and behavior across the Seashore. Heavy browsing by white-tailed deer has resulted in adverse impacts on native vegetation across Fire Island as well as on natural and cultural resources at the William Floyd Estate. The presence of abundant food sources (including naturally occurring vegetation, unsecured garbage, intentional feeding, gardens/ornamental landscaping) and shelter in the Fire Island communities have resulted in adverse interactions between deer and humans and the developed environment. Adverse interactions also occur due to the habituation of deer to the unthreatening presence of humans and conditioning of deer, particularly to food sources, in the Fire Island communities and high-visitor use areas.

Alternative A (the no-action alternative) would continue to implement current management actions, policies, and monitoring efforts related to deer and their impacts. Current actions within the Seashore include limited public education and interpretation efforts, vegetation monitoring, and deer population and behavior surveys. All action alternatives (B, C, and D) would include an enhanced public education and outreach effort, fencing of the maritime holly forest within the Sunken Forest, securing the boundary fence at the William Floyd Estate, small-scale fencing to protect special-status species, increased vegetation monitoring, enhanced deer population and behavior monitoring, and close coordination with the New York State Department of Environmental Conservation. Under alternative B, additional deer browsing management actions would include fencing of the historic core at the William Floyd Estate and rotational fencing of selected forest areas at the William Floyd Estate lower acreage. The fencing would be implemented in conjunction with fertility control of white-tailed deer to gradually reduce and then maintain the deer population at an appropriate density to achieve the plan objectives. Deer observed approaching humans within the Fire Island communities would be relocated to the Fire Island Wilderness. Under alternative C (the environmentally preferable alternative), additional actions would be taken to directly reduce and maintain the deer population at an appropriate deer density to allow for vegetation regeneration. Deer population reduction and maintenance would be implemented through a combination of sharpshooting, capture and euthanasia of individual deer (where necessary), and public hunting (within the Fire Island Wilderness only). Deer observed approaching humans within the Fire Island communities would be captured and euthanized to reduce the risk of negative human-deer interactions and prevent other deer from learning this behavior through observation. Alternative D (the NPS preferred alternative) would include a

combination of actions from both alternatives B and C. The historic core at the William Floyd Estate would be fenced to exclude deer. The deer population on Fire Island and at the William Floyd Estate lower acreage would be reduced to an appropriate deer density to achieve the plan objectives through a combination of sharpshooting, capture and euthanasia of individual deer (where appropriate), and public hunting (within the Fire Island Wilderness only). Once reduced, the deer population could be maintained through fertility control or a continuation of actions used for direct reduction. Similar to alternative C, deer observed approaching humans within the Fire Island communities would be captured and euthanized.

Implementation of the preferred alternative would result in both beneficial and adverse impacts on vegetation, unique vegetation communities, and special-status plant species; wetlands; the white-tailed deer population; other wildlife and wildlife habitat; wilderness; cultural landscapes; visitor use and experience/recreation; Fire Island communities and adjacent landowners; public health and safety; and Seashore operations.

Note to Reviewers and Respondents:
The Draft plan/EIS is available for public and agency review and comment for 60 days, beginning when the U.S. Environmental Protection Agency Notice of Availability is published in the Federal Register. If you wish to comment on this plan/EIS, you may post them electronically at http://parkplanning.nps.gov/FireIslandDeerManagementPlan or you may mail comments to the name and address below. Before including your address, phone number, email address, or other personal identifying information in your comment, you should be aware that your entire comment, including your personal identifying information, may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we would be able to do so. After public review is completed, this plan/EIS will be revised in response to public comments. A final version of this plan/EIS will then be released, and a 30-day no-action period will follow. After the 30-day no-action period, the alternative or actions constituting the approved plan will be documented in a record of decision that will be signed by the Regional Director of the Northeast Region.

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Executive Summary

PURPOSE OF AND NEED FOR ACTION

PURPOSE

The purpose of this White-tailed Deer Management Plan and Environmental Impact Statement (plan/EIS) is to develop a deer management strategy that: supports protection, preservation, and restoration of native vegetation and other natural and cultural resources at the Seashore and reduces undesirable human-deer interactions in the Fire Island communities. The plan/EIS also promotes public understanding of the complex relationship between deer and Seashore resources, tick-borne diseases, people, and human infrastructure.

NEED

Since the late 1960s, the white-tailed deer (*Odocoileus virginianus*) population at Fire Island National Seashore (the Seashore) has expanded, leading to severe negative impacts on vegetation and cultural landscapes and an increase in undesirable human-deer interactions. Seashore staff have been working to understand and address issues linked to the deer population on Fire Island for 30 years. Concerns were initially focused around a noticeable increase in the number of deer within the Fire Island communities and the incidence of Lyme disease among Fire Island residents. Impacts of deer browsing on vegetation were also among the major concerns. In the mid-1980s, researchers documented a substantial decline in the diversity and abundance of key plant species in the Sunken Forest, one of the Seashore's rarest plant communities. More recently, Seashore staff have turned their attention to the threat posed by deer to native vegetation in other natural zones of the Seashore and the cultural landscape of the William Floyd Estate.

Information collected as part of research conducted at the Seashore indicates the need for a management plan to address impacts associated with changes in white-tailed deer abundance, distribution, and behavior, including

- adverse impacts on native vegetation resulting from heavy browsing by white-tailed deer
- adverse impacts on natural and cultural resources at the William Floyd Estate resulting from heavy browsing by white-tailed deer
- adverse interactions between deer and humans and the developed environment as a result of
  - the presence of abundant food sources (including naturally occurring vegetation, unsecured garbage, intentional feeding, gardens/ornamental landscaping) and shelter in the Fire Island communities
  - habituation of deer to the unthreatening presence of humans and conditioning of deer, particularly to food sources, in the Fire Island communities and high-visitor use areas

At current levels, deer browsing in the Sunken Forest and other vegetated areas of the Seashore is reducing the abundance and diversity of native vegetation, including important understory species. In some areas, current levels of browsing appear to be creating conditions for an increase in undesirable species. The loss of native vegetation and overall change in the vegetation communities could result in impacts on other wildlife species, such as groundnesting birds and small mammals using these areas for food and shelter.

As a consequence of the habituation of deer to humans on Fire Island, deer no longer flee humans. Many are also conditioned to actively seek food provided by some residents of Fire Island

communities or visitors to Fire Island. These artificial food sources include garbage, vegetable gardens, ornamental plantings, and corn (used as bait in 4-Poster Tickicide devices). This food conditioning and habituation to the presence of humans has led to behavioral changes in deer that add to various existing concerns for human health and safety, including direct physical injury to Fire Island community residents and visitors, sanitation issues regarding deer scattering garbage, and the perceived role of deer in the incidence of Lyme disease. Other concerns include damage to ornamental plantings and vegetable gardens, interactions with pets, deer feeding on garbage, and injury to deer from fences.

Additionally, current levels of browsing by deer at the William Floyd Estate are resulting in the degradation of elements of the cultural landscape. The high concentration of deer at the William Floyd Estate also contributes to the perceived risk of tick-borne diseases, which may affect visitation at the site.

OBJECTIVES

For the plan/EIS, objectives have been established for the entire Seashore, and more specific objectives have been developed for the Sunken Forest, the Fire Island communities, and the William Floyd Estate. The objectives for deer and vegetation management at the Seashore have been developed to achieve certain conditions throughout the Seashore as a whole and to achieve certain resource conditions at specific areas within the Seashore, as described below.

- Manage a viable white-tailed deer population in the Seashore that is supportive of the other objectives for this plan/EIS.
- Promote natural regeneration of native vegetation.
- Protect special-status plant species/vegetation communities and their habitat from high levels of deer browsing.
- Work collaboratively with other land management agencies on issues associated with abundance, distribution, and behavior of white-tailed deer at the Seashore.
- Improve public understanding of the issues such as human-deer interactions, and the impact of white-tailed deer on the cultural and natural resources of the Seashore, and tick-borne diseases throughout the Seashore, including the William Floyd Estate.
- Continue to expand the knowledge base regarding the relationship between deer browsing and plant communities at Fire Island National Seashore to improve management decisions.
- Within the Sunken Forest, maintain the character of the globally rare maritime holly forest in perpetuity by creating conditions for the regeneration of key canopy constituent tree species and a reasonable representation (as defined in the desired conditions description below) of herbs and shrubs that made up the Sunken Forest's vegetative composition when the Seashore was established.
- Reduce the potential for undesirable human-deer interactions both within the Fire Island communities and at other developed areas of the Seashore.
- Manage deer browse to allow for the restoration and preservation of the cultural landscape of the William Floyd Estate and for the regeneration of the forest within the lower acreage of the William Floyd Estate.

DESIRED CONDITIONS

Sunken Forest

The Sunken Forest is a globally rare ecosystem with herbaceous vegetation and forest regeneration that have been impacted by heavy browse pressure from deer. Five studies since 1967 indicate changes in the vegetation structure and composition of the Sunken Forest as the deer population expanded in the 1970s and 1980s, giving rise to the concern that forest regeneration to replace the aging canopy is limited and that the understory constituents are changing. One of the earliest studies (Art 1976) captures the vegetation composition and structure of the Sunken Forest in 1967 prior to the deer population irruption on Fire Island. Using Art's 1976 report as a guide, the desired condition is to maintain the character of the Sunken Forest, as stated in the Seashore's enabling legislation, by fostering the regeneration of key canopy constituent tree species and a reasonable representation of herbs and shrubs reminiscent of its floristic composition when Fire Island National Seashore was established (NPS 2011b).

Fire Island Communities

A desired condition of the Seashore is to reduce undesirable human-deer interactions within the Fire Island communities. Based on staff observations, deer observed approaching humans are likely responsible for the majority of the interactions in the Fire Island communities. To achieve this desired condition, the Seashore would need to focus on two goals: (1) changing the behavior of the people who intentionally and unintentionally feed deer, because they perpetuate the food conditioning of the deer and create future generations of deer that approach humans; and (2) addressing the individual deer that are highly food conditioned and already approach humans.

William Floyd Estate

The 613-acre William Floyd Estate consists of the historic house and surrounding fields of about 20 acres ("historic core" area), forests ("lower acreage"), small fields scattered among the forest setting, and a broad marsh associated with Narrow Bay. The historic core area of the William Floyd Estate experiences browsing impacts by deer at a level that causes repeated mortality of ornamental plants. Desired conditions for landscaping would be focused primarily on the historic core area. Specific character-defining features of vegetation at the William Floyd Estate are identified in the cultural landscape inventory (NPS 2006b), including the lopped tree line, the West Garden, a small orchard in the West Garden, planted trees southwest of the Mastic House, and ornamental trees and shrubs. A desired condition is sustainable management of those same ornamental plants or comparable alternatives and full restoration of the character of the historic core area for aesthetics and public interpretation. The Seashore would also like to promote native forest regeneration, particularly oaks and hickories within the William Floyd Estate forests.

DESCRIPTION OF THE PROJECT AREA

PROJECT LOCATION

The Seashore is located in Suffolk County in southeastern New York State, on the south shore of Long Island, approximately 70 miles east-southeast of New York City. The Seashore encompasses 19,579 acres of barrier island natural systems including marine waters, uplands, 1,381 acres of wilderness, and the historic William Floyd Estate. The William Floyd Estate is located on the southern coast of Long Island, in the village of Mastic Beach. The barrier island (Fire Island) is

separated from Long Island by the Great South Bay and is bordered by the Atlantic Ocean to the south, Fire Island Inlet to the west, and Moriches Inlet to the east. Upland areas of the Seashore include 26 miles of the barrier island beginning at Moriches Inlet west to the boundary of Robert Moses State Park and averages less than 1 mile in width, and the approximately 613-acre William Floyd Estate in Mastic Beach, Long Island (NPS 2012b).

Three breaches formed on Fire Island during Hurricane Sandy, and one still remains. The open breach is located in an area known as Old Inlet toward the eastern portion of the Otis Pike Fire Island High Dune Wilderness (Fire Island Wilderness). This open breach migrated rapidly westward over the winter storm season of 2012–2013 following Hurricane Sandy, but since then it has stayed relatively stable.

On Fire Island, 17 private residential communities and the Smith Point County Park are within the Seashore's administrative boundary. The eastern boundary of Robert Moses State Park is the west boundary of the Seashore.

WHITE-TAILED DEER POPULATION

Prior to the establishment of the Seashore in 1964, very few deer occupied Fire Island (O'Connell 1989). It is likely that the early deer population expanded from the remote natural areas on the eastern side of the Fire Island to the western side as deer were attracted to artificial food sources (e.g., gardens, garbage, lawns) in Fire Island communities. By the 1970s and 1980s the deer population had become established in Fire Island communities due to high survival rates and the availability of high-quality habitats (Underwood 1991). As a result, the Seashore began to take steps toward better understanding the population and impacts on Seashore resources. Over the decades, deer abundance has been estimated using different techniques. The deer population peaked in the mid-1990s, when the deer density on Fire Island exceeded 257 deer per square mile in some areas (Underwood 2005).

According to Seashore staff, few if any deer occupied the William Floyd Estate when the property was donated to the National Park Service in 1976. Distance sampling data collected in 2012 estimated the deer population to be approximately 106 deer per square mile (NPS 2013d). The latest (2012) deer density estimates (plus or minus the noted standard error) for the Seashore are provided in table ES-1 below.

TABLE ES-1. DEER POPULATION ESTIMATES FOR PORTIONS OF FIRE ISLAND NATIONAL SEASHORE (2012)

Location	Deer Density (deer per square mile)	Number of Deer
Robert Moses State Park	70 ± 10	60 ± 8
Lighthouse Tract	10 ± 5	2 ± 1
Kismet-Lonelyville	227 ± 42	80 ± 15
Ocean Beach – Ocean Bay Park	126 ± 14	37 ± 4
Sailors Haven-Sunken Forest	112 ± 24	27 ± 6
Fire Island Pines	149 ± 29	26 ± 5
Davis Park	137 ± 25	10 ± 2
Fire Island Wilderness	54 ± 6	91 ± 11
William Floyd Estate	106 ± 17	96 ± 16

Source: NPS 2013b

Little is known about individual deer movements at the Seashore. Telemetry data on 20 deer from the 1980s documented one instance of deer moving off Fire Island and rare instances when deer traveled long distances across Fire Island, but in general, most deer (particularly females) remained in smaller, established home ranges, typically 1.5 miles in length (O'Connell and Sayre 1988). Deer on the western side of the Fire Island Pines/Talisman had higher body weights from nutritional benefits within the Fire Island communities (from artificial food sources such as ornamental plantings, gardens, and intentional feeding) and were much more habituated to humans, whereas deer on the eastern side of the Fire Island had lower body weight, and many exhibited a flight response when approached (O'Connell and Sayre 1989; Underwood 2005). While some deer may occupy a home range that includes both Fire Island communities and natural areas, scientists do not know the frequency or timing of movements between those areas.

ALTERNATIVES

The alternatives under consideration include a no-action alternative and three action alternatives. Under alternative A: no action, existing deer management and monitoring efforts throughout the Seashore would continue. These actions include continued public education/interpretation efforts, vegetation monitoring, and deer population and behavior surveys. Each of the action alternatives (alternatives B, C, and D) includes the monitoring and education actions proposed under alternative A. In addition, all action alternatives would enhance those education efforts and propose to work collaboratively with the Fire Island communities, New York State Department of Environmental Conservation, New York State Parks, Suffolk County Parks, and local environmental groups on wildlife issues within the Fire Island communities. Each action alternative would manage undesirable human-deer interactions, protect native plant communities and cultural plantings, promote forest regeneration, and gradually reduce the deer population in the Seashore.

ELEMENTS COMMON TO ALL ALTERNATIVES

The following actions would continue under alternative A and would also be common to all action alternatives:

- human-deer interaction management
  - education/interpretation
  - deer behavior monitoring
  - incident reporting and response
- vegetation monitoring
- deer population monitoring

ALTERNATIVE A

Under the no-action alternative, the Seashore would continue to implement current management actions, policies, and monitoring efforts related to deer and their effects. Current actions within the Seashore include limited public education/interpretation efforts, vegetation monitoring, early detection and rapid response to invasive plant species, and deer population surveys.

ELEMENTS COMMON TO ACTION ALTERNATIVES

In addition to continuing the elements described under alternative A (public education/interpretation efforts, incident reporting and response, deer and vegetation monitoring), the actions below would be common to all action alternatives:

- enhanced public education and outreach effort
- fencing of the Sunken Forest
- securing the boundary fence at the William Floyd Estate
- tri-annual enhanced vegetation monitoring
- annual enhanced deer population monitoring
- minimum requirements analysis (for actions in the Fire Island Wilderness)
- coordination with the New York State Department of Environmental Conservation

ALTERNATIVE B

Under alternative B, deer observed approaching humans within the Fire Island communities would be translocated to the Fire Island Wilderness. Deer browsing management actions would include exclosure fencing in the Sunken Forest (approximately 44 acres of maritime holly forest), fencing of an area encompassing the historic core at the William Floyd Estate (approximately 80 acres), rotational fencing of selected forest areas at the William Floyd Estate lower acreage (approximately 66 acres at one time), and small-scale fencing to protect special-status species. The fencing would be implemented in conjunction with fertility control of white-tailed deer to gradually reduce and then maintain the deer population at an appropriate density to achieve the plan objectives (estimated at 20 deer per square mile across Fire Island and 20 deer per square mile at the William Floyd Estate). Fertility control would be implemented using a chemical reproductive control agent (when an acceptable agent, i.e., an agent meeting criteria specified in the plan/EIS, becomes available). For the purpose of including a diverse array of management alternatives, the plan/EIS assumes an acceptable chemical reproductive control agent that meets all of the established criteria may be available within 10 years. Once adequate levels of tree seedling recruitment have been reached, it may be possible to eliminate or reduce fencing. This would be assessed using adaptive management.

ALTERNATIVE C

Under alternative C, deer browse would be managed through exclosure fencing in the Sunken Forest (approximately 44 acres of maritime holly forest) and small-scale fencing to protect special-status species and key plants within the William Floyd Estate historic core. Actions would be taken to directly reduce and maintain the deer population at an appropriate deer density to allow for regeneration (estimated at 20 deer per square mile across Fire Island and 20 deer per square mile at the William Floyd Estate). The deer population would be reduced and maintained through a combination of sharpshooting, capture and euthanasia of individual deer (where necessary), and public hunting (within the Fire Island Wilderness only). Deer observed approaching humans within the Fire Island communities would be captured and euthanized to reduce the risk of negative human-deer interactions and prevent other deer from learning this behavior through observation. Alternative C has been identified as the environmentally preferable alternative.

ALTERNATIVE D

Deer browsing management actions would include exclosure fencing in the Sunken Forest (approximately 44 acres of maritime holly forest), fencing of an area encompassing the historic core at the William Floyd Estate (approximately 80 acres), and small-scale fencing to protect special-status species. The deer population would be reduced to an appropriate deer density to achieve the plan objectives (estimated at 20 deer per square mile across Fire Island and 20 deer per square mile at the William Floyd Estate) through a combination of sharpshooting, capture and euthanasia of individual deer (where appropriate), and public hunting (within the Fire Island Wilderness only). Once reduced, the deer population could be maintained through fertility control. Fertility control would be implemented using a chemical reproductive control agent (when an acceptable agent becomes available). Until an acceptable and effective reproductive control agent becomes available, the deer population would be maintained using the same methods used for direct reduction as described above. Deer observed approaching humans within the Fire Island communities would be captured and euthanized to reduce the risk of negative human-deer interactions and prevent other deer from learning this behavior through observation. Alternative D has been identified as the NPS preferred alternative.

ENVIRONMENTAL CONSEQUENCES

To focus the environmental analysis in this plan/EIS, the issues identified during scoping were used to derive a number of impact topics, which are resources of concern that could be affected, either beneficially or adversely, by implementing any of the proposed alternatives. The impact topics are outlined below, and table ES-2 provides a summary of the environmental consequences.

VEGETATION, UNIQUE VEGETATION COMMUNITIES, AND SPECIAL-STATUS PLANT SPECIES

The Seashore contains a variety of vegetation communities such as the Northern Beach Grass Dune and Maritime Deciduous Scrub Forest in upland areas, the maritime holly forest, and tidal marshes along the backbay shoreline. Deer population reduction as a result of deer management actions would promote vegetation richness and plant abundance because the impact of deer browse would be reduced.

The following state- and federally listed plant species occur within the Seashore: the state endangered and federally threatened seabeach amaranth (*Amaranthus pumilus*); the state endangered spring lady's tresses (*Spiranthes vernalis*), the state threatened marsh straw sedge (*Carex hormathodes*) and swamp sunflower (*Helianthus angustifolius*); the state-listed rare seabeach knotweed (*Polygonum glaucum*); and the state endangered dark-green sedge (*Carex venusta*), rough rush-grass (*Sporobolus clandestinus*), golden dock (*Rumex fueginus*), narrow-leaf sea-bite (*Suaeda linearis*), and slender marsh-pink (*Sabatia campanulata*).

WETLANDS

Over 800 acres of tidal marsh wetlands and 112 acres of freshwater dunal wetlands occur on Fire Island according to Klopfer et al. (2002). Tidal systems include low marsh and high marsh found primarily on the bay side of the Seashore and at the southern end of the William Floyd Estate. Freshwater systems include highbush blueberry swamp, northern interdunal cranberry swale wetlands, reed marsh dominated by the invasive species *Phragmites australis*, and red-

maple/blackgum swamp. White-tailed deer use these existing wetlands as a foraging source, and may cause some impacts due to deer browse and trampling of individual plants. In addition, the Seashore may consider the use of fences for browse control, some of which may bisect wetlands when installed.

WHITE-TAILED DEER POPULATION

Management actions proposed in this plan/EIS have the potential to affect the abundance, distribution, behavior, and in some cases physiology of deer at the Seashore. Management actions could cause deer to avoid certain areas in the Seashore. This could result in higher competition for resources in other areas and increased movement across the Seashore boundary.

OTHER WILDLIFE AND WILDLIFE HABITAT

Other wildlife, including mammals and birds, are affected by the existing deer population, primarily as a result of the alteration of available suitable habitat or direct competition for limited food resources. Impacts of heavy browsing on vegetation-dependent wildlife communities are well documented and include changes in species composition, abundance, and distribution. Reductions in white-tailed deer population densities would reduce competition for food and deer browsing. This could result in changes to feeding and nesting patterns for other wildlife within the Seashore. Noise associated with management actions could cause temporary changes in daily movement patterns and selection of feeding or breeding/nesting sites for other wildlife.

WILDERNESS

A wilderness area is defined, in part, as "an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain… An area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation" (PL 88-577). Pursuant to Public Law 95-585, the Fire Island Wilderness was established in the Seashore and is the only federally designated wilderness area in New York State. Deer management efforts within wilderness have the potential to affect the wilderness character.

CULTURAL LANDSCAPES

A cultural landscape inventory has been completed at the William Floyd Estate, and evidence of deer browse on vegetation has been documented by Seashore staff. The proposed alternatives would be designed, in part, to reduce the impact of deer browse on the cultural landscape at the William Floyd Estate.

VISITOR USE AND EXPERIENCE/RECREATION

The implementation of some of the proposed actions could have an impact on visitor use and experience. Some visitors to the Seashore view deer sightings as an integral part of their visit. Deer management actions may decrease the potential for visitors to observe deer within the Seashore, reducing satisfaction for some visitors. Conversely, there are visitors who come to the Seashore to enjoy other resources, such as to observe songbirds. Increased deer browse has the potential to impact these other resources and impact the satisfaction of these visitors.

Management activities such as reproductive treatments or direct reduction, or translocation may require visitors to be prohibited from certain areas of the Seashore. Additionally, some visitors may be opposed to the proposed management actions. As the alternatives are implemented, some visitor experiences may change as the deer population is reduced.

FIRE ISLAND COMMUNITIES AND ADJACENT LANDOWNERS

In addition to federally owned land, the Seashore encompasses 17 private communities and towns, Smith Point County Park, and three municipal beaches (Bellport Beach, Leja Beach/Davis Park, and Atlantique Beach). Robert Moses State Park is adjacent to the western end of the Seashore. Many Fire Island community residents enjoy the presence of deer and actively feed them to attract them to their property. However, community residents also have concerns related to browse on native vegetation (i.e., private landscaping), access to trash, disease transmission (i.e., Lyme disease), and habituation of deer. Because the deer population on Fire Island migrates between the Seashore and Fire Island communities, deer management efforts proposed in the alternatives would likely affect the presence of deer on adjacent properties.

PUBLIC HEALTH AND SAFETY

Any deer management activities would be conducted in a manner that would minimize risk to the safety of members of the public and Seashore employees; however, there are some inherent safety risks. In addition, tick-borne diseases pose health risks to Seashore visitors or area residents, as well as the larger Long Island area. Blacklegged ticks (*Ixodes scapularis*) carry Lyme disease, and the Department of Health and Human Services Center for Disease Control and Prevention has stated that abundant deer and rodent hosts are necessary to maintain the spirochete *Borrelia burgdorferi*, the causative agent of Lyme disease. Though deer cannot transmit the disease to humans or ticks, a high deer population may support an increased tick population compared to lower deer densities (CDC 2012; Stafford 2007).

SEASHORE OPERATIONS

Seashore staff and funding are used to promote the visitor experience and protect and monitor natural and cultural resources. Past and current monitoring of the Seashore's vegetation and deer population have been driven by available staff and funding. Proposals made in this plan/EIS could result in changes to staffing and funding.

CONSULTATION AND COORDINATION

INTERNAL SCOPING

Internal scoping meetings were held to provide opportunities for the NPS team to initiate the NEPA planning process and discuss the management of white-tailed deer at the Seashore and to develop the alternatives that are considered in this plan/EIS. The internal scoping process continued throughout the development of the plan/EIS through regular conference calls.

PUBLIC SCOPING AND OUTREACH

The Seashore published the Notice of Intent to prepare an EIS in the *Federal Register* on June 17, 2011. The Seashore also issued a press release on June 17, 2011. These documents represented the beginning of the public scoping and outreach process. In addition, the Seashore published three newsletters (summer 2011, fall 2012, and fall 2013) that were provided to known stakeholders and posted on the NPS Planning, Environment, and Public Comment website (http://parkplanning.nps.gov/FireIslandDeerManagementPlan).

COOPERATING AGENCIES

The National Park Service invited the New York State Department of Environmental Conservation and the U.S. Department of Agriculture Animal and Plant Health Inspection Services to be cooperating agencies for the plan/EIS in letters dated November 29, 2011. Each agency accepted this offer in memoranda of understanding finalized on July 3, 2012. The cooperating agencies participated in the monthly interdisciplinary team status calls and the development of alternatives, provided information in their areas of technical expertise, and had the opportunity to comment on the internal review draft plan/EIS as it was prepared.

AGENCY AND TRIBAL CONSULTATION

In addition to establishing which agencies would serve as cooperating agencies, as described above, other agencies were consulted to aid in identification of potential issues to be addressed in the plan/EIS. The following agencies were consulted during the planning process:

- Federal Agencies
  - U.S. Fish and Wildlife Service for compliance with section 7 of the Endangered Species Act
  - New York State Historic Preservation Officer (SHPO) for compliance with section 106 of the National Historic Preservation Act
- American Indian Tribes for compliance with section 106 of the National Historic Preservation Act
  - Unkechaug Indian Nation
  - Shinnecock Indian Nation
- State and Local Agencies
  - New York State Department of Environmental Conservation, a cooperating agency
  - NYS-DEC Division of Fish, Wildlife and Marine Resources
  - New York State Department of State (Coastal Management Program) for compliance with the Coastal Zone Management Act

TABLE ES-2. SUMMARY OF SIGNIFICANCE

Impact Topic	Alternative A	Alternative B	Alternative C	Alternative D
Vegetation, Unique Vegetation Communities, and Special-status Plant Species	The adverse impacts on vegetation/unique vegetative communities 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.	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.	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.	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.

TABLE ES-2. SUMMARY OF SIGNIFICANCE (CONT'D)

Impact Topic	Alternative A	Alternative B	Alternative C	Alternative D
Wetlands	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.	The 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.	The 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.	The 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.
White-Tailed Deer	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.	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.	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 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.

TABLE ES-2. SUMMARY OF SIGNIFICANCE (CONT'D)

Impact Topic	Alternative A	Alternative B	Alternative C	Alternative D
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.	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.	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.	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 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.

TABLE ES-2. SUMMARY OF SIGNIFICANCE (CONT'D)

Impact Topic	Alternative A	Alternative B	Alternative C	Alternative D
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.	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.	Neither beneficial nor adverse impacts on wilderness would not 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.	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.

TABLE ES-2. SUMMARY OF SIGNIFICANCE (CONT'D)

Impact Topic	Alternative A	Alternative B	Alternative C	Alternative D
Cultural Landscapes (William Floyd Estate)	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.	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.	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.	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.
Visitor Use and Experience/ Recreation	Neither adverse nor beneficial impacts on visitor use and experience/recreation would not 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.	Neither adverse nor beneficial impacts on visitor use and experience/recreation would not 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.	Neither adverse nor beneficial impacts on visitor use and experience/recreation would not 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.	Neither adverse nor beneficial impacts on visitor use and experience/recreation would not 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.
Fire Island Communities and Adjacent Landowners	Neither adverse nor beneficial impacts on Fire Island communities and adjacent landowners would not 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.	Neither adverse nor beneficial impacts are not 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.	Neither adverse nor beneficial impacts are not 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.	Neither adverse nor beneficial impacts are not 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.

TABLE ES-2. SUMMARY OF SIGNIFICANCE (CONT'D)

Impact Topic	Alternative A	Alternative B	Alternative C	Alternative D
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.	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.	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.	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.
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.	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.	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.	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.

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ACRONYMS AND ABBREVIATIONS

APHIS	[U.S. Department of Agriculture] Animal and Plant Health Inspection Services
CEQ	Council on Environmental Quality
CFR	code of federal regulations
CWD	chronic wasting disease
CZMA	Coastal Zone Management Act
dbh	diameter at breast height
DSC	[National Park Service] Denver Service Center
ECL	[New York State] Environmental Conservation Law
EIS	environmental impact statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act of 1973
FIA	Forest Inventory and Analysis
Fire Island Wilderness	Otis Pike Fire Island High Dune Wilderness
FTE	full-time equivalent
FY	fiscal year
IDT	interdisciplinary team
IPAC	[U.S. Fish and Wildlife Service] Information, Planning, and Conservation System
National Register	National Register of Historic Places
NEPA	National Environmental Policy Act of 1969
NHPA	National Historic Preservation Act of 1966
NPS	National Park Service
NVCS	National Vegetation Classification System
NYS-DEC	New York State Department of Environmental Conservation
OCRM	[National Oceanic and Atmospheric Administration] Office of Ocean and Coastal Resource Management
PEPC	[National Park Service] Planning, Environment, and Public Comment
PL	Public Law
plan/EIS	White-tailed Deer Management Plan and Environmental Impact Statement
PZP	porcine zona pellucida
the Seashore	Fire Island National Seashore
SHPO	State Historic Preservation Officer
USC	United States Code
USFWS	U.S. Fish and Wildlife Service

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Purpose of and Need for Action

1

INTRODUCTION

Since the late 1960s, the white-tailed deer (*Odocoileus virginianus*) population at Fire Island National Seashore (the Seashore) has expanded, leading to severe negative impacts on vegetation and cultural landscapes and an increase in undesirable human-deer interactions. As a result, the National Park Service (NPS) is preparing this White-tailed Deer Management Plan and Environmental Impact Statement (plan/EIS). The plan/EIS evaluates a range of alternative strategies and methods for white-tailed deer management, examines existing resource conditions, and analyzes the potential impacts on these resources as a result of the proposed management options. The plan/EIS complies with the National Environmental Policy Act of 1969 (NEPA), its implementing regulations (40 CFR [Code of Federal Regulations] 1500–1508), Department of the Interior (USDI) NEPA regulations (43 CFR 46), the NPS Director's Order 12: *Conservation Planning, Environmental Impact Analysis, and Decision-making* (NPS 2011c), and the accompanying Director's Order 12 Handbook (NPS 2001).

The plan/EIS has been prepared in cooperation with the New York State Department of Environmental Conservation (NYS-DEC) and the U.S. Department of Agriculture Animal and Plant Health Inspection Services. In addition, a team of agency scientists and subject matter experts (the science team) assisted with the planning process by evaluating scientific literature and research on the topics of deer management, human-deer interactions, and vegetation management; and reviewing and recommending monitoring protocols for deer populations, vegetation, and other Seashore resources. The National Park Service has used this information, results from public scoping, and recommendations from individuals with professional expertise to create a full range of alternatives to achieve the purpose, need, and objectives for the plan/EIS. The alternatives are adaptive and dynamic, allowing the National Park Service to consider new scientific information and make changes in management actions over time.

The "Purpose of and Need for Action" chapter explains the intent of the plan/EIS for the Seashore and the reason the National Park Service is taking action at this time. Ultimately, upon conclusion of the planning and decision-making process, an alternative will be selected and will guide the long-term management of white-tailed deer at the Seashore using an adaptive management approach.

PURPOSE OF AND NEED FOR ACTION

PURPOSE OF THE PLAN/EIS

The purpose of the plan/EIS is to develop a deer management strategy that supports protection, preservation, regeneration, and restoration of native vegetation and other natural and cultural resources at the Seashore and reduces undesirable human-deer interactions in the Fire Island communities. The plan/EIS is also intended to promote public understanding of the complex relationship between deer and Seashore resources, tick-borne diseases, people, and infrastructure.

NEED FOR ACTION

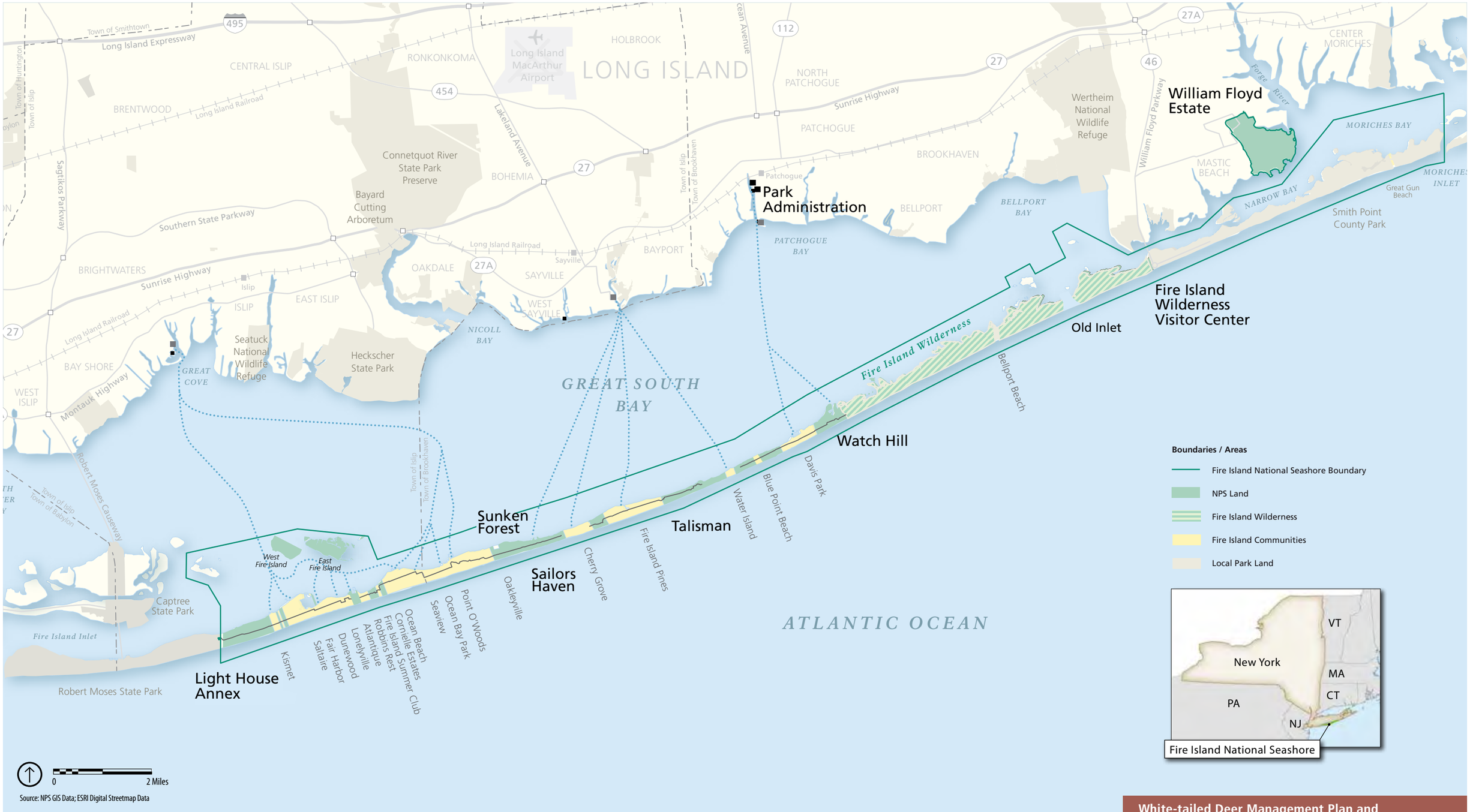
Seashore staff have been working to understand and address issues linked to the deer population on Fire Island for 30 years. Information collected as part of the research conducted at the Seashore indicates the need for a management plan to address impacts associated with changes in white-tailed deer abundance, distribution, and behavior, including the following:

- adverse impacts on native vegetation resulting from heavy browsing by white-tailed deer
- adverse impacts on natural and cultural resources at the William Floyd Estate resulting from heavy browsing by white-tailed deer
- adverse interactions between deer and humans and the developed environment as a result of
  - the presence of abundant food sources (including naturally occurring vegetation, unsecured garbage, intentional feeding, gardens, ornamental landscaping), and shelter in the Fire Island communities
  - habituation of deer to the unthreatening presence of humans and conditioning of deer, particularly to food sources, in the Fire Island communities and high-visitor use areas

At current levels, deer browsing in the Sunken Forest and other vegetated areas of the Seashore is reducing the abundance and diversity of native vegetation, including important understory species. The Sunken Forest is a globally rare ecological community on Fire Island where heavy browse pressure from deer has clearly adversely impacted forest regeneration and the species diversity and abundance of herbaceous vegetation. Management of this particular holly maritime forest is an important component of the plan/EIS in keeping with the Seashore's enabling legislation, which specifically calls out the protection of the Sunken Forest Preserve. The relationship between the Sunken Forest and the Sunken Forest Preserve are described later in this chapter. The vegetation composition and structure of the Sunken Forest was documented in 1967 prior to the deer population irruption on Fire Island. The study provides a comprehensive description of percent herbaceous cover, shrub and tree species, and their densities (Art 1976).

Additionally, current levels of browsing by deer at the William Floyd Estate are resulting in the degradation of elements of the cultural landscape, particularly ornamental plantings in the West Garden and natural vegetation in the surrounding woodland. In the West Garden, deer browse inhibits the maintenance of the gardens as they existed in the early 20th century. In the woodlands surrounding the lower acreage, deer browse reduces natural vegetation regeneration. The high concentration of deer at the William Floyd Estate also contributes to the perceived risk of tick-borne diseases, which may affect visitation at the site.

Seventeen communities are within the Seashore boundary but are not situated on federally owned land (figure 1). Deer reside within these communities, having established a common presence that some residents and visitors have come to enjoy, while others consider it a nuisance (Leong and Decker 2007). Behavioral shifts have occurred (both by deer and humans) over the years because the deer have become habituated to humans and conditioned to human food. This has led to undesirable human-deer interactions such as deer approaching humans, people intentionally feeding deer, people unintentionally feeding deer via unsecured garbage or ornamental plants, deer using residential storage areas and lower house levels as shelters, and negative dog-deer interactions. These undesirable interactions raise the risk of human injury by physical contact with deer and increase the likelihood of property damage by deer. In addition, higher numbers of deer and a limited understanding of the relationship between deer and tick-borne diseases promote the perception by Fire Island community residents of a higher risk of contracting Lyme disease. Other concerns include interactions with pets and injury to deer from fences.



White-tailed Deer Management Plan and Environmental Impact Statement

FIGURE 1
Project Vicinity Map

National Park Service
U.S. Department of the Interior

Fire Island National Seashore

Human-deer Interaction (Photo credit: NPS)

OBJECTIVES IN TAKING ACTION

Objectives help define what must be achieved for the National Park Service to consider the plan a success, help shape the range of alternatives for management options, and set the framework for the analysis of alternatives. For the plan/EIS, objectives have been established for the entire Seashore, and more specific objectives have been developed for the Sunken Forest, the Fire Island communities, and the William Floyd Estate. The objectives for deer management at the Seashore have been developed to achieve certain conditions throughout the Seashore as a whole and to achieve certain resource conditions at specific areas within the Seashore, as described below:

- Manage a viable white-tailed deer population in the Seashore that is supportive of the other objectives for this plan/EIS.
- Promote natural regeneration of native vegetation.
- Protect special-status species/vegetation communities and their habitat from high levels of deer browsing.
- Work collaboratively with other land management agencies on issues associated with abundance, distribution, and behavior of white-tailed deer at the Seashore.
- Improve public understanding of the issues such as human-deer interactions, the impact of white-tailed deer on the cultural and natural resources of the Seashore, and tick-borne diseases throughout the Seashore, including the William Floyd Estate.
- Continue to expand the knowledge base regarding the relationship between deer browsing and plant communities at Fire Island National Seashore to improve management decisions.
- Within the Sunken Forest, maintain the character of the globally rare maritime holly forest, as stated in the Seashore's enabling legislation, by fostering the regeneration of key canopy constituent tree species and a reasonable representation (as defined in the desired conditions description below) of herbs and shrubs that made up the Sunken Forest's vegetative composition when the Seashore was established.
- Reduce the potential for undesirable human-deer interactions both within the Fire Island communities and at other developed areas of the Seashore.
- Manage deer browse to allow for the restoration and preservation of the cultural landscape of the William Floyd Estate and for the regeneration of the forest within the lower acreage of the William Floyd Estate.

DESIRED CONDITIONS

The National Park Service defines desired conditions as resource conditions that the National Park Service aspires to achieve and maintain over time, and the conditions necessary for visitors to understand, enjoy, and appreciate those resources. The National Park Service has established different desired conditions for different portions of the Seashore influenced by how the deer herd is impacting the natural resources and visitor experience. This section describes the desired conditions, which provides the baseline for what the Seashore wishes to achieve in each of the geographic areas.

FIRE ISLAND COMMUNITIES

An important component of this plan would be improving the cooperative effort between the Fire Island communities and the Seashore in addressing the behaviors of residents and vacationers who promote food conditioning of deer. During the 2008–2011 deer density counts, biologists recorded instances in which deer were being fed by humans or foraging through unsecured garbage. During surveys, approximately 11% of deer were observed feeding from overturned trashcans, and approximately 11% of deer were being directly fed by a person. A desired condition of the Seashore is to reduce these undesirable human-deer interactions within the Fire Island communities (NPS 2011a).

Private residences in a Fire Island community
(Photo credit: VHB)

SUNKEN FOREST

The vegetation composition and structure of the Sunken Forest (including percent herbaceous cover, shrub and tree species and their densities) was documented in 1967 prior to the deer population irruption on Fire Island (Art 1976). The science team recommended that the Seashore use this report as a baseline to establish desired vegetation conditions for the Sunken Forest. Therefore, the desired condition is to maintain the character of the Sunken Forest, as stated in the Seashore's enabling legislation, by fostering the regeneration of key canopy constituent tree species and a reasonable representation of herbs and shrubs reminiscent of its floristic composition when Fire Island National Seashore was established (NPS 2011b).

FIRE ISLAND NATURAL AREAS

Natural areas of local and regional importance (other than the Sunken Forest and William Floyd Estate) occur on Fire Island. These areas include maritime forests at the Carrington Estate, Talisman, Blue Point, and in the Otis Pike Fire Island High Dune Wilderness (Fire Island Wilderness). Seashore managers wish to sustain naturally regenerating forests. While these areas

do not have defined vegetation targets, the vegetation monitoring completed before the implementation of this plan/EIS will help seashore mangers detect a response in the vegetation following management. Therefore, the Seashore has set the desired condition in these areas would be to see a positive response in vegetation an increase in species diversity.

WILLIAM FLOYD ESTATE

The 613-acre William Floyd Estate (figure 2) consists of the historic house and surrounding fields of about 20 acres ("historic core" area), forests ("lower acreage"), small fields scattered among the forest setting, and a broad marsh associated with Narrow Bay. The historic core area of the William Floyd Estate experiences browsing impacts by deer at a level that causes repeated mortality of ornamental plants. Desired conditions for landscaping would be focused primarily on the historic core area. Specific character-defining features of vegetation at the William Floyd Estate are identified in the cultural landscape inventory (NPS 2006b), including the lopped tree line, the West Garden, a small orchard in the West Garden, planted trees southwest of the Mastic House, and ornamental trees and shrubs. A desired condition is sustainable management of those same ornamental plants or comparable alternatives and full restoration of the character of the historic core area for aesthetics and public interpretation. The Seashore would also like to promote native forest regeneration, particularly oaks and hickories within the William Floyd Estate forests.

Orchard trees on the William Floyd Estate (Photo credit: NPS)

White-tailed Deer Management Plan and Environmental Impact Statement

National Park Service
U.S. Department of the Interior

Fire Island National Seashore

FIGURE 2
William Floyd Estate

DESCRIPTION OF FIRE ISLAND NATIONAL SEASHORE

PROJECT LOCATION

Established in 1964, the Seashore encompasses 19,579 acres of upland, tidal, and submerged lands along a 26-mile stretch of the 32-mile barrier island–part of a much larger system of barrier islands and bluffs stretching from New York City to the very eastern end of Long Island at Montauk Point. The Seashore is located in Suffolk County in southeastern New York State, on the south shore of Long Island, approximately 70 miles east-southeast of New York City. An extensive dunes system, centuries-old maritime forests, and solitary beaches are easily accessed on Fire Island. Also on Fire Island, within the boundary of the Seashore, are 1,381 acres of federally designated wilderness and the Light House Annex. Nearby on Long Island, also part of the Seashore, is the William Floyd Estate, the home of one of New York's signers of the Declaration of Independence.

On Long Island, the Seashore's headquarters are located in Patchogue and include administrative offices, a maintenance facility, and a ferry terminal. The William Floyd Estate is located on the southern coast of Long Island, in the village of Mastic Beach. Facilities at the William Floyd Estate include structures to accommodate visitors, maintenance equipment, and curatorial storage. The barrier island (Fire Island) is separated from Long Island by the Great South Bay and is bordered by the Atlantic Ocean to the south, Fire Island Inlet to the west, and Moriches Inlet to the east. Upland areas of the Seashore include 26 miles of the barrier island beginning at Moriches Inlet west to the boundary of Robert Moses State Park, an average of less than 1 mile wide, and the approximately 613-acre William Floyd Estate (NPS 2012b). The waters of the Great South Bay account for approximately 15,000 acres of the Seashore. The bottom lands of the Great South Bay are owned by the towns of Brookhaven and Islip and the Nature Conservancy (NPS 2012b).

Three breaches that formed on Fire Island during Hurricane Sandy in 2012, and one still remains. The open breach is located in an area known as Old Inlet toward the eastern portion of the Fire Island Wilderness. This open breach migrated rapidly westward over the winter storm season of 2012–13 following Hurricane Sandy, but since then it has remained relatively stable.

On Fire Island, interspersed within the Seashore are 17 private residential communities established before the Seashore's authorization. Resort development on Fire Island began as early as 1855, with a number of the communities having been established prior to the Great Depression of the 1930s. While the Fire Island communities lie within the administrative boundary of the Seashore, the Seashore has limited authority over the Fire Island communities and does not directly manage them. Some Fire Island communities are legally incorporated as independent governmental entities with elected officials, and others have legal ties to towns and other communities on Long Island. The Seashore's enabling legislation includes provisions for private land to be retained or developed if zoning requirements are met. No hard-surfaced roads connect the Fire Island communities, either to each other or to Long Island. They are accessible mainly by passenger ferry or private boat. Off-road vehicle use is restricted within the boundary of the Seashore on Fire Island. Without paved roads and with limited traffic, the Fire Island communities have retained much of their original character. Some of the Fire Island communities have hotels or facilities for overnight guests, while others are strictly residential. There are approximately 4,100 developed properties on Fire Island with approximately 300 residents living on Fire Island year-round. The number of year round residents has slowly and steadily declined in recent years. Vehicle access is limited to year-round residents, contractors and other service providers (telephone, fuel, garbage, etc.); all vehicles crossing federal lands must have an NPS driving permit.

During the summer season, the population of Fire Island swells to approximately 30,000, with a total of 2–3 million visitors arriving each year. Recreational visitation to sites and facilities owned or managed by the Seashore in 2011 was 520,000. The Seashore's primary visitor facilities located on Fire Island are the Light House Annex, Sailors Haven, Watch Hill, and the Fire Island Wilderness. Light House Annex is maintained and operated by the Fire Island Lighthouse Preservation Society, which offers tours and other visitor programs. Concessioners operate the marina at Sailors Haven as well as the marina and campground at Watch Hill. The Seashore maintains visitor services facilities at the eastern edge of the Fire Island Wilderness, Sailors Haven, Talisman, and Watch Hill. The Seashore offers lifeguarded swimming areas at Sailors Haven and Watch Hill. Also located on Fire Island are ranger stations, visitor contact facilities, maintenance facilities, and several units of Seashore housing. Located at either end of Fire Island are major state and county beaches with sizable visitation that are accessible by vehicle.

PURPOSE AND SIGNIFICANCE OF FIRE ISLAND NATIONAL SEASHORE

Purpose

Together with the Fire Island communities, government agencies, and other partners, the Seashore conserves, preserves, and protects for the use and appreciation of current and future generations relatively unspoiled and undeveloped beaches, dunes, and other natural features and processes. These include Fire Island's larger landscape and its surrounding marine environment. These resources possess high natural and aesthetic values to the nation as examples of great natural beauty and wildness in close proximity to large concentrations of urban population. The Seashore also conserves, preserves and protects the historic structures, cultural landscapes, museum collections and archeological resources associated with the Seashore including the Fire Island Light Station and the William Floyd Estate. Finally, the Seashore preserves the primitive and natural character of the Otis Pike Fire Island High Dune Wilderness and protects its wilderness character.

Significance

Fire Island National Seashore is part of a barrier island system encompassing relatively unspoiled and undeveloped beaches, dunes, marine environment and other natural features and dynamic processes within close proximity to the largest concentration of population of any national seashore in the United States. The dynamic barrier island environment of Fire Island has attracted and influenced a variety of human uses over hundreds of years. It has also been shaped by this continuum of human involvement, giving rise to the distinctive relationship between the built and natural environments. The resources which determine the Seashore's national significance include the following:

- The Sunken Forest, a 250-300 year old American holly-shadblow-sassafras maritime forest, is a globally rare and important habitat in the Northeastern United States.
- Fire Island National Seashore provides important habitat for marine and terrestrial plants and animals, including a number of rare, threatened and endangered species.
- Situated along the Atlantic Flyway, Fire Island is a globally important area for more than 330 migratory, over wintering and resident bird species.
- The Otis Pike Fire Island High Dune Wilderness, the only federally designated wilderness in New York State, lies within the most populous metropolitan area in the United States, offering a rare opportunity for a broad spectrum of the American public to experience wilderness.

- Owned and occupied by the Floyd Family from 1720 to 1976, the William Floyd Estate was the home of General William Floyd, a signer of the Declaration of Independence.

Fire Island Light was constructed in 1858 and has served as a critical navigation aid for the port of New York for more than 150 years. An active light has been at this location since 1826.

SCIENTIFIC BACKGROUND: DEER AND VEGETATION MANAGEMENT

Seashore concerns over the Fire Island deer population were initially focused around a noticeable increase in the number of deer within the Fire Island communities and the incidence of Lyme disease among Fire Island residents. Impacts of deer browsing on vegetation were also among the major concerns. In the mid-1980s, researchers documented a substantial decline in the diversity and abundance of key plant species in the Sunken Forest, one of the Seashore's rarest plant communities. As a result, Seashore staff along with academic and agency scientists embarked on a series of additional investigations documenting and describing the following:

- deer abundance and distribution across Fire Island
- fertility control as a potential deer population management tool
- browsing impacts on vegetation
- the role of disturbance on the regeneration capacity of the Sunken Forest and the likelihood of its future conservation
- ecology of Lyme disease and its vector-host relationships including ticks, birds, and mammals
- the human aspects related to white-tailed deer issues on Fire Island

More recently, Seashore staff have focused on the threat posed by deer to native vegetation in other natural zones of the Seashore and the cultural landscape of the William Floyd Estate. NPS staff have recently initiated collection of vegetation data in some of the Seashore's valued maritime forests to establish baseline understory conditions, and the preliminary evaluation of the data collected thus far indicates that deer browsing impacts have affected the ability for seedlings and saplings to develop similar to the conditions at the Sunken Forest. In some areas, current levels of browsing appear to be creating conditions for an increase in undesirable species. The loss of native vegetation and overall change in the vegetation communities could result in impacts on other wildlife species, such as ground-nesting birds and small mammals using these areas for food and shelter.

DEER AND VEGETATION MANAGEMENT ISSUES AND RESEARCH OVERVIEW

Population and Ecological Characteristics of White-tailed Deer at the Seashore. Prior to the establishment of the Seashore in 1964, very few deer occupied Fire Island (O'Connell 1989). It is likely that the early deer population expanded from the remote natural areas on the eastern side of Fire Island to the western side because deer were attracted to artificial food sources (e.g., gardens, garbage, lawns) in Fire Island communities (Underwood 2005). By the 1970s and 1980s the deer population had become established in the Fire Island communities due to high survival rates and the availability of high-quality habitats (Underwood 1991). As a result, the Seashore began to take steps toward better understanding the deer population and impacts on Seashore resources.

Over the decades, deer abundance has been estimated using different techniques. In the mid-1980s the Seashore initiated a program to estimate the herd size using low-level helicopter surveys. Later, distance sampling was used to estimate deer density. The change in methodologies occurred because individual deer could not be seen in the dense Fire Island communities from the helicopter, and because distance sampling is ground-based and statistically accounts for not seeing all individuals, it was considered more accurate. The deer population peaked in the mid-1990s, when the deer density on Fire Island exceeded 257 deer per square mile in some areas (Underwood 2005).

According to Seashore staff, few if any deer occupied the William Floyd Estate when the property was donated to the National Park Service in 1976. Distance sampling data collected in 2012 estimated the deer population to be approximately 106 deer per square mile at the William Floyd Estate (NPS 2013d). The latest deer density estimates (2012) for the Seashore are provided in table 1.

TABLE 1. DEER POPULATION ESTIMATES FOR PORTIONS OF FIRE ISLAND NATIONAL SEASHORE (2012)

Location	Deer Density (deer per square mile)	Number of Deer
Robert Moses State Park	70	60
Lighthouse Tract	10	2
Kismet-Lonelyville	227	80
Ocean Beach – Ocean Bay Park	126	37
Sailors Haven-Sunken Forest	112	27
Fire Island Pines	149	26
Davis Park	137	10
Fire Island Wilderness	54	91
William Floyd Estate	106	96

Source: NPS 2013b

Little is known about individual deer movements at the Seashore. Telemetry data on 20 deer from the 1980s documented one instance of deer moving off Fire Island and rare instances of deer travelling long distances across Fire Island, but in general, most deer (particularly females) remained in smaller, established home ranges, typically 1.5 miles in length (O'Connell and Sayre 1988). Although some deer may occupy a home range that includes both Fire Island communities and natural areas, scientists do not know the frequency or timing of movements between those areas.

The 1980s movement data (described above) appeared to strongly suggest a separation between deer on the western side of the Fire Island Pines/Talisman and the deer on the eastern side. O'Connell and Sayre (1989) found differences in behavior, population densities, and body condition between deer populations on the western and eastern parts of Fire Island. Deer on the western end had higher body weights from nutritional benefits within the Fire Island communities (from artificial food sources such as ornamental plants, gardens, and intentional feeding) and were much more habituated to humans, whereas deer on the eastern side of the Fire Island had lower body weight, and many exhibited a flight response when approached by humans (O'Connell and Sayre 1989; Underwood 2005).

Long-term Vegetation Monitoring and Research

Sunken Forest Vegetation. The Sunken Forest is a globally rare, old-growth maritime holly forest approximately 44 acres in size located within the Sailors Haven area, just west of Sailors

Haven marina. In 1960, a ±50-acre tract of land comprising beach foredunes, backdunes, and a portion of the Sunken Forest was dedicated for protection as an ecological sanctuary by a private group. Two years after the Fire Island National Seashore was established in 1964, this 50-acre property was deeded to the Seashore, and is referred to in the deed documents as the "Sunken Forest Preserve." The Sunken Forest, due to its uniqueness and rarity as a forest ecosystem, was highlighted in the Seashore's enabling legislation for preservation and protection. It should be noted that the term "Sunken Forest," as used throughout this document, refers to the 44-acre acre maritime holly forest, and as noted above, this forest is only partially contained in the area designated as the Sunken Forest Preserve.

The Seashore has conducted vegetation studies in the Sunken Forest for more than 45 years, and deer impacts on vegetation in the Sunken Forest have been observed over the last 30 years. Researchers have observed impacts on woody seedling densities and understory species composition attributed to heavy browsing (Art 1976, 1987, 1990; Forrester, Leopold, and Art 2007; Forrester, Leopold, and Underwood 2008; Underwood, Ries, and Raphael 2011).

In particular, scientists noted the absence of several herbaceous plants in later years (Forrester 2004) that were present during the initial studies (Schulte 1965; Art 1976). Regeneration of important canopy constituents (trees that make up the overstory) was also absent, particularly American holly (*Ilex opaca*). In comparison, more deer-resistant plants such as black cherry (*Prunus serotina*) were thriving, indicating a potential shift in canopy species over time.

An additional study (Forrester, Leopold, and Underwood 2008) used exclosures to conclude that deer are the dominant herbivore in the Sunken Forest. Past data sets compiled by the science team indicate that changes in the density of shrub layer species correspond to changes in the deer density for the same time interval. The data sets indicate that much of the impacts on vegetation from heavy browsing had already occurred by the mid-1980s. These impacts from heavy browsing by white-tailed deer continue today.

Seashore staff conducting research (Photo credit: NPS)

The Seashore has initiated the collection of vegetation data within other maritime forests and the William Floyd Estate forests to establish baseline conditions for future monitoring (NPS 2013e; NPS 2013f). Although evaluation of the data is preliminary, the data suggests a species composition shift is occurring to favor those tree species most avoided by deer (NPS 2013f), and because of deer browse, there is not sufficient recruitment of tree seedlings to sustain natural reproduction of the overstory canopy.

Human-Deer Interactions. Fire Island community residents and residents adjacent to the William Floyd Estate expressed the types of deer impacts they experience, including human-deer interactions, by participating in a study in which they were interviewed (Leong and Decker 2007) and/or completing a mail survey (Siemer et al 2007). The primary concerns were related to impacts associated with the deer population size and density, home range and movements, and behavior.

Impacts on residents include damage to landscaping and gardens; concerns about disease and ticks; sanitation issues; wildlife viewing opportunities; concerns about deer health; and interactions with pets; but also include concerns about impacts on deer such as habitat loss and behavior changes. Seashore staff have also documented human-deer interactions when notified and when a particular action was taken.

Previous Deer Management Efforts and Research

In 1988–89, the Seashore, in cooperation with New York State, introduced a public research hunt as a means to lower deer numbers in response to the deer population expansion at the Seashore. This hunt evaluated shotgun and archery hunting as methods of deer management, and collected information on the physical condition of the deer population (O'Connell and Sayre 1989). A questionnaire was also provided to participating hunters. Archery hunts occurred in the natural areas on the western side of Fire Island and firearms were permitted in the Fire Island Wilderness. Archery hunting began on December 17, 1988, and ended on December 23, 1988. Firearms hunting began on January 9, 1989, and ended on January 18, 1989. A total of 54 deer were harvested. However, problems with the logistics of the hunt included hunters dealing with dense vegetation, logistics of hunters gaining access to portions of the island, and unwillingness of hunters to disregard sex and size in harvesting deer. Body weights and reproductive rates were much lower than deer on the rest of Long Island. Furthermore, the program quickly became unpopular with Fire Island residents (Knoch and Lowery 1989).

The Fire Island communities funded a study through The Humane Society of the United States to evaluate the viability of immunocontraception as a newly emerging form of deer population control, out of concern about the linkage between deer abundance and tick-borne diseases and a desire to use nonlethal methods. This program began in 1993 and ended in 2009, lasting 16 years. With the assistance of Seashore staff, scientists conducted deer density counts using distance sampling within the Fire Island communities to evaluate the effectiveness of immunocontraception in reducing deer population density. Population surveys were performed annually during the course of the study and are ongoing. No immunocontraception occurred east of Fire Island Pines or at the William Floyd Estate. Population trend data gathered by Underwood (2005) showed that the population response was varied, but certain localized Fire Island communities with the longest history of immunocontraceptive treatments were associated with an approximate 50% decrease in population size over the 16 year study.

In 2005, the Seashore published a technical report entitled *White-tailed Deer Ecology and Management on Fire Island National Seashore* (Underwood 2005) that reviewed the subject of white-tailed deer at the Seashore, including deer population trends and movements, impacts on barrier island vegetation, and management recommendations. The report also included information on the ecological impacts caused by the abundance of deer.

Management Plan for White-tailed Deer in New York State

In 2009, the New York State Department of Environmental Conservation began development of a statewide deer management plan. The plan was designed to document the components of the state's deer management program and provide strategic direction for deer management within the state over a five-year period. The plan was developed with consideration of the diverse interests and values of the public, biological needs of deer, and the ecological relationship between deer and their environment. To that end, scientific data related to deer, public input, and the results of associated surveys were considered and incorporated into the recommendations and management actions included in the plan. The final *Management Plan for White-tailed Deer in New York State*

2012–2016 was completed in October 2011. Deer management efforts at the Seashore would be undertaken in consideration of NYS-DEC's plan. The primary goals of the plan are the following:

- manage deer populations at levels appropriate for human and ecological concerns
- promote and enhance deer hunting as an important recreational activity, tradition, and management tool in New York
- reduce the negative impacts caused by deer
- foster understanding and communication about deer ecology, management, economic aspects, and recreational opportunities while enhancing NYS-DEC's understanding of the public's interest
- manage deer to promote healthy and sustainable forests and enhance habitat conservation efforts to benefit deer and other species
- ensure that the necessary resources are available to support the proper management of white-tailed deer in New York (NYS-DEC 2011)

Previous Tick Management Efforts Related to Deer

In 2011 Cornell University completed a three-year study on the use of 4-Poster baiting stations to treat deer with the pesticide permethrin when they feed, with the intent of killing ticks on the deer. The baiting stations were located on nonfederal lands on Fire Island and used whole kernel corn as a lure to attract the deer. 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 Fire Island National 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 Seashore issued a Letter of Authorization for both communities as requested. From 2008 through 2012, deer consumed 28 tons of whole kernel corn at the Saltaire devices, with 11.2 tons distributed in 2012 alone (NPS 2013a).

4-Poster Device (Photo credit: NPS)

The National Park Service continues to reject the use of the 4-Poster devices on federal lands because the devices provide a regular, introduced food source for the deer population, in contradiction of NPS *Management Policies 2006*. The National Park Service has concerns, policies, and regulations against the supplemental feeding of wildlife, and is particularly concerned with the white-tailed deer population on Fire Island. The Fire Island communities may seek to continue this program.

SCOPING, ISSUES, AND IMPACT TOPICS

SCOPING

Early in the development of this plan/EIS, the National Park Service conducted meetings internally. Cooperating agencies were invited to assist with preparation of this document, and a science team convened to inform the planning process. The National Park Service also distributed consultation letters to relevant agencies (appendix A) and organized groups, issued press releases and newsletters, and solicited public comments during the scoping phase. A summary of scoping, agency consultations, and public involvement is provided below, and a detailed description is provided in "Chapter 5: Consultation and Coordination."

Internal Scoping and Planning

The National Park Service held internal meetings in October 2010 to provide an opportunity for the NPS to initiate the NEPA planning process and discuss the management of white-tailed deer and vegetation at the Seashore. Attendees included interdisciplinary team (IDT) members from the NPS Denver Service Center (DSC), NPS Northeast Region office, NPS Biological Resources Management Division, U.S. Geological Survey Patuxent Wildlife Research Center, the Seashore, and NPS consultants. Topics discussed during the meeting included the purpose, need, and objectives; public and agency involvement; potential issues; preliminary alternative elements; and data needs.

This group met again in December 2011, June 2012, and January 2014 to develop and refine the alternatives that are considered in this plan/EIS. The group reviewed the purpose, need, and objectives for the plan/EIS as well as potential constraints, potentially available management techniques, and public and science team suggestions to compile a full spectrum of potential alternatives. The alternatives that best met the objectives of the plan/EIS were included in this document.

The internal scoping process continued throughout the development of the plan/EIS through regular conference calls and meetings.

Cooperating Agencies

Two agencies have entered into an agreement with the National Park Service to be cooperating agencies in the development of the plan/EIS: New York State Department of Environmental Conservation and United States Department of Agriculture Animal and Plant Health Inspection Services. Both of these cooperating agencies have special technical expertise related to the issues under consideration in the plan/EIS and participate in regular status calls. Both agencies also attended the June 2012 and January 2014 meetings to develop and refine the alternatives considered in the plan/EIS.

Science Team

The National Park Service assembled a science team to answer technical questions posed by the IDT and to provide recommendations for use in the development of alternatives as part of the plan/EIS. The team was composed of national, regional, and local experts from the National Park Service, other agencies, and academia with expertise in the Seashore and its ecosystems, the management of natural resources (including deer) and cultural landscapes, and related social issues (see the List of Preparers in chapter 5). The science team participated in regular phone meetings

over an eight-month period to answer technical questions posed by the IDT and provide information for use in development of the plan/EIS. Following the science team's final meeting, an internal report was prepared to document the group's discussions. This report was used to inform the development of the alternatives presented in "Chapter 2: Alternatives."

Public Scoping and Outreach

The Notice of Intent to prepare the plan/EIS was published in the *Federal Register* on June 17, 2011, representing the beginning of the public scoping and outreach process. In addition, a newsletter with background information and the purpose, need, and objectives associated with the plan/EIS was mailed to known stakeholders and posted on the NPS Planning, Environment, and Public Comment (PEPC) website (http://parkplanning.nps.gov/fiis). The newsletter included information about how to provide comments either through PEPC or using standard mail. The public comment period closed on July 18, 2011. A total of 12 pieces of correspondence were received during the public comment period, comprising approximately 90 comments. Comments received during the public scoping process helped to inform the range of alternatives, as well as the impact topics to be addressed by the EIS. "Chapter 5: Consultation and Coordination" of this EIS provides more details about the public scoping activities, which were an integral part of the planning process for this EIS. Two additional newsletters were posted during the project to update the public on project status.

IMPACT TOPICS RETAINED FOR FURTHER ANALYSIS

As a result of this scoping effort, several issues were identified as requiring further analysis in this plan/EIS. These issues represent existing concerns as well as concerns that might arise during consideration and analysis of alternatives. To focus the environmental analysis in this plan/EIS, the issues identified during scoping were used to derive a number of impact topics, which are resources of concern that could be affected, either beneficially or adversely, by implementing any of the proposed alternatives. The impact topics are outlined below. The existing conditions associated with each impact topic are described in "Chapter 3: Affected Environment." The analysis of the impacts of each alternative is presented in "Chapter 4: Environmental Consequences."

Vegetation, Unique Vegetation Communities, and Special-status Plant Species

The Seashore contains a variety of vegetation communities such as the Northern Beach Grass Dune and Maritime Deciduous Scrub Forest in upland areas, the maritime holly forest, and tidal marshes along the backbay shoreline.

Based on a review of the U. S. Fish and Wildlife (USFWS) Information, Planning, and Conservation System and the NYS-DEC Division of Fish, Wildlife, and Marine Resources, the following state- and federally listed plant species are known to occur regionally in the Long Island area of New York: the state endangered and federally threatened seabeach amaranth (*Amaranthus pumilus*); the state endangered spring lady's tresses (*Spiranthes vernalis*); the state threatened marsh straw sedge (*Carex hormathodes*) and swamp sunflower (*Helianthus angustifolius*); the state-listed rare seabeach knotweed (*Polygonum glaucum*); and the state endangered dark-green sedge (*Carex venusta*), rough rush-grass (*Sporobolus clandestinus*), golden dock (*Rumex fueginus*), narrow-leaf sea-bite (*Suaeda linearis*), and slender marsh-pink (*Sabatia campanulata*).

No taking of these species is anticipated to take place as a result of Seashore actions, and the Seashore's current fencing of special-status species guards against take caused by deer browse. Should any need for take of any federally listed special-status species be identified due to

implementation of the proposed alternatives, the Seashore would consult with the USFWS. Otherwise, the proposed alternatives would include efforts to protect native vegetation and special-status plant species from deer browse and support forest regeneration. Therefore, the impact topic of vegetation, unique vegetation communities, and special-status plant species was retained for further analysis.

Wetlands

Executive Order 11990, "Protection of Wetlands" and NPS Director's Order 77-1: *Wetland Protection* (NPS 2012a) requires an examination of impacts on wetlands. Over 800 acres of tidal marsh wetlands and 112 acres of freshwater dunal wetlands occur on Fire Island according Klopfer et al. (2002). Tidal systems include low marsh and high marsh found primarily on the bayside of the Seashore and at the southern end of the William Floyd Estate. Freshwater systems include highbush blueberry swamp, northern interdunal cranberry swale wetlands, reed marsh dominated by the invasive species *Phragmites australis*, and red-maple/blackgum swamp. White-tailed deer use these existing wetlands as a foraging source, and may cause some impacts due to deer browse and trampling of individual plants. In addition, the Seashore may consider the use of fences for browse control, some of which may bisect wetlands when installed. Therefore, the impact topic of wetlands was retained for further analysis.

White-tailed Deer Population

Management actions proposed in this plan/EIS have the potential to affect the abundance, distribution, behavior, and in some cases physiology of deer at the Seashore. Management actions could cause deer to avoid certain areas in the Seashore. This could result in higher competition for resources in other areas and increased movement across the Seashore boundary. Therefore, the impact topic of white-tailed deer population was retained for further analysis.

Other Wildlife and Wildlife Habitat

Other wildlife, including mammals and birds, are affected by the existing deer population, primarily as a result of the alteration of available suitable habitat or direct competition for limited food resources. Impacts of heavy browsing on vegetation-dependent wildlife communities are apparent and include changes in species composition, abundance, and distribution. Reductions in white-tailed deer population densities would reduce competition for food and deer browsing. This could result in changes to feeding and nesting patterns for other wildlife within the Seashore. Noise associated with management actions could cause temporary changes in daily movement patterns and selection of feeding or breeding/nesting sites for other wildlife. Therefore, the impact topic of other wildlife and wildlife habitat was retained for further analysis.

Wilderness

A wilderness area is defined, in part, as "an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain… An area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation" (PL 88-577). Pursuant to Public Law 95-585, the Fire Island Wilderness was established in the Seashore and is the only federally designated wilderness area in New York State. Deer management efforts within wilderness have the potential to affect the wilderness character. Therefore, the impact topic of wilderness was retained for further analysis.

Cultural Landscapes

As described in Director's Order 28, a cultural landscape is "a geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person, or exhibiting other cultural or aesthetic values" (NPS 2002a). A Cultural Landscape Inventory has been completed at the William Floyd Estate, and evidence of deer browse on vegetation has been documented by Seashore staff. The proposed alternatives would be designed, in part, to reduce the impact of deer browse on the cultural landscape at the William Floyd Estate. Therefore, the impact topic of cultural landscapes was retained for further analysis.

Visitor Use and Experience/Recreation

The implementation of some of the proposed actions could have an impact on visitor use and experience. Some visitors to the Seashore view deer sightings as an integral part of their visit. Deer management actions may decrease the potential for visitors to observe deer within the Seashore, reducing satisfaction for some visitors. Conversely, there are visitors who come to the Seashore to enjoy other resources, such as to observe songbirds. Increased deer browse has the potential to impact these other resources and impact the satisfaction of these visitors.

Management activities such as reproductive treatments, direct reduction, or translocation may require visitors to be prohibited from certain areas of the Seashore. Additionally, some visitors may be opposed to the proposed management actions. As the alternatives are implemented, some visitor experiences may change as the deer population is reduced. Therefore, the impact topic of visitor use and experience was retained for further analysis.

Fire Island Communities and Adjacent Landowners

In addition to federally owned land, the Seashore encompasses 17 private communities and towns, Smith Point County Park, and three municipal beaches (Bellport Beach, Leja Beach/Davis Park, and Atlantique Beach). Robert Moses State Park is adjacent to the western end of the Seashore. Many Fire Island community residents enjoy the presence of deer and actively feed them to attract them to their property. However, community residents also have concerns related to browse on native vegetation (i.e., private landscaping), access to trash, disease transmission (i.e., Lyme disease), and habituation of deer. Because the deer population on Fire Island migrates between the Seashore and Fire Island communities, deer management efforts proposed in the alternatives would likely affect the presence of deer on adjacent properties. Therefore, the impact topic of Fire Island communities and adjacent landowners was retained for further analysis.

Public Health and Safety

Any deer management activities would be conducted in a manner that would minimize risk to the safety of members of the public and Seashore employees; however, there are some inherent safety risks. In addition, tick-borne diseases pose health risks to Seashore visitors or area residents, as well as the larger Long Island area. Blacklegged ticks (*Ixodes scapularis*) carry Lyme disease, and the Department of Health and Human Services Center for Disease Control and Prevention has stated that abundant deer and rodent hosts are necessary to maintain the spirochete *Borrelia burgdorferi*, the causative agent of Lyme disease. Though deer cannot transmit the disease to humans or ticks, a high deer population—in addition to the presence of rodents and small mammals—may support an increased tick population compared to a smaller deer population (CDC 2012; Stafford 2007).Therefore, the impact topic of public health and safety was retained for further analysis.

Seashore Operations

Seashore staff and funding are used to promote the visitor experience and protect and monitor natural and cultural resources. Past and current monitoring of the Seashore's vegetation and deer population have been driven by available staff and funding. Proposals made in this plan/EIS could result in changes to staffing and funding. Therefore, the impact topic of Seashore operations was retained for further analysis.

ISSUES AND IMPACT TOPICS CONSIDERED BUT DISMISSED FROM FURTHER ANALYSIS

The following impact topics were initially considered but were then dismissed from further analysis for the reasons outlined below.

Special-status Wildlife Species

Based on information provided by a search of the U. S. Fish and Wildlife's Information, Planning, and Conservation System and the NYS-DEC Division of Fish, Wildlife, and Marine Resources on March 5, 2012, a variety of state- and federally listed bird species occur within the Seashore. Identified species include the state species of concern seaside sparrow (*Ammodramus maritimus*); the state threatened northern harrier (*Circus cyaneus*), common tern (*Sterna hirundo*), and least tern (*Sternula antillarum*); the state protected birds little blue heron (*Egretta caerulea*), snowy egret (*Egretta thula*), tricolored heron (*Egretta tricolor*), laughing gull (*Leucophaeus atricilla*), and glossy ibis (P*legadis falinellus*); the state and federally endangered roseate tern (*Sterna dougallii*); and the state endangered and federally threatened piping plover (*Charadrius melodus*). In addition, the state endangered Eastern mud turtle (*Kinosternon subrubrum*) is known to occur within the Seashore.

Of the bird species listed above, most all favor beaches, foredunes, and marshes as habitat for either loafing, feeding, or nesting. The northern harrier will use marshes but can also be found utilizing open fields (Audubon 2014). The Eastern mud turtle is also a water dependent species, utilizing brackish marshes, ponds, and wet ditches (NYS-DEC 2014). All of the proposed actions are directed at improving vegetative habitats across the Seashore in the long term by controlling heavy deer browse. None of the actions would be directed at the habitats preferred by these special-status species. Therefore, the actions proposed in this document are unlikely to result in long-term impacts on state- and federally listed wildlife species. Localized, temporary impacts could occur from implementing direct reduction or fertility control to reduce deer numbers due to the presence of humans, though the long-term impact would be less than minor. Specifically, although only deer would be targeted by direct reduction efforts, other animals such as state- or federally listed birds could be temporarily disturbed by the sound of firearms or the presence of humans causing a temporary flight response. Because fertility control and direct reduction would occur during fall and winter months, this action would not impact any nesting birds. Based on the information above, the impact topic of special-status wildlife species was considered but dismissed from further analysis. The Seashore will provide the U.S. Fish and Wildlife Service with a copy of the plan/EIS and will continue to consult with the agency as the project moves forward, as appropriate.

Prime and Unique Farmlands

Prime farmland is one of several designations made by the U.S. Department of Agriculture to identify important farmlands in the United States. It is important because it contributes to the nation's short- and long-range needs for food and fiber. In general, prime farmland has an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing

season, an acceptable level of acidity or alkalinity, an acceptable content of salt or sodium, few to no rocks, and permeable soils (designated as prime farmland soils). Prime farmland soils within the project area occur at the William Floyd Estate and are characterized by Riverhead sandy loam and Sudbury sandy loam soil types (NRCS 2013). These soils are currently occupied by forests, agricultural fields, and maintained meadows. Although such soils are present within the project area, "unnecessary and irreversible conversion of farmland to non-agricultural uses" (Farmland Protection Policy Act of 1980) is not expected under the proposed alternatives. Therefore, the topic of prime and unique farmlands was considered but dismissed from further analysis.

Water Resources

NPS *Management Policies 2006* (NPS 2006a) states that the National Park Service will "take all necessary actions to maintain or restore the quality of surface waters and ground waters within the parks consistent with the Clean Water Act and all other applicable federal, state, and local laws and regulations." The Seashore is located off the southern coast of Long Island and is bordered by the Great South Bay to the north, the Atlantic Ocean to the south, Fire Island Inlet to the west, and Moriches Inlet to the east. However, the proposed action would not involve activities with the potential to affect these waters or water quality over the long term. Ground and surface water resources at the Seashore comprise a small portion of the ecosystem and are most sensitive to the ever-changing complexes shaped by wave and wind action, storms, and human actions. Implementation of the deer and vegetation management actions would not noticeably affect water resources. Therefore, the impact topic of water resources was considered but dismissed from further analysis.

Floodplains and Flood Zones

Executive Order 11988, "Floodplain Management" and NPS Director's Order 77-2: *Floodplain Management* (NPS 2003) require an examination of impacts on floodplains and flood zones and the potential risk involved in placing facilities within floodplains and flood zones. Changes in the white-tailed deer population would have no impact on the ability of the floodplain or flood zone to convey or store flood waters. Therefore, the impact topic of floodplains and flood zones was considered but dismissed from further analysis.

Historic Structures

Per the NPS *Management Policies 2006*, actions on historic and prehistoric structures are to be based on "sound preservation practice to enable the long-term preservation of a structure's historic features, materials, and quality." A historic structure is defined by the National Park Service in Director's Order 28: *Cultural Resource Management* (NPS 2002a) as "a constructed work, usually immovable by nature or design, consciously created to serve some human act." While historic structures and features exist within the Seashore, they would not be impacted by the proposed actions. Therefore, the impact topic of historic structures was considered but dismissed from further analysis.

Archeological Resources

The National Park Service defines an archeological resource as any material remains or physical evidence of past human life or activities that are of archeological interest, including the record of the effects of human activities on the environment. Known archeological resources have been studied and preserved at various curatorial and storage facilities at the Seashore. Although ground disturbing activities such as fencing installation have the potential to impact unknown archeological resources, the implementation of the proposed action would be unlikely to impact

known or unknown archeological resources. If previously undiscovered archeological resources are uncovered during construction, all work in the immediate vicinity of the discovery would be halted until the resources could be identified and documented, and an appropriate mitigation strategy would be developed in consultation with the State Historic Preservation Officer (SHPO). Therefore, the impact topic of archeological resources was considered but dismissed from further analysis.

Indian Trust Resources and Sacred Sites

Secretarial Order 3175 requires that any anticipated impacts on Indian Trust resources from a proposed project or action by U.S. Department of the Interior agencies be explicitly addressed in environmental documents. The federal Indian Trust responsibility is a legally enforceable obligation on the part of the U.S. to protect tribal lands, assets, resources, and treaty rights, and it represents a duty to carry out the mandates of federal laws with respect to American Indians, Alaskan Natives, and Native Hawaiians. During scoping, the Unkechaug Indian Nation and the Shinnecock Indian Nation were notified via letter of the proposed action (see appendix A). There are no known Indian Trust resources or sacred sites at the Seashore, and the lands comprising the Seashore are not held in trust by the secretary of the interior for the benefit of Indians due to their status as Indians. Therefore, the impact topic of Indian Trust resources and sacred sites was dismissed from further analysis.

Environmental Justice

Executive Order 12898, "General Actions to Address Environmental Justice in Minority Populations and Low-income Populations" requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high or adverse human health or environmental impacts of their programs and policies on minorities and low-income populations and communities. No minority or low-income populations are located in or adjacent to the Seashore, including the William Floyd Estate. Therefore, since the proposed action is confined to federal land and the Fire Island communities, the proposed management objectives and potential actions would not affect low-income or minority populations and the impact topic of environmental justice was dismissed from further analysis.

RELATED LAWS, POLICIES, PLANS, AND CONSTRAINTS

GUIDING LAWS, REGULATIONS, AND POLICIES

National Park Service Organic Act

By enacting the NPS Organic Act of 1916 (Organic Act), Congress directed the U.S. Department of Interior and the National Park Service to manage units "to conserve the scenery and the natural and historic objects and wildlife therein and to provide for the enjoyment of the same in such a manner and by such a means as will leave them unimpaired for the enjoyment of future generations" (16 USC [United States Code] 1). Congress reiterated this mandate in the Redwood National Park Expansion Act of 1978 by stating that the National Park Service must conduct its actions in a manner that will ensure no "derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress" (16 USC 1a-1).

NPS *Management Policies 2006*

Several sections from the NPS *Management Policies 2006* (NPS 2006a) are relevant to vegetation, cultural landscapes, and deer management at the Seashore. If natural landscapes are disturbed by natural phenomena, park units are to let them recover naturally unless manipulation is needed to (1) mitigate for excessive disturbance caused by past human effects or (2) preserve cultural and historic resources as appropriate based on park planning documents (section 4.4.2.4).

Management of "biotic cultural resources," which include plant and animal communities associated with the significance of a cultural landscape, is covered in section 5.3.5.2.5. NPS *Management Policies 2006* direct parks to plan with both cultural and natural resource stewardship in mind in this case, and to have plans that are jointly acceptable to both divisions. The NPS resource stewardship strategy is to "anticipate and plan for the natural and human-induced processes of change. Before any major treatment of a cultural landscape is undertaken, there must be an understanding of the degree to which change contributes to or compromises the historic character of the landscape, and the way in which natural cycles influence the ecological processes within the landscape. Treatment and management of a cultural landscape will establish acceptable parameters for change and manage the biotic resources within those parameters."

Deer management is guided by other sections of NPS *Management Policies 2006*. Park units are to maintain as parts of the natural ecosystems of parks all native plants and animals. The National Park Service is to achieve this by "preserving and restoring the natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal populations and the Fire Island communities and ecosystems in which they occur." Furthermore, the National Park Service is to "adopt park resource preservation, development, and use management strategies that are intended to maintain the natural population fluctuations and processes that influence the dynamics of individual plant and animal populations, groups of plant and animal populations, and migratory animal populations in parks." Whenever the National Park Service identifies a possible need for reducing the size of a park plant or animal population, the decision will be based on scientifically valid resource information that has been obtained through consultation with technical experts, literature review, inventory, monitoring, or research (NPS 2006a).

Section 4.4.2 of NPS *Management Policies 2006* also states, "Whenever possible, natural processes will be relied upon to maintain native plant and animal species, and to influence natural fluctuations in populations of these species. The Service may intervene to manage individuals or populations of native species when at least one of the following conditions exists:

- because a population occurs in unnaturally high or low concentration as a result of human influences (such as loss of seasonal habitat, the extirpation of predators, the creation of highly productive habitat through agriculture or urban landscapes) and it is not possible to mitigate the effects of the human influences;
- to protect specific cultural resources of parks;
- to protect rare, threatened, or endangered species."

Section 4.4.2.1 of NPS *Management Policies 2006* allows for the management of native species to prevent them from interfering broadly with natural habitats, natural abundances, and natural distributions of native species and natural processes. Section 4.4.2.1 of NPS *Management Policies 2006* states, "Where visitor use or human activities cannot be modified or curtailed, the Service may directly reduce the animal population by using several animal population management techniques, either separately or together. These techniques include translocation, public hunting on lands outside the park or where legislatively authorized within a park, habitat management, predator

restoration, reproductive intervention, and destruction of animals by NPS personnel or their authorized agents. Where animal populations are reduced, destroyed animals may be left in natural areas of the park to decompose" (NPS 2006a). Additionally, the Secretary of the Interior has broad discretion in managing wildlife. Section 4.4.2.1 of the NPS *Management Policies 2006* also states that the destruction of animals may be carried out by NPS personnel or their authorized agents.

NPS policies also require that parks "assess the results of managing plant and animal populations by conducting follow-up monitoring or other studies to determine the impacts of the management methods on nontargeted and targeted components of the ecosystem" section 4.4.2. This strategy is described in this plan including specific thresholds for taking action.

Authority to Manage White-tailed Deer

The National Park Service has broad authority to manage wildlife and other natural resources within the boundaries of units of the National Park System. According to 16 USC 3, "[The Secretary of the Interior] may… provide in his discretion for the destruction of such animals and of such plant life as may be detrimental to the use of any of [the parks, monuments, and reservations under the jurisdiction of the National Park Service]."

In defining this discretion, the 10th Circuit Court of Appeals, in *New Mexico State Game Commission v. Udall* (410 F.2d 1197, 1201), noted that the National Park Service "need not wait until the damage through overbrowsing has taken its toll on park plant life … before taking preventative action" (10th Cir. 1969). This discretion has been reinforced over time. In *United States v. Moore*, (640 F. Supp. 164, 166) the court found that Congress had given the Secretary of the Interior great discretion in regulating and controlling wildlife within the national parks. This discretion is further defined by NPS management policy.

OTHER FEDERAL AGENCY LAWS, REGULATIONS, PLANS, POLICIES, AND ACTIONS

In addition to those listed above, the National Park Service is governed by other federal laws and regulations. Based on the scope of this plan/EIS, these include the following.

Code of Federal Regulations, Title 36 and Title 43

Title 36, Chapter 1 of the Code of Federal Regulations provides the regulations "for the proper use, management, government, and protection of persons, property, and natural and cultural resources within areas under the jurisdiction of the NPS." In 43 CFR 24, the U.S. Department of the Interior is provided with policy guidance for interagency cooperation in the preservation, management, and use of fish and wildlife resources.

RELATED STATE LAWS, REGULATIONS, AND POLICIES

The NYS-DEC is responsible for administration and enforcement of the state's Environmental Conservation Law which includes the authority to administer fish and wildlife laws, carry out sound fish and wildlife management practices, and conduct fish and wildlife research. In addition, the NYS-DEC is the agency entrusted with administration and oversight of deer population management in New York according to the specific policies, authorities, and responsibilities outlined in the New York State Environmental Conservation Law Article 11.

ECL 11-0303 directs NYS-DEC to develop and carry out programs that will promote natural propagation and maintenance of desirable species in ecological balance and lead to the observance of sound management practices. ECL 11-0903 and 11-0907 describe NYS-DEC's authority for establishing open seasons, manner of take and bag limits for hunting deer in Suffolk County, including Fire Island. As a result of these statutes, current deer hunting opportunities in Suffolk County exist in the form of an archery season from October 1 to December 31, and a special firearms season commencing weekdays only no earlier than the first full week in January through January 31st (typically 15–20 hunting days).

In addition to take of deer through regulated hunting, ECL 11-0515 authorizes NYS-DEC to issue a revocable license for the collection and possession of wildlife for scientific purposes. Similarly, ECL 11-0521 allows for issuance of a permit for the capture, harassing, or taking of wildlife that are a nuisance, destructive to public or private property or a threat to public health or welfare.

NYS-DEC's current priorities and the values and issues expressed by the public for deer management are encompassed in the *Management Plan for White-tailed Deer in New York State 2012–2016* (NYS-DEC 2011). While statewide in scope, the deer plan also highlights management options available to public and private land managers. The plan identifies a tiered system of harvest management that allows for varying degrees of management intensity across a gradient of landscape scales, whereby regulated hunting is recognized as the most cost effective and equitable mechanism to manage deer populations across a broad range of geographic scales, whereas specific deer damage permits may be used to address situations of deer-related damage at community and property scales. The plan also describes the experimental framework through which fertility control projects may be conducted on wild deer within New York.

The National Park Service will coordinate with the state during implementation of this plan to ensure that mutual management goals are achieved and all pertinent regulatory and permitting needs are met. For example, if hunting or trapping are authorized or if research programs involving the taking or possession of fish and wildlife are implemented, these activities would conducted in accordance with Federal and State laws as appropriate.

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Alternatives 2

INTRODUCTION

This chapter describes the various actions that could be implemented for future management of white-tailed deer at Fire Island National Seashore. It provides detailed descriptions of each alternative (no-action and action alternatives), followed by a discussion of adaptive management and how it could be applied to the NPS preferred alternative. The remainder of the chapter addresses alternative elements that were considered but dismissed from detailed analysis, consistency with sections 101(b) and 102(1) of the National Environmental Policy Act, and the NPS preferred and the environmentally preferable alternatives.

OVERVIEW OF ALTERNATIVES

The alternatives selected for detailed analysis are summarized in table 2. The alternatives under consideration include a no-action alternative and three action alternatives.

Action alternatives were developed by the interdisciplinary planning team, which includes the cooperating agencies, with feedback from the public and the science team during the planning process. These alternatives meet, to varying degrees, the management objectives for Fire Island National Seashore and also the purpose of and need for action, as described in "Chapter 1: Purpose of and Need for Action."

ALTERNATIVE A: NO ACTION

Under alternative A: no action, existing deer management and monitoring efforts throughout the Seashore would continue. These actions include continued public education/interpretation efforts, vegetation monitoring, and deer population and behavior surveys.

ACTION ALTERNATIVES

Each of the action alternatives (alternatives B, C, and D) includes the monitoring and education actions proposed under alternative A. In addition, all action alternatives would enhance those education efforts and propose to work collaboratively with the Fire Island communities, New York State Department of Environmental Conservation, New York State Parks, Suffolk County Parks, and local environmental groups on wildlife issues within the Fire Island communities. Each alternative would take action to further reduce undesirable human-deer interactions, protect native plant communities and cultural plantings, promote forest regeneration, and reduce the deer population in the Seashore. Established thresholds for taking action, target deer densities, and target vegetation densities would guide management actions and are described in following section.

Initial Deer Density Goals to Achieve Vegetation Objectives

The Seashore's management goal for the natural areas (Sunken Forest, Fire Island Wilderness, Talisman, Blue Point Beach, Carrington Estate, and William Floyd Estate) is to protect and restore native vegetation communities. Vegetation targets vary between sections of the Seashore as described in chapter 2. To achieve the vegetation targets, the level of deer browsing must change either through exclusion fencing or reduction in deer numbers. Deer densities, based on 2012 sampling, vary widely across Fire Island on federally owned land. For instance, deer density in the immediate vicinity of the Light House Annex was estimated to be 10 deer per square mile, whereas at Sailors Haven (i.e., Sunken Forest), Fire Island Wilderness, and the William Floyd Estate, estimated densities were 112,

54, and 106 deer per square mile, respectively. By comparison, Horsley, Stout, and deCalesta (2003) determined that a deer density exceeding 20 deer per square mile caused noticeable impacts on forest regeneration in the Allegheny National Forest of Pennsylvania. The science team, relying on its professional experience and the scientific literature, recommends a similar population density (approximately 20–25 deer per square mile) as the initial density goal across Fire Island and at the William Floyd Estate lower acreage. The initial density target of 20–25 deer per square mile would be maintained for the first 8–10 years until vegetation is given ample time to display a response, understanding that the deer density target can be adjusted higher or lower through adaptive management based on monitored vegetation impacts and whether vegetation goals are reached.

The Sunken Forest preserve is the only section of the Seashore where herbaceous plants would be used as an indicator of achieving the desired conditions. The science team believes a single deer can do great harm to the herbaceous layer within the Sunken Forest. To meet the desired conditions for vegetation described previously, the science team recommended that no deer be allowed to forage within the Sunken Forest, establishing a target density of zero deer to completely protect this area from deer browse.

TABLE 2. SUMMARY OF THE ALTERNATIVES

ALTERNATIVE ELEMENTS	Alternative A (No Action)	Alternative B	Alternative C	Alternative D (NPS Preferred)
Deer Population Management Methods	**Island-wide:** No actions would be taken to control the deer population size. **Sunken Forest:** No actions would be taken to control deer access to vegetation within the Sunken Forest. **Fire Island Communities:** No actions would be taken on the deer population within the Fire Island communities to reduce negative human-deer interactions. **William Floyd Estate:** No actions would be taken to reduce deer numbers.	**Island-wide:** The deer population would be reduced to and managed at the target density (initially 20 – 25 deer per square mile) using a fertility control agent that meets NPS criteria. **Sunken Forest:** A fence would be erected around the 44 acre Sunken Forest totaling approximately 7,130 linear feet, and all deer would be hazed out of the fenced area to promote understory vegetation establishment and regeneration within the Sunken Forest. **Fire Island Communities:** Deer residing within the Fire Island communities that are observed regularly approaching humans would be translocated to the Fire Island Wilderness. Translocated female deer would be treated with a fertility control agent that meets NPS criteria. **William Floyd Estate:** ▪ The deer population would be reduced to and managed at the target density using a fertility control agent that meets NPS criteria. ▪ An exclusion fence would be installed to protect the historic core area from deer browse totaling approximately 80 acres. ▪ Cattle guards would be installed at the northern entrance gate to prevent deer outside the fence from entering when the gate is opened. ▪ The existing boundary fence would be secured to exclude deer. ▪ Rotational fencing of forested areas in the lower acreage would be installed for two consecutive 10-year rotations based on vegetation recovery monitoring. Approximately 29,700 linear feet of fencing would be installed, and deer would be hazed out of the fenced areas.	**Island-wide:** The deer population would be reduced to and managed at the target density using the following direct reduction methods: ▪ sharpshooting ▪ capture and euthanasia (following American Veterinarian Medical Association guidelines), ▪ public deer hunting at the Fire Island Wilderness **Sunken Forest:** Same as alternative B. **Fire Island Communities:** Deer that are observed regularly approaching humans would be captured and euthanized. **William Floyd Estate:** ▪ The deer population would be reduced to and managed at the target density using direct reduction methods (following American Veterinarian Medical Association guidelines). ▪ Small-scale fencing would be implemented around selected plants important in maintaining the cultural landscape within the historic core area. ▪ Same boundary fencing repair and cattle guard installation as under alternative B.	**Island-wide:** The deer population would be initially reduced using the same direct reduction methods as under alternative C. The deer population would be maintained at the target density using direct reduction methods and/or a fertility control agent that meets NPS criteria. **Sunken Forest:** Same as alternative B. **Fire Island Communities:** Same as alternative C. **William Floyd Estate**: ▪ The deer population would be initially reduced to the target density using direct reduction methods. Fertility control may be used in conjunction with continued direct reduction methods to maintain the deer population at the target density. ▪ Same boundary fencing repair and cattle guard installation as under alternative B. ▪ Approximately 80 acres of the William Floyd Estate, which encompass the historic house and other accessory structures (i.e. the historic core), would be permanently fenced from deer, and hazing would occur to remove deer from within the fenced area.
Education/ Interpretation	Current levels of education/interpretation would continue.	Education/interpretation efforts would be enhanced throughout the Seashore, in Fire Island communities, and adjacent lands in the following ways: ▪ Enhance public education and outreach efforts to raise awareness of the role of humans in deer-related issues. ▪ Improved collaboration with Fire Island communities, New York State, Suffolk County, and environmental groups. ▪ Improved use of web and social media outlets for messaging about deer management. ▪ Enhanced education and enforcement of existing policies regarding deer management and feeding of wildlife.	Same as alternative B.	Same as alternative B.
Deer Population and Behavior Monitoring	Continued monitoring to determine deer densities and behavior of deer would continue annually.	▪ Enhanced monitoring to determine deer densities and behavior of deer would continue annually. – Translocation would be considered for deer that approach humans in the Fire Island Communities.	Enhanced monitoring to determine deer densities and behavior of deer would continue annually.	Same as alternative C.
Vegetation Monitoring	▪ Vegetation monitoring would continue at current levels. ▪ Annual surveys for special-status plants would continue, and protective fencing around special-status plants would continue.	▪ Vegetation monitoring would be enhanced on a frequency of once every three years to measure against established targets within Seashore natural areas, the Sunken Forest, and William Floyd Estate. ▪ Annual surveys for special-status species plants would continue, and protective fencing around special-status species plants would continue.	Same as alternative B.	Same as alternative B.

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THRESHOLDS FOR TAKING ACTION

As described in chapter 1, the Seashore has established desired conditions for various geographic areas of the Seashore. To reach those conditions, specific actions would be required. Actions to be taken have specific goals for success, which are used to help shape the action alternatives presented in this plan/EIS. Thresholds are established that indicate the point at which an action is taken (called a "threshold for taking action" or "action threshold") and are typically tied to a measurable parameter. The action thresholds for the different areas of the Seashore are presented below.

FIRE ISLAND COMMUNITIES

During the course of many deer density surveys over the past decade, Seashore biologists noted variation among individual deer in their reaction to human presence. Some deer exhibit a flight response, some exhibit no response at all, and others were observed approaching people. Biologists recorded the behavior of each deer during surveys to accurately identify and measure the number of deer actively approaching people. Approximately 11% of the deer observed during the surveys between 2008 and 2011 approached the biologists. Additionally, Seashore biologists anecdotally noted that the deer approaching appeared to be the same individuals, suggesting that these returning deer are the cause of many human-deer interactions, likely due to food conditioning. In contrast, only 3% of the deer on federally owned lands that were surveyed (Light House Annex, Sailors Haven, and Fire Island Wilderness) approached the biologists (NPS 2011a).

The National Park Service believes that eliminating all undesirable human-deer interactions is unrealistic. Instead, the focus would be on reducing the percentage of deer that approach people, using the behaviors noted in these surveys as a measure. The Seashore believes that a realistic target for the Fire Island communities would be observing less than 3% of deer approaching the biologists, which is in line with the 2008–2011 detections on federal lands (where there are fewer food attractants) and is a benchmark for how deer behave in less developed areas on Fire Island. If the threshold of 3% is exceeded, the Seashore would take action to reduce the number of deer that approach people as measured by observations during the deer density surveys.

SUNKEN FOREST

The vegetation monitoring data indicates little change in the tree canopy in terms of density, species composition, and importance values since the establishment of the Seashore (NPS 2011b). However the primary concern is that understory regeneration of trees and shrubs needed to replace the midstory and overstory canopy in the Sunken Forest is lacking due to heavy deer browse. For example, in analyzing four important canopy constituents, three showed dramatic declines in density, with blackgum (*Nyssa sylvatica*) and American holly (*Ilex opaca*) being completely absent from sample plots in 2011 (table 3).

TABLE 3. THE DENSITY OF STEMS IN THE SAPLING/SHRUB LAYER FOR THE FOUR IMPORTANT CANOPY CONSTITUENTS IN THE SUNKEN FOREST, SHADBLOW (*AMELANCHIER CANADENSIS*), SASSAFRAS (*SASSAFRAS ALBIDUM*), BLACKGUM (*NYSSA SYLVATICA*), AND AMERICAN HOLLY (*ILEX OPACA*)

Species	DENSITY Stems per acre			
	1967	**1986**	**2002**	**2011**
Shadblow (*Amelanchier Canadensis*)	194±86	129±47	65±65	57±36
Sassafras (*Sassafras albidum*)	24±18	32±25	8±8	73±34
Blackgum (*Nyssa sylvatica*)	57±43	8±8	8±8	0
American holly (*Ilex opaca*)	16±11	8±8	0	0
Total	291±41	178±29	81±15	129±19

Notes: Data available from permanent plots in the Sunken Forest (Art 1976, 1987; Forrester 2004; NPS 2011b). Values are means ± standard errors.

The Seashore intends to monitor stem densities in the sapling and shrub layers of those key constituents as the targeted measure for reaching the desired condition. The 1967 stem density data was selected as a guide for determining which species to measure and what the target densities should be.

The Seashore has chosen four woody species (dominant canopy constituents) and two species of understory shrubs that were relatively common in 1967 (Art 1976) as the target species: shad blow (*Amelanchier canadensis*), sassafras (*Sassafras albidum*), blackgum (*Nyssa sylvatica*), American holly (*Ilex opaca*), chokeberry (*Aronia arbutifolia*), and inkberry (*Ilex glabra*) (table 4). The action thresholds for these sapling and shrub species are based on the 1967 densities and are provided below (measured in terms of individuals greater than 3.28 feet [1 meter] in height and less than 1.2 inches [3 cm] in diameter at breast height [dbh]).

TABLE 4. ACTION THRESHOLDS FOR SAPLINGS AND SHRUBS

Species	Action Threshold (stems per acre)
Shad blow (*Amelanchier canadensis*)	Less than 101 stems per acre (250 stems per hectare)
Sassafras (*Sassafras albidum*)	Less than 16 stems per acre (40 stems per hectare)
Blackgum (*Nyssa sylvatica*)	Less than 40 stems per acre (100 stems per hectare)
American holly (*Ilex opaca*)	Less than 8 stems per acre (20 stems per hectare)
Chokeberry (*Aronia arbutifolia*)	Less than 101 stems per acre (250 stems per hectare)
Inkberry (*Ilex glabra*)	Less than 113 stems per acre (280 stems per hectare)

The presence or absence of species and percent cover of ground cover plants (herbaceous, woody, and liana) were surveyed in permanent plots in 1967, 1986, 2002, and 2011. This data showed that a number of species were present in 1967 but absent from the 2002 and 2011 surveys: Carolina rose (*Rosa carolinia*), small cranberry (*Vaccinium oxycoccus*), wild sarsaparilla (*Aralia nudicaulis*), cinnamon fern (*Osmunda cinnamomea*), starry false lily of the valley (*Maianthemum stellatum*), seaside goldenrod (*Solidago sempervirens*), inkberry (*Ilex glabra*), and winged sumac (*Rhus copallinum*). The Seashore would like to see a return of these species as part of the regeneration effort. However, formulating target thresholds for each of these ground cover plants would prove difficult, given the evolutionary traits of each species (i.e., seasonal growth and flowering patterns) and other site-specific abiotic factors (i.e., degree of sunlight, soil, moisture and fertility) that change from year to year. Furthermore, the National Park Service realizes that achieving a

quantifiable target might be difficult for some species that have been absent from the forest for so long and may not be plentiful in the seed bank (Forrester 2004). Instead, the Seashore would be satisfied with achieving a presence of those ground cover plants that were common in 1967 but are rare or missing today. To measure this, the Seashore has elected to choose wild sarsaparilla (*Aralia nudicaulis*) and starry false lily of the valley (*Maianthemum stellatum*) as the indicator ground cover species, because both are imperiled within the Sunken Forest and both serve as important indicators of browsing pressure. The Seashore would continue measuring the vegetation within the permanent plots to record the presence or absence and percent cover of these two species.

OTHER FIRE ISLAND NATURAL AREAS

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. Seashore staff would extend the data collection to other maritime forests in the future. A comprehensive dataset would be useful in fully understanding understory conditions throughout each of the natural areas, but this dataset is not complete. For the Talisman and Blue Point maritime forests, preliminary data indicate that regeneration of forest overstory constituents have been impacted by deer browse, and the Seashore would like to restore forest seedling growth. Success would be determined by an understory seedling density target of 2 seedlings per square meter (excluding black cherry) based on a weighted scale of seedling size as described in appendix B.

WILLIAM FLOYD ESTATE

Historic House and Surrounding Landscape

The historic core area of the William Floyd Estate would require successful establishment of key ornamental plantings for the cultural landscape to be restored. The Seashore intends to annually monitor the condition of ornamental plantings to determine relative condition. Deer browsing heavy enough to result in poor vegetation growth and vegetation mortality would serve as a threshold for taking action to control deer browse. Seashore staff would assess and document the general condition of the cultural plantings and rely upon professional judgment of qualified cultural landscape experts to determine whether corrective action is needed. The future cultural landscape treatment plan would identify more detailed thresholds for taking action, once completed.

William Floyd Estate Forests

The forested areas of the William Floyd Estate would be managed as natural areas separate from the historic core area. The number of tree seedlings would be the action threshold indicator. The Seashore selected an action threshold based on available research on forest regeneration and the regeneration standard adopted by the Pennsylvania Regeneration Study (USDA Forest Service 2013). This standard has also been adopted by the New York State Department of Environmental Conservation as part of their recent statewide deer management plan (NYS-DEC 2011). The Pennsylvania Regeneration Study is a component of the Forest Inventory and Analysis (FIA) Program being implemented nationwide by the U.S. Forest Service (USDA Forest Service 2013). The FIA program has collected data in Pennsylvania forests since the 1950s; however, sampling occurred on a "periodic" basis every 10–15 years. Data collection has intensified with surveys being conducted on a 5 year rotation (McWilliams et al. 2004). Based on this study, forest regeneration targets (adequate recruitment) for the William Floyd Estate would be reached when an average of 2 seedlings (native and deer preferred species) per square meter (8,079 seedlings per acre) are

observed (McWilliams et al. 2005). To monitor for vegetation targets, the densities of living seedlings greater than 5 cm in height but less than 1 cm dbh are recorded within the four 1 square meter subplots located at the corners of each 100 square meter (10 × 10 m) plot. There are four height class categories that are surveyed, and weighting factors are applied to each seedling according to its height class (see appendix B for details).

ALTERNATIVE A: NO ACTION

Under the no-action alternative, the Seashore would continue to implement current management actions, policies, and monitoring efforts related to deer and their effects. Current actions within the Seashore include limited public education/interpretation efforts, vegetation monitoring, and deer population surveys. The actions that would continue under alternative A are described below in detail. These actions are also common to all action alternatives.

EDUCATION/INTERPRETATION

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, preventing 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. Interpretive rangers and other members of the Seashore's staff would also continue to provide information on these topics at visitor contact stations, and offer interpretive programs focused on white-tailed deer and human-wildlife issues at Seashore sites and within Fire Island communities as feasible. Finally, relevant information would be posted on the Seashore's website, social media platforms, and through local news outlets.

VEGETATION MONITORING

Vegetation monitoring would continue. Only vegetation on federal tracts within the boundaries of the Seashore is surveyed. Areas that fall within this plan/EIS are (from west to east) the Light House Annex, Sunken Forest, Carrington Estate, Talisman, Blue Point Beach, Fire Island Wilderness, and William Floyd Estate. Due to the variety of habitat types, different sampling protocols are established for each area. Sampling occurs annually, with each area being sampled once every five years.

Special-Status Plant Species

The Seashore performs annual surveys across the entire length of Fire Island in search for special-status plants that occupy beaches and foredunes. When special-status plants are discovered occupying these dune habitats, Seashore staff often place small-scale screens around individual plants or colonies to protect them from deer browse. This practice would continue under alternative A.

DEER MONITORING

Behavior Monitoring

Deer behavior monitoring is completed in conjunction with the deer population monitoring. Each year, three biologists traverse pre-determined transects to record the presence of deer. Surveys are initiated either 20 minutes before official sunrise or timed so the survey is finished just before

sunset. This is to ensure sampling is conducted when deer are most active. When conducting the survey from within a vehicle, speeds are constrained to no more than 10 mph. Two different kinds of deer behavior are recorded: (1) initial behaviors, including feeding behaviors and forage type (if applicable); and (2) reaction to observers. Initial behavior refers to the behavior that the majority of the group of deer is engaged in at the time of detection. Habituation and reactive behaviors describe response to the observer's presence; an individual or group of deer within a detection is considered "unaffected" if they do not visibly react to the observer's presence. The behaviors during the surveys could be "affected" by the distance of the deer from the transect, and whether an individual or deer group is aware of the observer's presence.

Deer Population Monitoring

Deer population monitoring, described in appendix C of this document, would continue. This monitoring includes distance sampling surveys to estimate white-tailed deer densities as well as deer behavior monitoring (described above). Fire Island community sites and most natural areas (including the Sunken Forest) on Fire Island are surveyed every year, whereas the William Floyd Estate and Fire Island Wilderness are surveyed every three years. Deer population data collected in the field includes aspects of herd composition such as sex, age (fawn/adult), and group size.

Incident Reporting and Response

Seashore park rangers report wildlife-related incidents throughout the boundaries of the Seashore while roving or when directly contacted by visitors. All deer-related incidents occurring in the Fire Island communities are reported to the NYS-DEC's Wildlife Reporting Hotline. Seashore park rangers would assist with each incident as needed.

ELEMENTS COMMON TO ACTION ALTERNATIVES

In addition to continuing the elements described under alternative A (public education/interpretation efforts, incident reporting and response, deer and vegetation monitoring), the actions described below are common to alternatives B, C, and D. In addition to these actions, all action alternatives incorporate adaptive management approaches, which are described in detail in "Adaptive Management Approaches Included in the Action Alternatives."

ENHANCED PUBLIC EDUCATION/INTERPRETATION EFFORTS

Seashore staff would enhance public education/interpretation 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. Actions could include the following:

- Work collaboratively with Fire Island communities, New York State Parks, Suffolk County Parks, and local environmental groups to develop, share, and use consistent and strategic messaging with regard to human-deer interactions and deer management on Fire Island.
- Dedicate interpretive effort where feasible to conduct outreach and provide interpretive media in the Fire Island communities on the topic of living with deer. This would include education on deer biology and ecology, supplemental food source reduction (i.e., garbage management), and gardening with deer-resistant native plants.
- Improve use of web and social media pages to engage virtual visitors in an online discussion on human-deer interactions and deer management. This could include developing an interactive web-based activity on the Seashore's "For Kids" page.

- Develop a curriculum-based education program centered on the topic of deer issues on Fire Island.
- Implement a citizen-science project engaging Fire Island community residents and residents adjacent to the William Floyd Estate in deer and vegetation research and monitoring.
- Enhance education and enforcement of existing policies related to deer management and feeding of wildlife within NPS boundaries.

FENCING OF THE SUNKEN FOREST

The 44-acre globally rare maritime holly forest at the Seashore known as the Sunken Forest has incurred understory impacts from heavy deer browse for decades. Scientists believe that attempts to restore understory vegetation—herbaceous vegetation in particular—could be disrupted by a single foraging deer, and the only way to prevent deer browsing impacts completely is the installation of an exclusion fence. Each of the action alternatives, therefore, would include an exclusion fence approximately 7,130 feet long and 10 feet tall surrounding the maritime holly forest type within that portion of the Sunken Forest preserve called out in the enabling legislation (figure 3). The location of the fence would be dictated by minimizing environmental impacts (particularly to wetlands), minimizing structural conflicts with existing boardwalks, and the potential for long-term bayside shoreline erosion due to increasing water levels resulting from sea-level rise. As a mitigating step to offset impacts caused by construction of the fence, the Seashore would consider collecting desirable herbs and shrubs and replanting those plants within the area of disturbance.

SECURING THE BOUNDARY FENCE AT THE WILLIAM FLOYD ESTATE

The outlining fence along the property boundary of the William Floyd Estate is an aging chain-link structure. Over the years, the fence has incurred damage from vandals and storms, and animals have burrowed under the fence creating small gaps of sufficient space for deer to freely crawl through. To best control the deer density, each action alternative includes enhancements and/or replacement of the property fence. In addition, when staff have approached gates at the William Floyd Estate to unlock for vehicular passage, deer have been observed quickly passing through the gates as soon as they are opened. As part of the deer management plan to prevent deer movements through vehicular gates, each of the action alternatives includes provisions to install cattle gates at each vehicular gate.

ENHANCED VEGETATION MONITORING WITHIN NATURAL AREAS

Biologists recently began an expansive monitoring program to record baseline conditions of the vegetation within these natural areas and to observe changes in vegetation over time, as described in appendix B. Monitoring requires permanent vegetation plots for which comparisons can be made. Data collection would occur annually, with each natural area being sampled at least once every three years. This enhanced vegetation monitoring is described under alternative B.

SMALL-SCALE FENCING OF SPECIAL-STATUS PLANTS

As described under alternative A, the Seashore would continue annual searches for those special-status plant species occupying beaches and foredunes that are vulnerable to deer browse impacts. When special-status species plants are discovered, the Seashore would install small-scale fencing around the plants to protect them from deer browse.

White-tailed Deer Management Plan and Environmental Impact Statement

National Park Service
U.S. Department of the Interior

Fire Island National Seashore

FIGURE 3
Sunken Forest Proposed Fencing - All Action Alternatives

ENHANCED DEER POPULATION MONITORING

Monitoring deer numbers is a critical element of the plan to measure deer densities relative to observed changes in vegetation. Under each of the action alternatives, enhancement of deer monitoring efforts would occur by increasing the monitoring events across all regions of the Seashore to an annual basis. During deer density counts, staff would record observed deer behavior as a means of indexing the frequency of undesirable human-deer interactions. This data would be a key component in determining whether Seashore goals are met and any adaptive management actions throughout the implementation of the plan. This enhanced monitoring is described in appendix C.

MINIMUM REQUIREMENTS ANALYSIS

NPS *Management Policies 2006*, section 6.3.5, "Minimum Requirement" states that all management decisions affecting wilderness must be consistent with the minimum requirements concept. This concept is a systematic process used to determine if administrative actions, projects, or programs affecting wilderness character, resources, or the visitor experience are necessary, and if so, how to minimize the resulting impacts.

The term "minimum requirements" comes from section 4 (c) of the Wilderness Act, which states "…except as necessary to meet minimum requirements for the administration of the area for the purpose of this Act…" The minimum requirement decision process involves two steps. First, to determine if any administrative action is necessary to meet minimum requirements for administration of the area for the purpose of the Wilderness Act, and if so, to then determine the minimum activity (method or tool) needed to accomplish the action which would have the least impact on the wilderness resource, character, and purposes.

The National Park Service would complete a minimum requirement analysis for the NPS preferred alternative prior to implementation, striving to minimize the extent of adverse impact while accomplishing the Seashore's necessary wilderness objective.

COORDINATION WITH STATE

The NYS-DEC regulates the hunting and collection of animals by the public through the issuance of permits. In addition, once a fertility control agent (discussed in more detail below and not applicable to alternative C) is approved for use by the Environmental Protection Agency (EPA), the agent must also be registered for use in New York. Registration of any agent would include labeled restrictions. By law, any landowner using the agent would need to comply with these labeled restrictions. The Seashore, in implementing this plan/EIS, would work closely with NYS-DEC. Coordination would include routine meetings with NYS-DEC staff, data sharing, public relations, and reporting.

DEER POPULATION MANAGEMENT ACTIONS CONSISTENT WITH ALTERNATIVES B AND D

FERTILITY CONTROL

Reproductive control in wildlife management has been assessed for several decades across multiple species. Its use has gained more attention as the public has become more interested in wildlife management decisions. For reproductive control agents to effectively reduce deer population size, they must decrease the reproductive rate to less than the mortality rate. In urban deer populations, mortality rates are generally very low (approximately 10%). Also, to control the growth of the deer population, it is necessary to treat 70%–90% of the female deer with a highly effective product to successfully reduce or halt population growth in a closed population without immigration or emigration (Rudolph, Porter, and Underwood 2000; Hobbs, Bowden, and Baker 2000). The science and understanding of fertility control are evolving. The most updated information about fertility control is summarized in appendix D. The terms fertility control and reproductive control are used synonymously in this document.

Two categories of reproductive control technology were considered: chemical reproductive control agents and surgical sterilization. Chemical reproductive control agents offer great promise for future wildlife management (Rutberg et al. 2004), as described in appendix D. Surgical sterilization was considered but dismissed based on the criteria established for fertility control (see "Alternative Elements Considered but Dismissed" at the end of this chapter).

Several chemical reproductive control agents (immunological and nonimmunological) are being developed and tested for use in deer population control (Fagerstone et al. 2010). These include the standard porcine zona pellucida (PZP) vaccine (Kirkpatrick et al. 1992; Turner, Kirkpatrick, and Liu 1996; Naugle et al. 2002; Miller et al. 2009); uniquely formulated PZP, such as SpayVac® (Fraker et al. 2002) and long-acting formulations of native PZP (Rutberg et al. 2013); GnRH vaccine (Miller et al. 2000, 2001; Curtis et al. 2002; Fraker et al. 2002; Gionfriddo et al. 2009, 2011); and Leuprolide (Baker et al. 2002, 2004). Each of these agents is described briefly in table 5 and in more detail in appendix D.

TABLE 5. CHEMICAL REPRODUCTIVE CONTROL AGENTS

Issue	Standard (Native) PZP Vaccine	SpayVac® PZP Vaccine	GnRH Vaccine (e.g., GonaCon™)	Leuprolide (GnRH agonist)
Mode of Action	Blocks sperm penetration and fertilization; estrous cycles continue	Blocks sperm penetration and fertilization; estrous cycles continue	Prevents secondary hormone (luteinizing hormone [LH] and follicle stimulating hormone [FSH]) secretion, which stops folliculogenesis and ovulation	Prevents secondary hormone (LH and FSH) secretion, which stops folliculogenesis and ovulation
Mode of Administration	Injection	Injection	Injection	Injection
Number of Doses	Twice initially and annual booster	Once initially and booster when needed	Once initially and booster when needed	Current formulation – annually
Timing	Treated prior to breeding season to allow sufficient time for antibody development	Treat prior to breeding season and allow sufficient time for antibody development	Treated prior to breeding season and allow sufficient time for antibody development	Treated immediately prior to breeding season on an annual basis

The current research related to chemical reproductive control technologies offers highly variable results in terms of key elements such as contraceptive efficacy and duration (appendix D). As stated above, there are also logistical issues related to the administration of these drugs that could have substantial implications for success and sustainability. Therefore, only when the following criteria are met would reproductive control be implemented as a management tool.

1. The fertility control agent is federally approved and state-registered 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.
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).

Such an agent is not currently available. Regardless, because Seashore staff anticipates an agent that meets all NPS criteria would be available upon implementation or within the next 10 years (as research and development continues), this tool has been retained as part of the range of alternatives. However, evaluation of existing agents using criteria for an acceptable agent showed that GonaCon™ met more of the criteria than other chemical reproductive control agents (table 6).

TABLE 6. EVALUATION OF FERTILITY CONTROL BASED ON SELECTION CRITERIA FOR FIRE ISLAND NATIONAL SEASHORE

Agent	Criterion 1 Federally Approved and State Registered	Criterion 2 Multiyear Efficacy (3+)	Criterion 3 Capable of Remote Administration	Criterion 4 Meat Safe for Humans	Criterion 5 Minimal Impact on Deer Behavior
Immunocontraceptives					
"Native" PZP	No	No	Yes	Likely, but need EPA approval	No – repeated estrous cycles
SpayVac®	No	Possibly[a]	Unknown	Likely, but need EPA approval	No – repeated estrous cycles
Long-term Pelleted PZP	No	Possibly[b]	No	Likely, but need EPA approval	Unknown – likely repeated estrous cycles
GnRH (GonaCon™)	No[c]	Possibly[d]	Possibly[e]	Yes	Yes
GnRH Agonists					
Leuprolide Acetate	No	No	Yes	Likely but need EPA approval	Yes
Histrelin Acetate	No	No	No	Likely but need EPA approval	Unknown
Other					
GnRH Toxins	No	Unknown	Unknown	Likely but unknown	Unknown
Steroid Hormones	No	No	Unknown	Unlikely, but need regulatory guidance	Unknown
Contragestives	No	No	Yes	Yes	Yes

TABLE 6. EVALUATION OF FERTILITY CONTROL BASED ON SELECTION CRITERIA FOR FIRE ISLAND NATIONAL SEASHORE (CONT'D)

Agent	Criterion 1 Federally Approved and State Registered	Criterion 2 Multiyear Efficacy (3+)	Criterion 3 Capable of Remote Administration	Criterion 4 Meat Safe for Humans	Criterion 5 Minimal Impact on Deer Behavior
Other					
Physical Sterilization – Ovariectomy	Not applicable[f]	Yes - permanent	No	Yes – after anesthesia withdrawal date	No – lack of reproductive hormones will change reproductive behaviors and likely social behaviors
Physical Sterilization – Tubal Ligation	Not applicable[f]	Yes - permanent	No	Yes – after anesthesia withdrawal date	No – repeated estrous cycles

a SpayVac® has demonstrated 80%–100% efficacy for up to 5–7 years in horses and deer (Fraker, pers. comm., 2009; Miller et al. 2009; Killian et al. 2008). The term "possibly" is used because long-term studies (greater than 5 years) have been conducted only in captive deer and had a small sample size in each treatment group (N=5) (Miller et al. 2009). The only longer term study in free-ranging white-tailed deer did not evaluate past the third year (Rutberg et al. 2013).

b Long-term pelleted PZP has not been adequately evaluated past year 2 in free-ranging deer to determine extended efficacy (Rutberg et al. 2013).

c Federally approved but not registered in New York state for use in free ranging white-tailed deer populations.

d Research on one-shot, multiyear GnRH vaccine in penned/captive deer indicates GonaCon is 88%–100% effective in year 1, 47%–100% effective in year 2, and 25%–80% effective up to 5 years post-treatment (Miller et al. 2008). The term "possibly" is used because the 3+ year efficacy has only been demonstrated in captive deer, with small sample size, and lacks confidence intervals. Work in free-ranging deer suggests lower efficacy rates and shorter duration of efficacy (Gionfriddo et al. 2009, 2011).

e Work published in elk used dart delivery to administer the GnRH vaccine (Killian et al. 2009). However, the current label for GonaCon™ requires it to be hand injected.

f Not applicable because this is a veterinary procedure rather than a product. The procedure requires general anesthesia, a veterinarian to perform surgery, post-operative antibiotics, and is likely associated with a higher mortality rate (approximately 6%; MacLean et al. 2006) than anesthesia alone (approximately 1.5%; Rutberg et al. 2013). Results in permanent sterilization.

Under alternative B, the Seashore would not be able to initiate a reproductive control program until a chemical reproductive control agent meeting all criteria becomes available. Prior to the availability of an acceptable agent, all other components of alternative B would be implemented following initiation of this plan. The availability of an acceptable agent would also limit the options available to the park for population maintenance under alternative D (but direct reduction methods would be available for use under this alternative).

The Seashore would monitor the status of reproductive control research on a periodic basis through consultation with subject matter experts and review of new publications. When new information and/or advances in the use of reproductive control agents could benefit deer management in the Seashore and established criteria are met, the decision to use an appropriate chemical reproductive control agent would be determined by the Seashore. This determination would be made based on how well the criteria for an acceptable control agent are met and on availability, cost, efficacy, duration, and safety at the time the action was implemented. The determination of an appropriate control agent is discussed further in "Adaptive Management Approaches Included in the Action Alternatives."

ADMINISTRATION OF THE REPRODUCTIVE CONTROL AGENT

Number of Females Treated at Fire Island

To effectively reduce deer population size, treatment with a reproductive control agent must decrease the reproductive rate to less than the mortality rate. The actual deer mortality rates at Fire Island and at the William Floyd Estate are not known; however, these rates are expected to be low particularly on Fire Island in the absence of hunting, given that few, if any, deer die from motor vehicle collisions, a high source of mortality in most urban deer populations. Fire Island, like many other suburban deer populations, has a high number of artificial food sources, which could contribute to a lower mortality rate.

Thus, under alternative B, it is assumed that it would be necessary to treat approximately 70%–90% of the females in order to reduce deer population growth (Hobbs, Bowden, and Baker 2000; Rudolph, Porter, and Underwood 2000). After several years of application at this rate of treatment, a small (e.g., 5 %) reduction in the deer population could be expected (Hobbs, Bowden, and Baker 2000). However, in a deer management plan completed at Valley Forge National Historical Park, a deer population model indicated that the reduction in the deer population using a reproductive control agent could be more than that, possibly up to 33% after 5 years and up to 60% after 10 years (NPS 2009c). These estimates from Valley Forge National Historical Park are similar to findings at the Fire Island communities of Kismet to Lonelyville (Rutberg and Naugle 2008). This western segment of Fire Island has the longest history of fertility control (PZP) research, from 1993–2009. Rutberg and Naugle (2008) included population data collected using distance sampling from 1995–2006, and deer density declined by ~58% from 1997–2006 (approximately 85–35 deer, respectively). Alternatively, population reduction through PZP treatment was nominal in other portions of Fire Island (Naugle et al. 2002; Underwood 2005), reflecting the logistical challenges associated with implementing fertility control treatments.

The Seashore's 2012 deer population on Fire Island was estimated at 194–392 deer, based on deer density of surveyed lands (about 3.926 square miles). Deer density survey data collected by the National Park Service indicate that approximately 58% of the deer in the Seashore (113–227 deer) are females. Under alternative B, approximately 100–205 females (~90% of 113 and 227) would be treated in the first year and then every three years, assuming minimal deer population reduction (~5%). At the other end of the spectrum, assuming a deer population reduction similar to what was observed on Fire Island (Kismet to Lonelyville) and predicted at Valley Forge National Historical Park, approximately 100–205 deer would be treated years 1 and 4, approximately 70–140 deer would be treated in years 7 and 10, and approximately 40–80 deer would be treated in year 13. All numbers are approximate and would depend on how the deer population responds; therefore adaptive management approaches would be key to a successful program.

Number of Females Treated at the William Floyd Estate

The Seashore's 2012 deer population at the William Floyd Estate was estimated at 66–141 deer, based on the deer density of surveyed lands (about 0.9043 square miles). Deer density survey data collected by the National Park Service indicate that approximately 73% of the deer at the William Floyd Estate (48–103 deer) are female. At the high range, the number of females that would be treated ranges from 45–95 (~90% of 48 and 103) for the first year and then every three years, assuming minimal deer population reduction (~5%). At the other end of the spectrum, assuming a deer population reduction similar to what was observed on Fire Island (Kismet to Lonelyville) and predicted at Valley Forge National Historical Park, approximately 45–95 deer would be treated years 1 and 4, approximately 30–60 deer treated in years 7 and 10, and approximately 20–40 deer treated in year 13. All numbers are approximate and adaptive management is key to a successful program.

Application Procedures. Regardless of the reproductive control agent used, treated females would need to be marked (tagged) to facilitate identification of which deer have been treated, to avoid multiple treatments of the same individuals. For most marking techniques, each deer must be captured and handled at least once for the first treatment. Tracking and capturing previously treated females would require time to locate the deer or to lure it to a capture site so that it could be treated. After deer have been handled, successfully capturing them for subsequent treatments can become difficult (Rudolph, Porter, and Underwood 2000).

Training. Regardless of the technique implemented, qualified federal employees or contractors with demonstrated experience in the administration of reproductive control would perform these activities. NPS employees and contractors performing the darting would be required to successfully complete training on the use and storage of a dart gun, as well as on the administration of anesthesia and the fertility control agent. This training is important to ensure the safety of NPS employees, contractors, and Seashore visitors. Federal employees or contractors also would need to be qualified to handle live deer in order to minimize harm to the animal or the employee. If more than one location were simultaneously used to remotely administer controls with tranquilizer darts, these areas would be adequately separated for safety reasons.

MONITORING

Additional monitoring to document reproductive control success (pregnancy rate, and reproductive rate) would be implemented. Data collected from monitoring would be used to test the accuracy of modeling results to reduce modeling uncertainties. It would be expected that as the number of females treated with a reproductive control agent increased over time, the percent of pregnant females would decrease. Data on reproductive rates also would be used to describe the existing deer population. Detailed monitoring plans are included in appendixes B and C.

ALTERNATIVE B

Under alternative B, deer observed approaching humans (during distance sampling surveys) within the Fire Island communities would be translocated to the Fire Island Wilderness. In addition to the common to all actions described above, deer browsing management actions would include fencing of an area encompassing the historic core at the William Floyd Estate (approximately 80 acres), and rotational fencing of selected forest areas at the William Floyd Estate lower acreage (approximately 66 acres at one time). The fencing would be implemented in conjunction with fertility control of white-tailed deer to gradually reduce and then maintain the deer population at an appropriate density to achieve the plan objectives for vegetation (estimated at 20–25 deer per square mile across Fire Island and the William Floyd Estate). Fertility control would be implemented using a chemical reproductive control agent (when an acceptable agent, i.e., an agent meeting criteria specified in the plan/EIS, becomes available). For the purpose of this plan/EIS and for the purpose of including a diverse array of management alternatives, the Seashore assumes that an acceptable reproductive control agent meeting all of the established criteria would be available within 10 years of the drafting of this document. Once adequate levels of tree seedling recruitment have been reached at the William Floyd Estate, it may be possible to eliminate or reduce fencing. This would be assessed using adaptive management.

FENCING

Fencing would be used to exclude deer from the maritime holly forest known as the Sunken Forest (approximately 44 acres of fenced area) and the William Floyd Estate (figures 3 and 4). At the William

Floyd Estate, both an area encompassing the historic core—approximately 80 acres—and rotational fencing in the lower acreage would be constructed. Rotational fencing would create four defined areas, ranging in size from 8–37 acres and totaling approximately 66.5 acres in the first 10 years, then approximately 65 acres in the second 10 years. When defining exclosure locations and the amount of fencing required, Seashore staff would consider the proposed locations in relation to historic structures, cultural landscapes, visitor-use areas, Seashore boundaries, accessibility, known archeological resources, the trail system, and maintenance requirements. High-use visitor areas, areas with the potential for adverse visual impacts, and areas with high maintenance requirements (e.g., floodplains) would be avoided as much as possible. Large fenced areas would be constructed on Seashore property at least 100 feet from the Seashore boundary to provide adequate construction area and minimize impacts on neighboring properties. Prior to fence construction, archeological surveys would be conducted at fence post locations.

The fences would be a minimum of 8–10 feet high and mesh size would be sufficient to allow most small animals to move freely through the fence. It is expected that technical details (e.g., type of footer, post type, and spacing, etc.) would vary based on factors such as topography, geologic substrate, access, potential visibility, and presence of archeological resources. This information would be provided on a site-by-site basis through development of a detailed implementation plan. Electric fencing would not be used in the Seashore based on concerns for visitor safety, potential impacts on other native wildlife, and long-term maintenance requirements.

Deer would be driven out of the fenced areas by Seashore staff before completing the fencing. Visitors would be allowed within the fenced areas at the Sunken Forest and the William Floyd Estate historic core. Visitors would not be able to use the areas enclosed by rotational fences (William Floyd Estate lower acreage) during or after construction. All fencing would be monitored by Seashore staff and maintained by contract with a local fence company. Monitoring of all fenced areas would consist of visual inspection for fence integrity and would be coordinated with vegetation monitoring activities. If any deer were found within a fenced area, they would be driven out of the fenced area by Seashore staff.

The timeline for the duration that fences would remain in place differs between the Sunken Forest and the William Floyd Estate. For the Sunken Forest and the William Floyd Estate historic core area, fences would be permanent. At the William Floyd Estate lower acreage, rotational fences would be used to protect vegetation from deer browse. It is estimated that it would take at least 10-15 years to achieve an adequate level of regeneration within the rotationally fenced areas at the William Floyd Estate (8,079 tree seedlings per acre) and for seedlings to exceed the typical deer browsing height (approximately 60 inches) (Horsley, Stout, and deCalesta 2003). Once monitoring within the fenced area indicated adequate regeneration and tree seedlings exceeded browse height, the rotational fencing would be moved to immediately adjacent areas in order to reuse one side of the previous fenced area, thus minimizing relocation and labor costs.

DEER TRANSLOCATION

The method of capturing and moving deer from one area to another would be considered in alternative B of the plan/EIS. Translocation is not considered a long-term solution; however, it may have applicability in the short term while human behaviors that cause and perpetuate undesirable human-deer interactions are being reduced in the Fire Island communities to the extent possible.

Translocation would be considered only for those deer that approach humans in the Fire Island communities to achieve the plan's objective of reducing undesirable human-deer interactions. Individuals would only be captured from Fire Island communities west of Sailors Haven. Captured females would be treated with a fertility control agent, and all captured animals would be

translocated to the Fire Island Wilderness where the deer population is estimated to be approximately 100 individuals. Seashore biologists have observed natural fluctuations in the deer population at the Fire Island Wilderness, which has been between 100 and 150 deer. Translocating deer to the Fire Island Wilderness would cause a slight increase in the population density in that area. However, biologists have concluded that the density would remain within the natural range of population variability. Biologists also have concluded that translocating deer to the Fire Island Wilderness would cause browsing pressure to remain within the range experienced under natural fluctuations of the population. Vegetation would need to be monitored and if impacts are observed, alternative actions would need to be taken through the adaptive management process (any adjustments not covered in this plan would require additional planning and compliance).

Deer that approach humans would first be identified by NPS staff based on behavior observations during deer monitoring surveys. These individual deer would be captured and/or anesthetized and then transported to the Fire Island Wilderness, most likely by truck. Decisions regarding the implementation of this method would be made based on efficiency, the minimum requirements and tools necessary to carry out the task (in the context of wilderness management), and safety for both the animal and the handler. All precautions would be made to minimize stress to the animal as well as handling time. Release sites in the Fire Island Wilderness would be identified but should be no less than 4 miles from Davis Park (the easternmost Fire Island community). Reproductive control (as part of alternative B) would occur before the individual deer is released into the Fire Island Wilderness.

All individuals would be marked to track their survival, movements, and behaviors after translocation. An assessment of each translocated individual would be made every year to determine the success of the translocation efforts. Capture and euthanasia would be considered for translocated individuals that consistently return to Fire Island communities and/or continue to approach humans.

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FIGURE 4

William Floyd Estate Proposed Fencing - Alternative B

ALTERNATIVE C

Under alternative C, deer browse would be managed through exclosure fencing in the Sunken Forest (approximately 44 acres of maritime holly forest) and small-scale fencing to protect special-status species and key plants within the William Floyd Estate historic core. Actions would be taken to reach vegetation recovery and forest regeneration goals by directly reducing and maintaining the deer browsing pressure through use of direct reduction methods. These methods also would be used to maintain the deer density at a density where vegetation can successfully regenerate (initially 20–25 deer per square mile Seashore-wide). Deer population reduction and maintenance would be implemented through a combination of sharpshooting, capture and euthanasia of individual deer (where necessary), and public hunting (within the Fire Island Wilderness only). Deer observed approaching humans within the Fire Island communities would be captured and euthanized.

FENCING

Vegetation management actions under alternative C would vary depending on the location. Fencing of the Sunken Forest and small-scale fencing of special-status plant species island-wide would take place as described under alternative B. At the William Floyd Estate, small-scale fencing and/or protective barriers would be established within the historic core to protect key cultural landscape plantings, and key species would be replanted as needed to restore the cultural landscape. Decisions on appropriate plant species and their locations would be made in a future cultural landscape treatment plan. Generally, proposed plantings would include a formal garden consisting of flowers and a small fruit tree orchard adjacent to the western side of the house within the historic core.

DEER POPULATION MANAGEMENT ACTIONS

Under alternative C, various deer management actions would be used depending on the location. Across Fire Island, a combination of sharpshooting, capture and euthanasia, and a controlled public hunt (at the Fire Island Wilderness only) would be used to lower the deer density to approximately 20–25 deer per square mile. In the Fire Island communities, deer that approach humans would be captured and euthanized, contributing to the number of animals that need to be removed to meet the initial deer density target. Within the Sunken Forest, the sensitive maritime forest would be fenced, as described under alternative B, and all deer within the fence would be removed through direct methods (sharpshooting or capture and euthanasia). Finally, at the William Floyd Estate, direct reduction would be used to lower the deer density to approximately 20–25 deer per square mile. These actions are described below in more detail.

Sharpshooting

Sharpshooting would involve the use of professionals or skilled volunteers to remove deer within the Seashore in designated areas, generally using firearms. All sharpshooters would be held to rigorous skill and safety standards. Methods, removal numbers, and sex preferences are described below.

Methods. Qualified federal employees or contractors would be used to implement this action. They typically would be expected to work with Seashore staff to coordinate all details related to sharpshooting actions, such as setting up bait stations, locating deer, sharpshooting, and preparation of carcasses for disposal or donation. Disposition of the deer (donation of meat and

disposal of waste or carcasses) would be coordinated by Seashore staff (e.g., transportation to the meat processing facility and coordination with the meat recipient).

In most locations, high-power, small-caliber rifles would be used at close range. Nonlead ammunition would be used in this case to meet NPS policy (NPS 2009d). Use of nonlead ammunition also would serve to preserve the opportunity to donate the meat or to leave it in the field for scavenging wildlife without risking dissemination of lead into the food chain. Every effort would be made to ensure humane treatment of individual deer.

Sharpshooting would primarily occur at night (between dusk and dawn) during late fall and winter months, when deer are more visible and there are few visitors at the Seashore. In some restricted areas, sharpshooting may take place during the day, if needed. In this case, the areas would be closed to Seashore visitors. In both cases, qualified federal employees or contractors would be located in elevated positions (e.g., tree stands) or in clearly marked, high-clearance government vehicles traveling on trail roads on the Fire Island and within the William Floyd Estate. Spotlights would be used during night operations. The public would be notified of any Seashore closures and deer management activities in advance via media releases and alerts posted to the Seashore's website and social media venues; and with printed notification posted at Seashore visitor contact stations, Seashore bulletin boards, and public billboards located within the Fire Island communities. Visitor access would be limited as necessary during direct reductions, and NPS personnel would patrol public areas to ensure compliance with Seashore closures and public safety measures. During sharpshooting activities, noise-suppression devices and night vision equipment would be used to reduce disturbance to the public. Activities would be conducted in compliance with all federal firearm laws administered by the Bureau of Alcohol, Tobacco, Firearms, and Explosives.

Temporary bait stations could be used to attract deer to safe removal locations. The stations would be placed in Seashore-approved locations, away from public-use areas, to maximize the efficiency and safety of the direct reduction program. The amount of bait placed in any one location could range from 20–100 pounds, depending on the bait used and the number of deer in the immediate area (DeNicola et al. 1997b).

Training. Qualified federal employees or contractors with demonstrated expertise and training in the implementation of successful wildlife and deer management actions—including firearms handling, direct removal techniques, carcass processing, and wildlife capture and handling—would perform these activities. These individuals also would need to demonstrate firearms proficiency, based on NPS firearms qualifications, on an annual basis throughout the project. On-site training would include Seashore orientation and required safety measures to protect visitors, NPS employees, and volunteers. Volunteers would not be allowed to use firearms but may assist in other activities such as the transport and processing of carcasses, maintenance of bait stations, and implementation of Seashore closures. Volunteer training would be provided by NPS staff to support volunteer involvement.

Disposal. Deer carcasses would be transported by NPS staff and/or contractors to a central location for temporary storage during removal actions and collection of biological data. Deer removed off site would be transported by NPS staff and/or contractors on a daily basis for processing; more than one processing facility may be used. The meat from these deer would be provided directly from the meat processing facility to a local food bank or food pantry for the purpose of redistribution for human consumption. In situations where access to the carcass is difficult or not in a highly visible area, surface disposal may be acceptable. In these circumstances, every effort would be made to reduce the visibility of the carcass to Seashore visitors.

Number of Deer Removed. Seashore staff would determine the number of deer to be removed based on the most recent deer population survey and the initial deer density goal of approximately 20–25 deer per square mile, as well as past experience of other deer population reduction programs, technical feasibility, and success of forest regeneration in later years of plan implementation. Based on 2012 deer density reports for Fire Island and the experience with population reduction at other national park units such as Valley Forge National Historical Park, it is estimated that the desired deer density goal could be reached at Fire Island and the William Floyd Estate in 1–2 years if 65% of the population is initially targeted for removal. These estimates are based on the technical, financial, and logistic feasibility of removal at both locations. It is recognized that deer population reduction could proceed more rapidly if it is possible to remove more deer in each year and if the deer population growth is lower than anticipated.

Table 7 provides a likely scenario for the removal actions at each location, beginning with the 2012 deer population numbers. The scenario assumes that direct reduction methods would be used to remove the deer. Removal would be targeted for the six-month period from October through March. The extent to which the three methods of direct reduction would be used is dependent on variable factors (e.g., number of hunting permits issued, number of deer that would need to be euthanized, etc.) which would be established upon implementation of the plan and could vary by year.

As previously noted, several factors could influence the number of years required to reach the initial deer density goal. The numbers presented in table 7 are estimates based on 2012 deer density and estimates of annual growth, as well as what experienced staff believe is reasonable. These numbers could change over time when the plan is implemented. For example, as the deer population numbers decrease through successful direct reduction efforts, deer might become adapted to the direct reduction operations and become more evasive, increasing the effort necessary to reach the removal numbers in any year. Actual reproduction and mortality rates might differ from the estimates used in this projection. If reproduction rates were higher and mortality lower than estimated, the population growth would be greater, and more deer would need to be removed; this could increase the time to reach the initial density goal or call for a greater number of deer to be removed, if feasible given available resources. The converse would be true if reproduction rates were lower and mortality rates higher than estimated, resulting in removing fewer deer and reaching the deer density goal in less time. Immigration of deer into the Seashore property could also vary, and this would have an effect on the number of deer to be removed (Porter, Underwood, and Woodward 2004). Thus, monitoring would be an essential part of this alternative, and actions could be adjusted as described in the "Adaptive Management Approaches Included in the Alternatives" section.

The number of deer removed in years following attainment of the desired density goal would be adjusted as described in the "Adaptive Management Approaches Included in the Action Alternatives" section. This number may vary annually depending on the success of previous removal efforts, deer adaptations to removal efforts, vegetation regeneration response, and other factors. In general, at Fire Island the number of deer to be removed annually would range from 10–31, while at William Floyd Estate, it would range from 3–12.

The number of females in the deer population also would influence reproduction rates. Due to the preferential removal of females, as described below, recruitment into the population should decrease, because fewer females would be reproducing. However, as the habitat improves, reproductive rates may increase as well.

TABLE 7. ESTIMATED DEER REMOVALS BY YEAR AND LOCATION (ALTERNATIVE C)

Year	Total Number of Deer	Percent Removed	Number Removed	Post-Removal Number	Post-Removal Density (deer per square mile)	Reproduction	Immigration	Pre-removal Number for the Following Year
Fire Island (low end of population)								
1	194	65	126	68	17.3	10	0	78
Fire Island (high end of population)								
1	392	65	255	137	34.9	21	0	158
2	158	65	80	77	19.9	12	0	89
William Floyd Estate (low end of population)								
1	66	65	43	23	25.4	3	0	27
2	27	33	9	18	19.9			
William Floyd Estate (high end of population)								
1	141	65	92	49	54.2	7	0	57
2	57	65	37	20	22.1	3	0	23
3	23	22	5	18	19.9	3	0	21

Sex Preference. Focus on female deer is necessary to stabilize or reduce deer populations (DeNicola et al. 2000). However, due to the size of the deer population, during the first two years of direct reduction, both female and male deer across age classes would be removed based on opportunity. Thereafter, at least 15 females should be taken for every 10 males (WVU 1985). There would be a preference for removing females, because this would reduce the deer population level more efficiently over the long term.

Records would be kept on the herd composition (i.e., age and sex) of all deer removed from the Seashore to provide the Seashore with additional information on herd population metrics. This information would be compared with data used in deer population models to improve model accuracy.

Capture and Euthanasia

Capture and euthanasia would be used only in circumstances where sharpshooting would not be appropriate due to safety or security concerns, such as within the Fire Island communities or close to occupied buildings. For this reason, this method would be used on an estimated 15% or less of the total number of deer removed based on the experience of Seashore biologists conducting annual deer density counts who are familiar with the Seashore setting. Activities would occur when few people visiting the Seashore.

Captured deer would be euthanized as humanely as possible, in accordance with current veterinary recommendations such as those published by the American Veterinary Medical Association. Most capture methods involve using bait to attract deer to a specific area where deer could be darted with a tranquilizer (Schwartz et al. 1997) or captured using select trapping methods. Tranquilizing darts could also be used without bait stations when deer are within range of darting. The method of capture and euthanasia would be selected based on the specific circumstances (location, number of deer, accessibility, and reasons that sharpshooting was not advised). Animals euthanized with chemicals would be appropriately disposed of, and would not be available for consumption.

Qualified federal employees or contractors with demonstrated experience in direct (lethal) removal actions and training in the use of methods and tools associated with humane euthanasia (firearms and/or tranquilizer darts) would perform these actions. Training would include safety measures to

protect visitors, NPS employees, and contractors. Federal employees or contractors would also be qualified to handle live deer in order to minimize any harm to an animal or an employee. Appropriate safety measures would be followed when setting up the capture area.

Data would be collected on each deer removed by capture and euthanasia to include (at a minimum) age, weight, sex, location of removal, circumstance requiring removal and capture, and method used.

Public Hunting at the Fire Island Wilderness

A controlled public hunt would be carried out in the Fire Island Wilderness, abiding by the NYS-DEC hunting season and regulations. The Seashore would be responsible for managing the public hunt and may limit the number of hunters and the hours available for hunting. To protect vegetation at the Fire Island Wilderness, hunters would not be allowed to use vehicles. The use of both bowhunting and firearms could be allowed, as dictated by the state deer hunting seasons. At least one check station would be provided for the collection of biological data (i.e., sex and age), possibly near the Fire Island Wilderness visitor center. Gut piles may be left behind in the field for natural decomposition/scavenger use.

ALTERNATIVE D

Deer browsing management actions would include exclosure fencing in the Sunken Forest (approximately 44 acres of maritime holly forest), fencing of an area encompassing the historic core at the William Floyd Estate (approximately 80 acres), and small-scale fencing to protect special-status species. The deer population would be reduced to an appropriate deer density to achieve the plan objectives (estimated at 20–25 deer per square mile) through a combination of sharpshooting, capture and euthanasia of individual deer (where appropriate), and public hunting (within the Fire Island Wilderness only). Once reduced, the deer population could be maintained through fertility control in place of or to supplement use of direct reduction methods. Fertility control could be implemented using a chemical reproductive control agent when an acceptable agent becomes available. Until an acceptable and effective reproductive control agent becomes available, the deer population would be maintained using the same methods used for direct reduction as described above for alternative C. Deer observed approaching humans within the Fire Island communities would be captured and euthanized.

FENCING

Vegetation management actions under alternative D would vary depending on the location. Fencing of the Sunken Forest and small-scale fencing of special-status plant species island-wide would take place as described under alternative B. At the William Floyd Estate, fencing of the historic core area would occur as described for alternative B to protect from deer browse all plantings important to the cultural landscape. The layout of fencing at the William Floyd Estate is illustrated in figure 5.

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FIGURE 5

William Floyd Estate Proposed Fencing - Alternative D

DEER POPULATION MANAGEMENT ACTIONS

Direct Reduction

Under alternative D, the direct reduction methods described under alternative C would be implemented to quickly reduce the deer population to the initial density goal. These methods also may be used for deer population maintenance. For instance, if monitoring indicates that the reproductive control application has been ineffective in maintaining the deer population at the desired density or if an acceptable reproductive control agent is not available, these could be reasons for the continued use of direct reduction methods.

Reproductive Control

Reproductive control of female deer through the use of a chemical reproductive control agent also could be implemented (when an acceptable chemical agent becomes available) as described under alternative B to maintain the deer population after it has been reduced. Ideally, implementation would begin simultaneously with direct reduction. However, for the purposes of this analysis, it is estimated that the use of reproductive control could begin during the third year of population reduction, if an acceptable agent is available at that time (if an acceptable agent is not available, direct reduction methods would be used, as stated previously). The success of implementing reproductive control on a deer population that has undergone reduction efforts for several years would depend on advances in reproductive control agents, sensitivity of the deer population to humans, methods used by the qualified federal employees or contractors, changes in immigration with reduced deer density, and general deer movement behavior (Porter, Underwood, and Woodward 2004; Naugle et al. 2002). It should be expected that getting close enough to administer remote injections would become increasingly difficult after reduction efforts due to deer behavioral changes in response to previous human interaction (Underwood 2005).

Assuming reproductive control was initiated when the Seashore's deer population density reached the range of 20–25 deer per square mile, the Seashore's total deer population would be no more than 220 animals on Fire Island and 24 animals at the William Floyd Estate. Assuming that the sex ratio composition of the reduced deer population was approximately 50:50 based on selective targeting of females during direct reduction, there would be approximately 122 females in the population. For the initial fertility control treatment, the estimated number of adult females that may need to be treated and marked for identification would be 110 individuals, or 90% of the females. The deer population would be monitored as fertility control continues in subsequent years, and uncertainties could be tested via modeling approaches as part of adaptive management. If the deer population increased during the reproductive control application under this alternative, periodic direct reduction methods could be initiated to maintain the deer population density at the identified goal.

ADAPTIVE MANAGEMENT APPROACHES INCLUDED IN THE ACTION ALTERNATIVES

All of the action alternatives (alternatives B, C, and D) described in this chapter incorporate adaptive management approaches to meeting the objectives of the plan. Each alternative includes a management action followed by a period of monitoring to evaluate the results of the action. By using an adaptive management approach, managers would be able to change the timing or intensity of management treatments to better meet the goals of the plan as new information is obtained. The adaptive management approach and its integration into the action alternatives are more fully described below.

Successful management of natural systems is a challenging and complicated undertaking. All USDI bureaus are encouraged to "use adaptive management to fully comply" with the Council on Environmental Quality's guidance that requires "a monitoring and enforcement program to be adopted . . . where applicable, for any mitigation" (516 DM 1.3 D (7); 40 CFR 1505.2). In addition, USDI has outlined the adaptive management approach in a technical guide developed to provide guidance to all USDI bureaus and agencies (Williams, Szara, and Shapiro 2007).

Adaptive management is based on the assumption that current resources and scientific knowledge are limited. Nevertheless, an adaptive management approach attempts to apply available resources and knowledge and adjusts management techniques as new information is revealed. Holling (1978) first described the principle of adaptive management as requiring management decisions and policies to be viewed as hypotheses change.

USING THE ADAPTIVE MANAGEMENT PROCESS

Adaptive management is a systematic approach for improving resource management by learning from management outcomes (Sexton et al. 1999). An adaptive approach involves exploring ways to meet management objectives, predicting the outcomes of alternatives based on the current state of knowledge, implementing one or more of these alternatives, monitoring to learn about the impacts of management actions, and then using the results to update knowledge and adjust management actions (Murray and Marmorek 2004). Adaptive management focuses on learning and adapting, through partnerships of managers, scientists, and other stakeholders, who learn together how to create and maintain sustainable resource systems (Bormann et al. 2006).

Under the approach outlined by USDI guidance, adaptive management should be used when decisions must be made despite uncertainty and there is a commitment to using this approach. The deer management situation at Fire Island National Seashore meets all of these conditions.

There are two phases involved in a successful adaptive management plan: the set-up phase and the iterative phase. The set-up phase was completed concurrently with the development of this plan/EIS. The iterative phase would commence with the implementation of an action. Adaptive management approaches that would be included in the iterative phase are described below.

ADAPTIVE MANAGEMENT APPROACH

Under this plan/EIS, the following five steps would constitute the iterative phase of the adaptive management approach. For illustrative purposes, alternative D is used as an example for each of these steps.

1. Monitor the conditions. These conditions would be recorded and compared against baseline data to determine whether management actions are necessary. For much of the Seashore, baseline data already exist. Seashore staff are currently expanding monitoring efforts to gather additional data in areas where data on baseline conditions does not exist.
2. Apply the management action. Deer would be managed using an action alternative described in this document; for example, alternative D could initiate removal of deer to lower the deer population and reproductive control to maintain the deer density at the desired target range when an agent was available and met the criteria established in this plan/EIS. Initial thresholds for taking action for the various areas of the Seashore have been established, as described under the "Thresholds for Taking Action" section in chapter 1, and these thresholds will be adjusted if necessary in the future.

3. Monitor for the effectiveness of each management action. Monitoring would determine whether the management actions were achieving the desired outcome. For example, is there a reduction in the number of human-deer contacts within the Fire Island communities, or is forest regeneration occurring in the lower acreage of the William Floyd Estate as the initial deer density goal is achieved? Is reproductive control maintaining the deer population within the targeted deer density range?
4. If monitoring indicates that the goal of forest regeneration is not at an adequate level because of deer browsing pressure, reconsider the management actions. For example, under alternative D, this could result in establishing a lower deer density goal and using a combination of removal methods to reduce the population to achieve the new density.
5. If the management action is effective, and the forest is regenerating, consider modifications to the intensity of the action. For example, if forest regeneration is successfully occurring, consider whether deer density be raised (i.e., remove fewer deer) while still producing the same effect.

The adaptive management approach would be used in the following areas.

Undesirable Human-Deer Interactions

The plan incorporates several tools to reduce undesirable human-deer interactions. Methods of education/interpretation and coordination with community officials and boards, landowners, and vacationers will be important to the success of the plan. The Seashore would establish methods for reaching out to the Fire Island communities, and results of the education/interpretation efforts would be monitored via direct communication with visitors, questionnaires/surveys, and observations of direct feeding of deer and exposed garbage during deer distance sampling counts. It would take time for the Seashore's efforts at education/interpretation to effectively change the human behaviors that promote undesirable human-deer interactions. Modifications to actions would be based on these monitored results over time and compared to baseline conditions. Adjustments may be required in communication techniques such as the use of social media sites, printed materials, and public hearings. If the Seashore experiences little decrease in feeding of deer by the public, and deer are continuously feeding in exposed garbage, the Seashore would investigate additional methods for public outreach.

In addition, actions would be required to remove deer that approach humans. It is expected that decreases in negative human-deer interactions would occur within the second year after the majority of those deer (as observed during monitoring) are removed. The Seashore would annually monitor the deer population to determine the estimated deer density and to observe deer behavior. In the initial years of the plan, the goal would be to observe fewer deer approaching biologists during monitoring compared to the previous year. As described in the thresholds for taking action, the Seashore expects the percentage of deer observed to approach Seashore biologists is expected to approach 3%. As those deer observed approaching humans are removed, the Seashore expects a point in time when either all the deer approaching humans have been removed or at least the number of deer between years does not differ. If removal of deer that approach humans does not reduce the incidence of human-deer interactions, additional actions could be developed to manage other factors which encourage human-deer interactions.

Vegetation Management

Actions are needed to improve vegetation conditions within the Sunken Forest, other maritime forests, and the William Floyd Estate. The action thresholds differ for each area, and the proposed actions could be modified based on the best available data for forest regeneration, results of monitoring plot data, and deer density changes. The Seashore expects little changes in planned actions would be needed for the Sunken Forest since all deer would be removed within a protected

fenced area. Nonetheless, monitoring data would be compared with expectations (that herbaceous and woody vegetation would increase as deer density decreased) for each of the other areas of the Seashore. Other influences would also be considered in an adaptive management program to include climate change and the spread of invasive species. It is expected that it would take at least eight to 10 years after the initial deer density goal was achieved until vegetation results would be seen in the monitored plots within the maritime forests and the William Floyd Estate. If results after 10 years did not meet the objectives and goals of the plan, or ongoing monitoring indicated that there were other factors limiting forest regeneration, adjustments would be made to the existing vegetation management. These adjustments could include manipulation of forest canopies to control sunlight, artificial plantings, nonnative species management, or responses to the effects of climate change. Canopy treatments would be used if it were determined that the existing forest structure was preventing sunlight from reaching new seedlings. Enhanced nonnative species management may also be needed to promote forest regeneration and reduce competition. Finally, as the science and effects related to climate change become clearer, the Seashore may modify its vegetation management to continue to promote vegetation recovery in the changing climate.

The Seashore has extensive data on vegetation within the Sunken Forest, dating as far back as 1967. This data gives the Seashore a glimpse of the condition of the Sunken Forest before the irruption of the deer population, which is important at establishing targets. Once the Sunken Forest is protected from deer via fencing, monitoring within established vegetation plots would determine the success of the plan. If targeted vegetative species are not present after 8–10 years, the Seashore may consider more adaptive management approaches such as planting new stems, manipulating canopy openings, removing undesirable species (such as black cherry), or controlling heavy vine cover to promote preferred species.

Deer Density Goal

The number of deer to be removed annually throughout Fire Island and at the William Floyd Estate would be adjusted based on the results of the previous year's removal effort, the monitoring of forest regeneration, deer population surveys, and deer population growth projections. The approximate number of deer to be removed would be defined by the difference between the estimated deer population density and the initial density goal selected (e.g., 20–25 deer per square mile). This density goal would be achieved within two years, after which annual removal objectives would be based on the number of deer remaining in the population after each year's removal actions and factoring in an annual growth rate in order to maintain the population at the target level. This process of determining the number of deer to be removed would be repeated each year.

A primary objective of this plan is to achieve the successful regeneration of vegetation at the Seashore. Thus, vegetation monitoring results would be the key parameter for determining success, and not deer density. If monitoring indicated that vegetation was not regenerating, management actions would be adjusted. The following are examples of how this adaptive management approach could be implemented based on different outcomes:

- If vegetation regeneration is observed prior to meeting the initial deer density goal, the initial deer density target may be adjusted upward to the density that would still allow regeneration to occur.
- If the initial deer density goal of 20–25 deer per square mile was not reached within the first six years of the plan, additional efforts may be made to reach the desired density through the use of other methods of removal, such as increasing the use of capture and euthanasia in areas where sharpshooting was not effective.
- If vegetation regeneration proved to be insufficient within eight to 10 years after the initial deer density goal was reached, then the deer density goal could be lowered by five

additional deer per square mile, with a 6-year monitoring period before further reductions were made in density goals.

- In addition, if insufficient vegetation regeneration occurred after the deer density goal was reached, methods and protocols would be reviewed to identify the variables that were limiting expected results, and the methods used may be adjusted as necessary to correct for such factors.

Reproductive Control

Using alternative D as an example, reproductive control via a chemical reproductive control agent is one of the proposed measures to maintain the deer density once the target density was reached via direct reduction. The Seashore has gained knowledge and experience at controlling deer numbers using contraception from a multiyear study on the Fire Island. However, questions remain regarding its effectiveness as a tool for long-term management of deer at the Seashore. As the need for deer management methods increases, additional agents could be developed and tested for reproductive control on free-ranging deer. The Seashore could review the science at that time to determine if other agents are appropriate for the Seashore. The size, scale, and location of the application would depend on the specifications and efficacy of the drug. Furthermore, success of reproductive control using a contraceptive agent is dependent on the Seashore's methods and skill to capture animals for administering the chemical agent. The Seashore may find that modifications in capturing techniques would be needed to increase success.

Implementing Elements of the Plan/EIS

A number of the elements of the plan/EIS are based on recent vegetation monitoring, the current deer density at the Seashore, existing technology, and knowledge of deer population dynamics. As the plan/EIS is implemented, it is assumed that knowledge and experience with these issues would increase at the Seashore, within the state, and across the National Park Service. Improved knowledge and experience may result in adjustments being made to the timing of direct reduction, the implementation of reproductive controls, or any of the other elements included in the plan/EIS. Changes in timing would be made in cooperation with the state and only when there was scientific evidence to support such an action.

ALTERNATIVE ELEMENTS CONSIDERED BUT DISMISSED

The following alternative elements were considered but dismissed from further detailed analysis as explained below.

CAPTURE AND RELOCATION OFF OF FIRE ISLAND

Live-capture and relocation as an alternative may have limited success in controlling a small, isolated population, or in removing animals from one area to augment populations in other areas where the deer population is below desired levels (Coffey and Johnston 1997). Whereas translocation of deer on the same property would be allowed by New York State, state regulations do not support capture and relocation of white-tailed deer between separate land parcels within the state. Therefore, capture of deer on Fire Island for relocation on Long Island was dismissed as a management option.

REVERSING DEER BEHAVIOR TO REDUCE UNDESIRABLE HUMAN-DEER INTERACTIONS

The science team evaluated potential actions that could possibly reverse the behavior of those deer most habituated to the human presence (i.e., aversive conditioning) in an effort to reduce undesirable human-deer interactions. To change actual deer behavior, scientists believe that deer would need to have dramatic negative experiences in order to break their habituation. Suggested actions were discussed, such as cues of predators, hunting, dispersal of negative scents, visual or audible devices, or the use of dogs to chase deer, but these actions are impractical on private lands within the Fire Island communities. Scientists believe direct negative human interactions that provide deer the fear of harm, termed as "hazing," would be the only approach that may change deer behavior, but the likelihood of success is very low in the scientists' opinion. Deer movements or behavioral patterns are difficult to modify once they have been established (DeNicola et al. 2000). Furthermore, hazing would need to be consistent, around the clock, and perpetual, which is problematic because it would require participation by all humans, even non-Seashore individuals, which is unrealistic as part of a NPS deer management plan. For these reasons, aversive conditioning of deer at the Seashore was dismissed from further consideration.

SURGICAL STERILIZATION

Surgical sterilization of females is an effective method of controlling reproduction and has been used extensively in domestic animal medicine. However, implementation requires capture, general anesthesia, and surgery conducted by a veterinarian, which is generally considered labor intensive and costly (Boulanger, et al. 2012) and calls into question the long-term sustainability of sterilization as a wildlife management tool, except under very limited circumstances. Boulanger and others (2012) note that surgical sterilization is a costly but effective technique for reducing suburban deer herds if 80% or more of the female deer in a population are sterilized and that proportion is maintained over time. Overall success was greatest for closed populations. Only in rare circumstances is physical sterilization reversible.

Depending on the method of sterilization, this procedure may have behavioral effects on both male and female deer. If gonads are removed, then the source of important reproductive hormones would be removed. This is likely to change deer social interactions. If gonads are not removed, females would continue to ovulate and show behavioral signs of estrus and consequently may extend the breeding season.

This option would involve administering a tranquilizing agent to female deer via dart by qualified personnel. Once the tranquilizing agent had taken effect, surgery in the field would be performed by a qualified veterinarian to remove or disconnect select reproductive organs, affecting permanent infertility. Overall, this option would take a substantial amount of time per deer. When compared to the alternatives considered in this document and the number of deer that would need to be treated surgical sterilization is technically unfeasible as a stand-alone alternative. Based on these reasons, surgical reproductive control was dismissed as a management option.

The potential use of surgical sterilization in combination with other deer population management actions was also reviewed. Discussion focused on the potential number of deer that would require treatment; the length of time required to achieve the deer density goal if implemented in combination with direct reduction; mortality of treated females; available research on population level effects particularly for large, free-ranging deer populations; baseline data on Seashore deer required to fully develop a combined alternative involving surgical sterilization; and potential implications of using a nonreversible management action. Surgical reproductive control was

dismissed as an element of a combined alternative because there is little available research on population level effects. Therefore, the use of an irreversible management action based on population parameters that could potentially change greatly in the future was not recommended.

SUPPLEMENTAL FEEDING

Providing supplemental food to deer is often suggested as a way of reducing damage to natural or ornamental vegetation. However, the NPS *Management Policies 2006*, section 4.4.1, "General Principles for Managing Biological Resources," and section 4.4.2, "Management of Native Plants and Animals," are aimed at allowing natural processes to occur whenever possible (NPS 2006a) and would not support supplemental feeding. For this reason, the use of supplemental feeding was dismissed as a management option.

PREDATOR REINTRODUCTION

Relationships between predators and prey are complex, and the impact of predators on herbivore populations is variable (McCullough 1979). Coyotes (*Canis latrans*) are deer predators present throughout much of North America but are currently not found in or near the Seashore. However, this species appears to be opportunistic, taking advantage of specific periods of deer vulnerability and has not demonstrated a consistent ability to control deer populations. Even though coyote populations have increased and the coyote's range has expanded over the past 20 years, both deer and coyote populations have increased simultaneously in many areas (NYS-DEC and CCE 1991). Biologists believe that coyotes are partly responsible for declining deer numbers in some areas, but changes in deer populations in other areas appear unrelated to coyote density. Coyotes hunt individually and are territorial, so large deer are generally not taken by individual coyotes.
Wolves are efficient deer predators, but they have been eliminated from much of the United States. Introducing wolves to the Seashore is not feasible due to a lack of suitable habitat. Wolves have home ranges averaging 30 square miles when deer are the primary prey (Mech 1990), which is much larger than the Seashore's 8.8 square miles. Also, most of the Seashore is surrounded by, or includes, an urban or suburban environment, in particular at the William Floyd Estate and in the Fire Island communities, making it impractical for predators such as wolves or coyotes to be reintroduced. There are issues with possible adverse effects on residents, especially the safety of pets and children.

Due to reasons described above relating to effectiveness, habitat limitations, and human safety concerns, the use of predators to manage the deer population was dismissed from further analysis.

REPELLENTS, PLANTINGS, AND OTHER DETERRENTS

Chemical repellents and the selection of plants that are not palatable to deer are good options for individual homeowners to discourage deer from destroying residential yards and gardens. These repellents can be sprayed on or attached to nearby vegetation, thus protecting individual plants or larger areas (Coffey and Johnston 1997). However, repellents are removed by rainfall, requiring repeated applications. At high deer densities, repellents may be completely ineffective (Maryland DNR 2002). Therefore, it would be impractical to effectively manage deer through the use of repellents in a large park setting. Visual and sound deterrents also are available to scare deer away from areas (API 2000). However, visual and sound deterrents and planting of unpalatable plants would be impractical in a large park setting and could have impacts on visitor experience. Therefore, using repellents, select plantings, and other deterrents was dismissed as a management option.

CONSISTENCY WITH SECTIONS 101(B) AND 102(1) OF THE NATIONAL ENVIRONMENTAL POLICY ACT

Council on Environmental Quality (CEQ) regulations (40 CFR 1500.2) require that the EIS include an analysis of how each alternative meets or achieves the purposes of NEPA, as stated in sections 101(b) and 102(1). This section describes how each of the alternatives under consideration in this plan/EIS meets or achieves these policies.

1. Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.
2. Ensure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings.
3. Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences.
4. Preserve important historic, cultural, and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice.
5. Achieve a balance between population and resource use that would permit high standards of living and a wide sharing of life's amenities.
6. Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

ALTERNATIVE A (NO ACTION)

Alternative A would meet the purpose of NEPA to some extent because limited protection of certain rare species and habitats would be continued. Under alternative A, the Seashore would continue to attain a wide array of beneficial uses (criterion 3), although there would be continued degradation of natural and cultural resources. Damage to vegetation, unique vegetation communities, and special-status plant species; white-tailed deer population; other wildlife and wildlife habitat; wilderness; cultural landscapes; Fire Island communities and adjacent landowners; public health and safety; and Seashore operations would continue, as a result of excessive browsing by high numbers of deer. The continued degradation of natural features and cultural landscapes would not maintain a balance between the deer population and the surrounding resources (criterion 5). Additionally, this alternative would neither fulfill the responsibilities of each generation as the trustee of the environment for succeeding generations nor preserve important aspects of our national heritage (criteria 1 and 4, respectively), because of the degradation of natural features and cultural landscapes. Alternative A would not enhance the quality of renewable vegetation resources (criterion 6). The expected adverse impacts would not ensure healthful, productive, or esthetically pleasing surroundings (criterion 2).

ALTERNATIVE B

This alternative would meet some of the criteria within the life of the plan, primarily in the latter years, as fencing and reproductive controls took effect. Members of the planning team noted that the fencing would protect part of the environment without requiring the reduction of the deer population. However, it would provide only limited direct protection for vegetation, unique vegetation communities, and special-status species. This alternative would also rely heavily on a technology (fertility control) that might not be available for a number of years. The gradual progress this alternative provides would not fully achieve all six criteria. In particular, the exclosures would detract from esthetics of the cultural landscapes (criterion 2), and reproductive control methods

could have other unintended consequences. The installation and movement of fencing could result in additional damage of resources (e.g., wetlands), an undesirable consequence (criterion 3). Alternative B also raises concern about unintended consequences (criterion 3) because it would rely on technology (fertility control) that has not been proven in free-ranging deer as a population management tool. Fencing would not limit the choices available to the public (criterion 4) because access to the William Floyd Estate and to the trails within the Sunken Forest would be provided through gates in the fences. The lack of protection for a large percentage of the Seashore, and the time it would take any reproductive control to be effective, would mean that succeeding generations might not see desired results for some time (criterion 1). Incorporating adaptive management principles would help achieve some balance between population and resource use (criterion 5), but the limited history of reproductive control success and the limits on how much vegetation would be included in exclosures means that it would not be possible to completely approach the maximum attainable recycling of resources (criterion 6).

ALTERNATIVE C

Alternative C would succeed in meeting all of the criteria within the life of the plan. By immediately reducing deer browsing pressure, this alternative would allow vegetation in the Seashore to regenerate for the benefit of future generations faster than alternative B (criterion 1). The immediate reduction in the deer population and subsequent improvements in the natural environment would provide a great deal of benefit. There would be some safety concerns associated with direct reduction methods used to implement alternative C; however, by implementing proper controls, these concerns could be minimized. The result would be safer conditions throughout the Seashore and Fire Island communities because of lower incidence of human-deer interactions. However, the small-scale fencing would detract from esthetics of the cultural landscapes (criterion 2). Alternative C would require temporary closures of some areas of the Seashore during direct reduction implementation, which would limit the use of these areas. However, these closures would occur at times and places that are not high visitation periods and would take place to maximize public safety. This alternative would avoid undesirable conditions by immediately reducing deer browsing. Alternative C would avoid unintended consequences associated with direct reduction actions through implementing regular Seashore closures, scheduled closures of certain areas of the Seashore, and public outreach and communication (criterion 3). The closures within the Seashore would limit individual choice, but only for limited periods. These closures would allow for the reduction of the deer population, which would protect the Seashore's natural and cultural resources and provide greater choices in the future (criterion 4). This alternative also would achieve a balance between the deer population and the surrounding Seashore resources (criterion 5). Finally, by immediately reducing the deer browsing pressure and promoting forest regeneration, this alternative would enhance the quality of renewable resources (criterion 6).

ALTERNATIVE D

Alternative D is similar to alternative C in the extent to which it would meet the intent of NEPA. The evaluation of these alternatives shows that both would fulfill the responsibilities of each generation as a trustee of the environment for succeeding generations (criterion 1) to a large degree because both would immediately reduce deer numbers, thereby reducing browsing pressure and promoting regeneration. The exclosures would detract from esthetics of the cultural landscapes (criterion 2). Both alternatives also would help achieve a balance between population and resource use (criterion 5). Although they may approach the criteria in a slightly different manner, both alternatives would approach the maximum attainable regeneration of depletable resources (i.e., vegetation) by reducing and maintaining the deer population density (criterion 6). Implementation of alternative D would

avoid unintended consequences (criterion 3) associated with direct reduction actions through implementing regular Seashore closures, scheduled closures of certain areas of the Seashore, and public outreach and communication, and could cause some concern about unintended consequences because it would use technology that has not been proven in free-ranging deer as a maintenance tool. Risks to health and safety (criterion 3) associated with the reproductive control method would be less than alternative B because fewer deer would be treated with a fertility control agent. Although the planning team recognized the uncertainties associated with reproductive control agents, it was recognized that this technology is developing rapidly and would provide additional information in the near future. Any safety concerns would be reduced through proper safety controls. Finally, alternatives C and D both would preserve important historic, cultural, and natural aspects of the Seashore in the long term (criterion 4), because the smaller deer population would reduce browse pressure on vegetation in natural areas, the Fire Island Wilderness, and the cultural landscapes at William Floyd Estate.

ENVIRONMENTALLY PREFERABLE ALTERNATIVE

In accordance with the Director's Order 12 Handbook, the National Park Service identifies the environmentally preferable alternative in its NEPA documents for public review and comment (section 4.5 E[9]). The environmentally preferable alternative is the alternative that causes the least damage to the biological and physical environment and best protects, preserves, and enhances historical, cultural, and natural resources. The environmentally preferable alternative is identified upon consideration and weighing by the responsible official of long-term environmental impacts against short-term impacts in evaluating what is the best protection of these resources. In some situations, such as when different alternatives impact different resources to different degrees, there may be more than one environmentally preferable alternative (43 CFR 46.30).

Based on the analysis of environmental consequences of each alternative presented in chapter 4 and summarized in table 9 below, alternative C has been identified as the environmentally preferable alternative because it is the alternative that would best protect the biological and physical environment by ensuring an immediate reduction in deer population, thereby reducing browsing pressure and promoting regeneration over the life of the plan. Alternatives C and D would best protect, preserve, and enhance the historic, cultural, and natural processes that support the Seashore's cultural landscape and vegetation through various management options to maintain low deer numbers. Although alternatives C and D are very close in meeting the goal that identifies the environmentally preferable alternative, alternative C was identified as the environmentally preferable alternative primarily because it would reduce the deer population using a method which has proven effective.

NPS PREFERRED ALTERNATIVE

The preferred alternative is the alternative which would fulfill the National Park Service's statutory mission and responsibilities (CEQ 1981). The preferred alternative was identified with consideration to the likelihood of meeting the objectives, flexibility and management options available for use in order to meet the objectives, timeframe in which desired conditions would be met, public concerns regarding safety and resource management, and feasibility of implementing the plan given uncertain economic conditions. The NPS has identified alternative D as the agency preferred alternative because immediate reduction of the deer population would provide the greatest protection of the Seashore's resources while imposing a minimal risk during implementation of carefully managed direct reduction actions. Additionally, under this alternative, Seashore managers would have the widest range of options available for the purpose of managing both deer browse and the deer population levels (i.e., fencing, direct reduction, and/or fertility

control). Having this flexibility would allow Seashore managers to implement whichever methods best balance resource protection with public safety and the level of effort needed for Seashore staff to implement the management activities.

HOW ALTERNATIVES MEET OBJECTIVES

As stated in chapter 1, all action alternatives selected for analysis meet all objectives to a large degree. The action alternatives must also address the stated purpose of taking action and resolve the need for action; therefore, the alternatives were individually assessed in light of how well they would meet the objectives for this plan/EIS, which are listed in chapter 1 of this document. Alternatives that did not meet the objectives were not analyzed further (see the section "Alternative Elements Considered but Dismissed" previously in this chapter).

Table 4 compares the alternatives by summarizing the elements being considered, while table 8 compares how each of the alternatives described in this chapter would meet the plan objectives. "Chapter 4: Environmental Consequences" describes the effects of each alternative on each impact topic. These impacts are summarized in table 9. The significance of the impacts is described in chapter 4 and summarized in table ES-1.

TABLE 8. HOW ALTERNATIVES MEET OBJECTIVES

Objective	Alternative A (No Action)	Alternative B	Alternative C	Alternative D (NPS Preferred)
Manage a viable white-tailed deer population in the Seashore that is supportive of the other objectives for this plan/EIS.	Does not meet the objective. No actions would be taken to manage the white-tailed deer population.	Meets the objective. Manages the white-tailed deer population in a way that would support other objectives following a relatively long period (approximately 13 years) to achieve deer density targets.	Meets the objective. Manages the white-tailed deer population in a way that would support other objectives relatively quickly, reaching desired deer densities targets after approximately 3 years.	Meets the objective. Same as alternative C.
Promote natural regeneration of native vegetation.	Does not meet the objective. No reduction in deer browsing pressure, resulting in inhibition of natural regeneration.	Meets the objective. Fencing of the Sunken Forest and rotational fencing at the William Floyd Estate would offer immediate protection from deer browsing pressures in those exclosures. Deer browsing pressures would be reduced throughout the rest of the Seashore, promoting natural regeneration after the initial 13 years of fertility treatment.	Meets the objective. Combined direct reduction actions would directly reduce browsing pressure, promoting natural regeneration after approximately 3 years.	Meets the objective. Same as alternative C.
Protect special-status species/vegetation communities and their habitat from high levels of deer browsing.	Does not meet objective. Although the Seashore currently fences individual special-status species plants when discovered, no plan would be implemented to reduce the deer browsing pressures from the communities as a whole.	Meets the objective. Fencing of the Sunken Forest and rotational fencing at the William Floyd Estate would offer immediate protection for special-status species/vegetation communities and their habitat from deer browsing pressures in those exclosures. Deer browsing pressures would be reduced throughout the rest of the Seashore, promoting natural regeneration after the initial 13 years of fertility treatment.	Meets the objective. Combined direct reduction actions would directly reduce browsing pressure on special-status species/vegetation communities and their habitat, promoting natural regeneration after approximately 3 years.	Meets the objective. Same as alternative C.
Work collaboratively with other land management agencies on issues associated with abundance, distribution, and behavior of white-tailed deer at the Seashore.	Does not meet objective. While the Seashore would continue general collaboration with other land management agencies, there would be no comprehensive plan in place to address issues associated with abundance, distribution, and behavior of white-tailed deer at the Seashore.	Meets the objective. Seashore staff would implement enhanced education/interpretation efforts as part of a comprehensive deer management plan in collaboration with other land management to address issues associated with abundance, distribution, and behavior of white-tailed deer at the Seashore.	Meets the objective. Same as alternative B.	Meets the objective. Same as alternative B.
Improve public understanding of the issues such as human-deer interactions, the impact of white-tailed deer on the cultural and natural resources of the Seashore, and tick-borne diseases throughout the Seashore, including the William Floyd Estate.	Does not meet objective. The Seashore would not implement a comprehensive education/interpretation effort to improve public understanding of the issues such as human-deer interactions, the impact of white-tailed deer on the cultural and natural resources of the Seashore, and tick-borne diseases throughout the Seashore, including the William Floyd Estate.	Meets the objective. Seashore staff would implement enhanced education/interpretation efforts to improve public understanding of the issues such as human-deer interactions, the impact of white-tailed deer on the cultural and natural resources of the Seashore, and tick-borne diseases throughout the Seashore, including the William Floyd Estate.	Meets the objective. Same as alternative B.	Meets the objective. Same as alternative B.
Continue to expand the knowledge base regarding the relationship between deer browsing and plant communities at Fire Island National Seashore to improve management decisions.	Partially meets the objective. The Seashore would continue current deer and plant monitoring efforts.	Meets the objective. Current deer and plant monitoring efforts would be enhanced as part of the plan to expand the knowledge base regarding the relationship between deer browsing and plant communities at the Seashore.	Meets the objective. Same as alternative B.	Meets the objective. Same as alternative B.

TABLE 8. HOW ALTERNATIVES MEET OBJECTIVES (CONT'D)

Objective	Alternative A (No Action)	Alternative B	Alternative C	Alternative D (NPS Preferred)
Within the Sunken Forest, maintain the character of the globally rare maritime holly forest by creating conditions for the regeneration of key canopy constituent tree species and a reasonable representation (as defined in the desired conditions description below) of herbs and shrubs that made up the Sunken Forest's vegetative composition when the Seashore was established.	Does not meet objective. Deer browse pressure would continue to inhibit regeneration of vegetation within the Sunken Forest's globally rare maritime holly forest.	Meets the objective. Deer would be excluded from the Sunken Forest to eliminate browsing pressure that could inhibit regeneration of vegetation within the Sunken Forest's globally rare maritime holly forest.	Meets the objective. Same as alternative B.	Meets the objective. Same as alternative B.
Reduce the potential for undesirable human-deer interactions both within the Fire Island communities and at other developed areas of the Seashore.	Does not meet objective. No comprehensive program would be implemented to reduce the potential for undesirable human-deer interactions within Fire Island communities and at other developed areas of the Seashore.	Meets the objective. The Seashore would reduce the potential for undesirable human-deer interactions through the implementation of enhanced education/interpretation within the Fire Island communities and at other developed areas of the Seashore. Additionally, the Seashore would reduce this potential through reduction of the local deer population over approximately 13 years.	Meets the objective. Same as alternative B, except that the deer population would be reduced more rapidly, over a 2-year period.	Meets the objective. Same as alternative C.
Manage deer browse to allow for the restoration and preservation of the cultural landscape of the William Floyd Estate and for the regeneration of the forest within the lower acreage of the William Floyd Estate.	Does not meet the objective. The current level of deer management does not reduce deer browse at sufficient levels to allow for the restoration and preservation of the cultural landscape of the William Floyd Estate and for the regeneration of the forest within the lower acreage of the William Floyd Estate.	Meets the objective. Deer browse would be reduced immediately through the use of fencing and would otherwise be reduced over approximately 13 years, allowing for the restoration and preservation of the cultural landscape of the William Floyd Estate and for the regeneration of the forest within the lower acreage of the William Floyd Estate.	Meets the objective. Deer browse would be rapidly reduced over a 2-year period, allowing for the restoration and preservation of the cultural landscape of the William Floyd Estate and for the regeneration of the forest within the lower acreage of the William Floyd Estate	Meets the objective. Same as alternative C.

TABLE 9. SUMMARY OF ENVIRONMENTAL CONSEQUENCES

Impact Topic	Alternative A (No-action)	Alternative B	Alternative C	Alternative D
Vegetation, Unique Vegetation Community, and Special-status Species	**Fire Island Natural Areas** ▪ Existing deer population would not be reduced, causing continued high levels of deer browse island-wide. ▪ Browsing pressure would lead to a lack of forest regeneration, low survivorship of herbaceous plants, and the eventual dominance of unpreferred and browse-resistant plants, several of which are nonnative. ▪ Heavy deer browse would continue to alter understory species composition and densities within maritime forests. **Sunken Forest** ▪ Species composition would change over time to species not preferred by deer, such as black cherry. Eventual loss of oak-hickory community type could occur over time. ▪ Native seedlings positioned to replace canopy stems would continue to be impacted by heavy deer browse. ▪ Native plant constituents present in the 1960s would be locally extirpated within the Sunken Forest. ▪ Goals for managing vegetation at the Sunken Forest as mandated by enabling legislation would not be achieved over the long term. **William Floyd Estate** ▪ Continued high level of deer browse would impact forests' ability to regenerate native overstory species due to understory shifts in species composition caused by deer browse. **Special-status Species** ▪ Special status species susceptible to deer browse and trampling with no control of deer numbers. ▪ Continued seasonal fencing of special-status species from deer would benefit these plants	**Fire Island Natural Areas** ▪ Gradual reduction in deer density across the island would reduce browsing pressures on native vegetation. Reduction to initial target density would require up to 13 years. ▪ Vegetation is expected to recover from current browse levels approximately 8 to 10 years following deer population reduction. Therefore, vegetation recovery would require up to 23 years to be fully realized. ▪ If an acceptable fertility control agent is not available for up to 10 years following implementation of this plan, vegetation recovery would require up to 33 years to be fully realized. ▪ Reduced deer browse on understory herbs, shrubs, and seedlings in maritime forests. ▪ Translocation of deer may cause a localized increase in deer browse of native vegetation at the Fire Island Wilderness until the deer density is lowered. **Sunken Forest** ▪ Deer exclusion from this area would remove deer browsing pressures native seedlings, allowing for recovery of understory vegetation. ▪ Vegetation would be removed and/or relocated during installation of fencing, totaling 7,130 LF or 1.31 acres. ▪ Vegetation could be trampled during the deer drive to remove deer from the fenced area. ▪ Vegetation monitoring and implementation of adaptive management would benefit vegetation due to growing understanding and knowledge of the rare holly maritime forest ecosystem. **William Floyd Estate** ▪ Vegetation would be removed and/or relocated during installation of fencing (rotational fencing and core fencing) totaling 30,300 LF or 5.6 acres. ▪ Forest understory vegetation would recover with exclosure fencing. ▪ Exclusion of deer from fenced areas would cause higher browse pressure in surrounding areas until the overall deer density is reduced. **Special-status Species** ▪ Translocation of deer to the Fire Island Wilderness may cause a localized increase in deer browse of special-status species until the deer density is lowered; however, impacts would continue to be mitigated through use of fencing.	**Fire Island Natural Areas** ▪ Rapid reduction in deer density across the island would reduce browsing pressures on native vegetation. Reduction to initial target density would require approximately two years. ▪ As under alternative B, vegetation is expected to recover from current browse levels approximately 8 to 10 years following deer population reduction. Therefore, under alternative C, vegetation recovery would require up to 12 years to be fully realized. ▪ Other impacts on vegetation would be the same as described under alternative B but on the accelerated timeline described above. **Sunken Forest** ▪ Same as alternative B. **William Floyd Estate** ▪ Small-scale fencing/protective barriers around target species would protect select vegetation. ▪ Understory forest vegetation restoration would occur due to the rapid deer reduction described above. **Special-status Species** ▪ Same as alternative B.	**Fire Island Natural Areas** ▪ Same vegetation recovery as described under alternative C, with deer density reduced along the same timeline. **Sunken Forest** ▪ Same as alternative B. **William Floyd Estate** ▪ Deer would be excluded from this historic core, as described under alternative B. ▪ Rapid deer reduction would provide lower browsing pressure and recovery of understory forest vegetation, even in areas where deer exclusion fencing is not installed. **Special-status Species** ▪ Same as alternative B.

TABLE 9. SUMMARY OF ENVIRONMENTAL CONSEQUENCES (CONT'D)

Impact Topic	Alternative A (No-action)	Alternative B	Alternative C	Alternative D
Wetlands	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.	▪ Temporary disturbance to 273 linear feet of wetland vegetation during removal of vegetation needed for construction ▪ Temporary disturbance from sidecasted soil from post holes ▪ Temporary disturbance to wetland vegetation in later years during fence maintenance. ▪ Permanent displacement of vegetation where displaced by the fence. ▪ Wetland functions would remain intact.	Same as B	Same as B
White-tailed Deer Population	▪ Increased competition for resources could result in malnutrition resulting in weight loss, lower reproductive rates, and higher fawn mortality if deer numbers grow higher with no mechanisms for population control. ▪ The high population density also exerts a higher level of risk for the spread of communicable deer diseases such as chronic wasting disease. ▪ Deer would continue to be at risk of ingestion of harmful substances from foraging in garbage.	▪ The white-tailed deer population density would be reduced through use of an acceptable fertility control agent and would then be maintained at that density using the same method. The population would decline gradually over approximately 13 years as it reached the target density. ▪ Across the Seashore, fewer deer would be competing for resources, resulting in overall better population fitness. ▪ The population may experience unintended mortality of deer during handling needed for tagging deer treated with a fertility agent. ▪ The population may experience behavioral changes due to application of a fertility control agent. – Late season fawning possible by treated females. – Longer rutting period causing more energy exertion by adults, particularly bucks. ▪ In areas surrounding newly constructed deer exclosures, deer density would increase, resulting in increased competition for resources, until density is reduced through use of fertility control. ▪ The population may lose access to artificial food supplies with better refuse management and public information provided in the Fire Island communities and other lands adjacent to the Seashore.	▪ The white-tailed deer population density would be reduced through a variety of direct reduction methods, including sharpshooting, capture and euthanasia, and hunting, and would then be maintained at that density using the same methods. The population would decline rapidly over approximately two years as it reached the target density. ▪ As under alternative B, reduced deer numbers would result in improved habitat quality from lower browsing pressure and better deer population fitness. However, this fitness improvement would be realized more quickly that under alternative B. ▪ Deer exclosures would have the same localized increase in population density as described under alternative B; however, the density would be reduced much more rapidly. ▪ Same loss of artificial food supplies as under alternative B.	▪ The white-tailed deer population density would be reduced using the same methods described under alternative D, with the same impacts taking place along the same timeline; however, the Seashore would consider use of an acceptable fertility control agent in addition to or in place of the direct reduction methods for population density maintenance. ▪ Should the Seashore implement use of a fertility control agent, the related impacts described under alternative B would apply. ▪ Same loss of artificial food supplies as under alternative B.

TABLE 9. SUMMARY OF ENVIRONMENTAL CONSEQUENCES (CONT'D)

Impact Topic	Alternative A (No-action)	Alternative B	Alternative C	Alternative D
Other Wildlife and Wildlife Habitat	▪ Deer overbrowsing would continue to negatively impact food and shelter availability for other wildlife species. Forests species such as songbirds, insects, and small mammals would be particularly impacted by competition for remaining habitat. ▪ Residents of Fire Island communities may not understand the impacts of the plants they use for landscaping have. They may continue to propagate nonnative invasive species adjacent to natural areas, which could decrease habitat quality within the Seashore.	▪ Lower deer density would reduce deer browse of vegetation that provides food and shelter for other species. Forests species such as songbirds, insects, and small mammals would be particularly benefited by removal of competition for and by recovery of habitat. Deer density would be reduced gradually, reaching a density that would allow vegetation recover in approximately 13 years. ▪ Where exclosures are installed, wildlife would benefit from immediate removal of deer browsing; however, competition for resources and habitat alteration would continue at increased levels outside the exclosure until the deer density is effectively reduced. ▪ Wildlife would be disturbed during fencing installation, and fencing may disrupt natural movement patterns of some other wildlife species. ▪ A list of non-native invasive species to avoid along with a list of species encouraged to plant will be provided to the residents of Fire Island communities. This could help reduce the propagule pressure and spread of non-native invasive species to adjacent natural areas.	▪ Impacts would be the same as under alternative B with the following differences: – Deer density would be reduced more quickly, reaching a density anticipated to allow vegetation recovery over the course of approximately 2 years. – Less exclusion fencing would be installed, and where fencing is installed, the deer density outside it would be reduced rapidly (over approximately 2 years).	Same as alternative C.
Wilderness	**Fire Island Wilderness** ▪ Untrammeled, natural, and undeveloped qualities of wilderness diminished somewhat by existing management and monitoring activities; however, these actions would move the Fire Island Wilderness ecosystem towards desired conditions in the long term. ▪ Fire Island Wilderness would continue to offer opportunities for solitude and a primitive and unconfined type of recreation. ▪ The natural quality of the wilderness character could be diminished if deer density reaches a point where overgrazing causes an ecosystem imbalance.	**Fire Island Wilderness** ▪ Same impacts from ongoing resource management as described under alternative A. ▪ Untrammeled quality and opportunities for solitude would be diminished by use of fertility control (i.e., use of a chemical agent to alter deer biology). ▪ Opportunities for solitude could be further diminished by marking of translocated deer.	**Fire Island Wilderness** ▪ Same impacts from ongoing resource management as described under alternative A. ▪ Opportunities for solitude would be diminished for non-hunting visitors in the Fire Island Wilderness, but opportunities for solitude for hunters would be expanded by the establishment of deer hunting in Fire Island Wilderness.	**Fire Island Wilderness** ▪ Same impacts from ongoing resource management as described under alternative A. ▪ Impacts would be similar to both alternatives B and C because this alternative includes use a combination of population control methods: – Untrammeled quality and opportunities for solitude would be diminished by use of fertility control (i.e., use of a chemical agent to alter deer biology) – Opportunities for solitude would be diminished for non-hunting visitors in the Fire Island Wilderness, but opportunities for solitude for hunters would be expanded by the establishment of deer hunting in Fire Island Wilderness.
Cultural Landscapes (William Floyd Estate)	**Historic Core** ▪ Loss of character-defining features/landscape plantings would continue. ▪ The Seashore would remain unable to replant/maintain the gardens due to ongoing high levels of deer browsing. ▪ Small-scale fencing within the historic core would continue to impose a non-character defining feature within the cultural landscape. ▪ Lack of historically present vegetation inhibits visitor understanding of the cultural landscape. **Lower Acreage** ▪ The forest/field pattern may be altered over time due to the potential for forest regeneration to be inhibited by deer browse.	**Historic Core** ▪ Exclusion fencing within the historic core would add a non-character defining feature within the cultural landscape, altering views into and out of the historic core slightly; however, the fencing would be camouflaged within the tree line to minimize visual intrusion to the extent possible. ▪ Character-defining vegetation could be replanted (trees and garden) and would be able to flourish within the deer exclosure. This would also allow for enhanced visitor understanding of the cultural landscape. ▪ The west garden would be replanted and would flourish most as compared to the other alternatives. **Lower Acreage** ▪ Forested vegetation to recover and regenerate through use of two phases of rotational fencing. The forest/field patterns would be maintained.	**Historic Core** ▪ Small-scale fencing may allow the enhancement of select plantings within the historic core for visitor interpretation purposes, but the enhanced plantings would necessarily be limited in scope. Gardens outside of fencing would remain vulnerable to deer browse, albeit at lower levels than current conditions. ▪ Small-scale fencing within the historic core would continue to impose a non-character defining feature within the cultural landscape. **Lower Acreage** ▪ Once the deer population density decreases, the lower acreage forested vegetation could recover and regenerate. Over long-term, forest/field patterns maintained (a beneficial impact). This would allow recovery of regeneration more quickly than under alternative B.	**Historic Core** ▪ Same as alternative B. **Lower Acreage** ▪ Same as alternative C.

TABLE 9. SUMMARY OF ENVIRONMENTAL CONSEQUENCES (CONT'D)

Impact Topic	Alternative A (No-action)	Alternative B	Alternative C	Alternative D
Visitor Use and Experience/ Recreation	▪ Clear presence of deer in the Seashore. Deer viewing is frequent. Deer population could continue to grow, making viewing opportunities more frequent. This impact could be beneficial or adverse, depending on preference of the visitor. ▪ An increase in the deer population could reduce habitat and/or food sources for other wildlife species (other than deer). This would reduce the viewing potential for those other species. ▪ Deer are browsing vegetation at the William Floyd Estate, diminishing the cultural landscape and, therefore, the associated visitor experience of this resources. ▪ Continued trampling of vegetation could reduce the overall experience for visitors	▪ Enhanced education about deer management would make visitors aware of why the park is taking action and better educate them on how to avoid negative interactions. ▪ Deer population would be reduced gradually, reaching more sustainable densities in approximately 13 years through use of fertility control. – Reduced opportunities to view deer could be beneficial or adverse, depending on visitor preferences. – Could enhance viewing opportunities for other wildlife species. ▪ Visitors could be aware of the deer treatment activities occurring, which could reduce their overall experience. ▪ Visitors would no longer have the opportunity to view deer in the Sunken Forest, due to the exclusion of deer by fencing. ▪ Fencing could intrude on existing natural viewsheds, island-wide (including within the Sunken Forest) and at William Floyd Estate. ▪ Fencing could limit visitor access to some areas, especially during fence construction/installation; however, visitors would retain access to the Sunken Forest and the William Floyd Estate historic core. ▪ Visitors would benefit from an improved understanding of the cultural landscape at the William Floyd Estate due to restoration within fenced areas.	▪ Enhanced education about deer management would be the same as under alternative B. ▪ Deer population would be reduced more quickly than under alternative B, in approximately 2 years. Following reduction, impacts on visitor use and experience/recreation would be the same as under alternative B. ▪ Some visitors may be upset by the use of direct reduction methods; other visitors may appreciate the more efficient method of reduction. ▪ The Seashore would permit deer hunting in the wilderness, which would provide an additional recreational opportunity. ▪ Small fencing/protective barriers would remain installed within the William Floyd Estate. The fencing may detract from visitor experience but may allow some restoration of vegetation that would improve visitor understanding of the historic setting/cultural landscape at the William Floyd Estate. ▪ Same impacts of fencing of the Sunken Forest as described under alternative B.	▪ Enhanced education about deer management would be the same as under alternative B. ▪ This alternative combines impacts described under alternatives B and C. The same methods used to quickly reduce the population under alternative B would be used under this alternative. Fertility control methods may be used to maintain population levels following the initial reduction. As such, impacts would be the same as described under those alternatives. ▪ Same impacts from fencing of the William Floyd Estate and Sunken Forest, both described under alternative B.
Fire Island Communities and Adjacent Landowners	▪ Human-deer interactions would continue because of ongoing provision of artificial food sources, including presence of unsecured garbage. ▪ Deer would continue to use Fire Island communities for foraging habitat and for shelter. ▪ Deer would continue to browse on gardens and other plantings within the communities. ▪ Deer would continue to spill and/or feed from unsecured garbage cans.	▪ Negative interactions would be reduced through public education to reduce feeding of deer and properly secure garbage. ▪ Reduced deer browse (decreased gradually over approximately 13 years) would improve condition/appearance of community vegetation. ▪ Reduced deer viewing opportunities may improve or diminish community member experience, depending on individual sentiments toward particular species. ▪ Targeted removal of food-conditioned deer from the communities would reduce negative human-deer interactions	▪ Negative interactions would be reduced through public education, as under alternative B. ▪ Reduced deer browse would have the same impacts as described under alternative B; however, these impacts would be realized more quickly because the deer population would be decreased more rapidly (over approximately 2 years).	▪ Negative interactions would be reduced through public education, as under alternative B. ▪ Reduced deer browse would have the same impacts as described under alternative B, but along the same timeline as alternative C.
Public Health and Safety	▪ Deer may continue to approach humans because of ongoing food-conditioning of deer. ▪ Visitors would continue to be concerned over the perceived risk of tick-borne illness.	▪ Reduced chance of deer approaching humans because of educational outreach to reduce food-conditioning of deer. Fencing of the historic core of the William Floyd Estate would further reduce the perceived risk of tick-borne illness. ▪ Visitors concerned over the perceived risk of tick-borne illness would decrease due to educational outreach. ▪ Reduced negative human-deer interactions due to deer population density (decreased gradually over approximately 13 years).	▪ The same educational outreach as alternative B would reduce the risk of deer approaching humans. ▪ Reduced deer population density would have the same impacts as described under alternative B; however, these impacts would be realized more quickly because the deer population would be decreased more rapidly (over approximately 2 years)	▪ The same educational outreach as alternative B would reduce the risk of deer approaching humans. ▪ Reduced deer population density would have the same impacts as described under alternative B, but along the same timeline as alternative C.

TABLE 9. SUMMARY OF ENVIRONMENTAL CONSEQUENCES (CONT'D)

Impact Topic	Alternative A (No-action)	Alternative B	Alternative C	Alternative D
Seashore Operations	▪ Seashore staff would continue to spend approximately 270–300 hours annually on deer-related community outreach. Case Incident Reports would continue to require approximately 185 hours annually. ▪ Deer monitoring would continue annually on Fire Island in general, requiring approximately 120 hours for three staff. Additionally, monitoring would take place every 3 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 3-year cycle. Monitoring at the William Floyd Estate requires 25 hours from three staff every 3-year cycle. ▪ Staff time related to maintenance and repair of fencing would be limited, requiring approximately 4 hours per year at the William Floyd Estate and 32 hours (16 hours each for 2 staff) on Fire Island. The vegetation monitoring program would continue to be conducted every 5 years, requiring five dedicated staff for 4 months (460 hours).	▪ Same as alternative B, with an additional 180 hours for developing lesson plans for local schools and additional programs/interpretation. ▪ Time needed for Case Incident Reports may decrease due to a decreased deer population. ▪ A long-term increase in staff and budget would be required to implement application of an acceptable fertility control agent and maintenance of deer exclusion fencing. Costs are uncertain at this time and would be determined at a later date depending upon the agent that becomes available.	▪ Implementation of additional education programs and interpretation would require the same level of effort as alternative B. ▪ Use of sharpshooting and hunting would require a substantial increase in effort at the Seashore. ▪ The level of effort needed for maintenance of fencing would be less than required under alternative B.	▪ Implementation of additional education programs and interpretation would require the same level of effort as alternative B. ▪ Reducing the deer population using a combination of the methods described under alternatives B and C would require a substantial increase in effort at the Seashore. The costs to implement this alternative would be similar to those described under alternative C; however, 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 as the only method of population reduction). ▪ The level of effort associated with fencing would be greater than under alternative C but less than under alternative B.

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Affected Environment

3

INTRODUCTION

The "Affected Environment" chapter describes existing conditions for those elements of the natural, cultural, and social environment that could be affected by implementation of the actions considered in this plan/EIS for Fire Island National Seashore. Relevant impact topics were selected based on agency and public concerns, regulatory and planning requirements, and known or expected resource issues. The impact topics addressed in this plan/EIS are vegetation, unique vegetation communities, and special-status plant species; wetlands; white-tailed deer population; other wildlife and wildlife habitat; wilderness; cultural landscapes; visitor use and experience/recreation; Fire Island communities and adjacent landowners; public health and safety; and Seashore operations. The information provided in this chapter is used as a basis for comparing the potential impacts of each alternative presented in "Chapter 4: Environmental Consequences."

VEGETATION, UNIQUE VEGETATION COMMUNITIES, AND SPECIAL-STATUS PLANT SPECIES

A description of the vegetation at the Seashore can be subdivided into community types on Fire Island and at the William Floyd Estate located on Long Island. Barrier islands, such as Fire Island, offer unique geomorphic and vegetative complexes driven by natural forces including tidal cycles, salt spray, coastal winds, storm surges, overwashes, sand accretion/erosion, and topographic modifications (Art 1976; Erenfeld 1990; Forrester, Leopold, and Art 2007). Often, the vegetation types are arranged in a linear fashion from ocean to bay. Schulte (1965) describes the basic landforms in simple generic terms such as dune, marsh, and forest. Forrester (2004) uses similar broad categories in describing communities from ocean to bay such as beach, dune, swale, maritime forest, and marsh. Vegetation on the Seashore is the product of those natural forces as well as human influences. Human influences, such as development and sand renourishment projects, affect species composition, abundance, and spatial patterns (Klopfer et al. 2002).

Interdunal swale in Sailors Haven (Photo Credit: VHB)

The Seashore is composed of public and private lands that include 17 private communities and towns, Smith Point County Park, and three municipal beaches (Bellport Beach, Leja Beach/Davis Park, and Atlantique Beach). The natural areas are prime examples of formations resulting from sand deposition, coastal winds and storms, salt spray, and other natural forces. Anthropogenic disturbances, artificial plantings, and the spread of invasive plant species in and around the Fire Island communities are factors that contribute to vegetation patterns within the Seashore. The

portion of Fire Island west of the Fire Island Wilderness contains the highest degree of such human-caused vegetative influences, where nonnative or introduced species are intermixed with undisturbed federal tracts of native vegetative communities. Sections of the federally owned land also contain rare maritime vegetative communities that are described in more detail below. The majority of the eastern half of the Seashore comprises natural lands associated with the Fire Island Wilderness and Smith Point County Park. Situated on the south shore of Long Island, the William Floyd Estate contains vegetative community types that, though typical of those on Long Island, are dramatically different from those found on Fire Island. Figures 6 through 6e depict the vegetation types found on Fire Island and are described in more detail below.

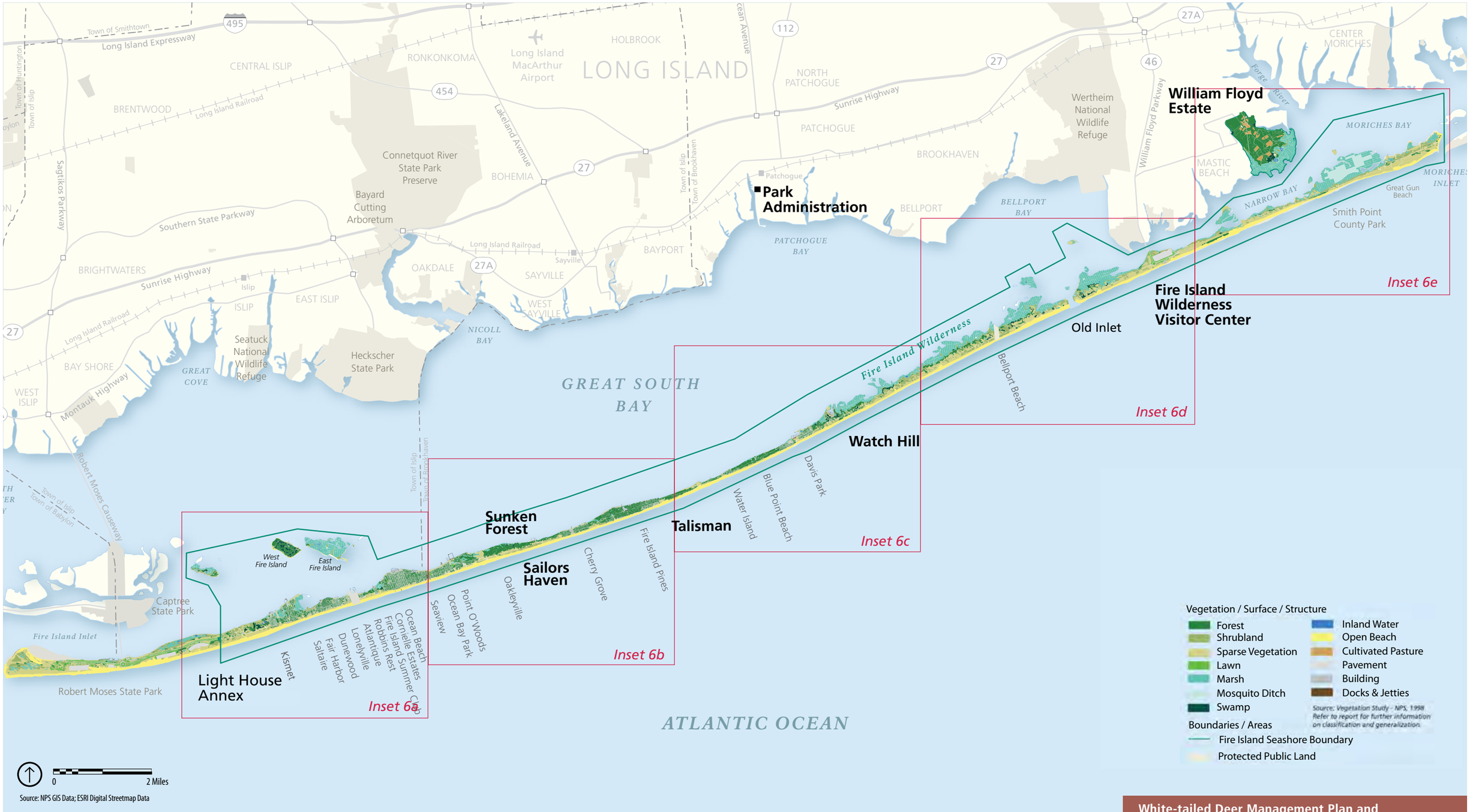
FIRE ISLAND COMMUNITIES

Seventeen private communities occupy 916 acres of Fire Island (NPS 2012c) and contain over 4,100 residential/vacation homes, several businesses, worship centers, and schools. Each of the Fire Island communities has its own unique character, but in terms of vegetative cover and habitats, the Fire Island communities all possess similar qualities. In general, houses within the Fire Island communities occupy relatively small lots that collectively span across the entire profile of Fire Island (oceanside primary dunes, secondary dunes, and bayside maritime forests). Native vegetation includes species commonly found throughout the Seashore such as eastern red cedar (*Juniperus virginianus*), shadblow (*Amelanchier canadensis*), American holly (*Ilex opaca*), bayberry (*Myrica pensylvanica*), pitch pine (*Pinus rigida*), black cherry (*Prunus serotina*), and the nonnative Japanese black pine (*Pinus thunbergii*). Landscape ornamentals are popular in the Fire Island communities and include a host of woody and herbaceous native and nonnative species. Some ornamentals plantings such as bamboo (*Phyllostachys* spp.) have escaped to become invasive species in the area vegetation. Public boardwalks, one-lane drives, and maintained footpaths between rows of houses provide public pathways for homeowners and visitors to move about the communities. Many of the homeowners have installed fences along property lines and public walkways to prevent deer from entering their properties, protecting personal landscaping and ornamental plantings from deer browsing.

NATURAL AREAS

The first detailed vegetative mapping effort for the Seashore was completed in 1975 (McCormick and Associates 1975). In 1999, mapping and classification of the vegetative communities for the entire Seashore were updated using the National Vegetation Classification System (Klopfer et al. 2002) (table 10). The information provided in this section is taken primarily from the Klopfer et al. 2002 report as the most comprehensive and current of its kind. It should be noted, however, that changes constantly occur at the barrier island as exemplified by the impacts of Hurricane Sandy in 2012, and that the expanse of any changes since the Klopfer et al. 2002 publication have yet to be analyzed. Thus, the summary of vegetation below is based on the best available information but should not be considered an accurate or precise description of the current conditions because this information is not updated.

Five broadly categorized groups were identified: salt marshes, dune grasslands, dune shrublands, interdunal swales, and forests/shrublands. Klopfer et al. (2002) further separates these groups into 27 vegetation associations, three of which are too small to map. Table 10 is a summary of the dominant vegetative community types and a listing of the common plants found in each.

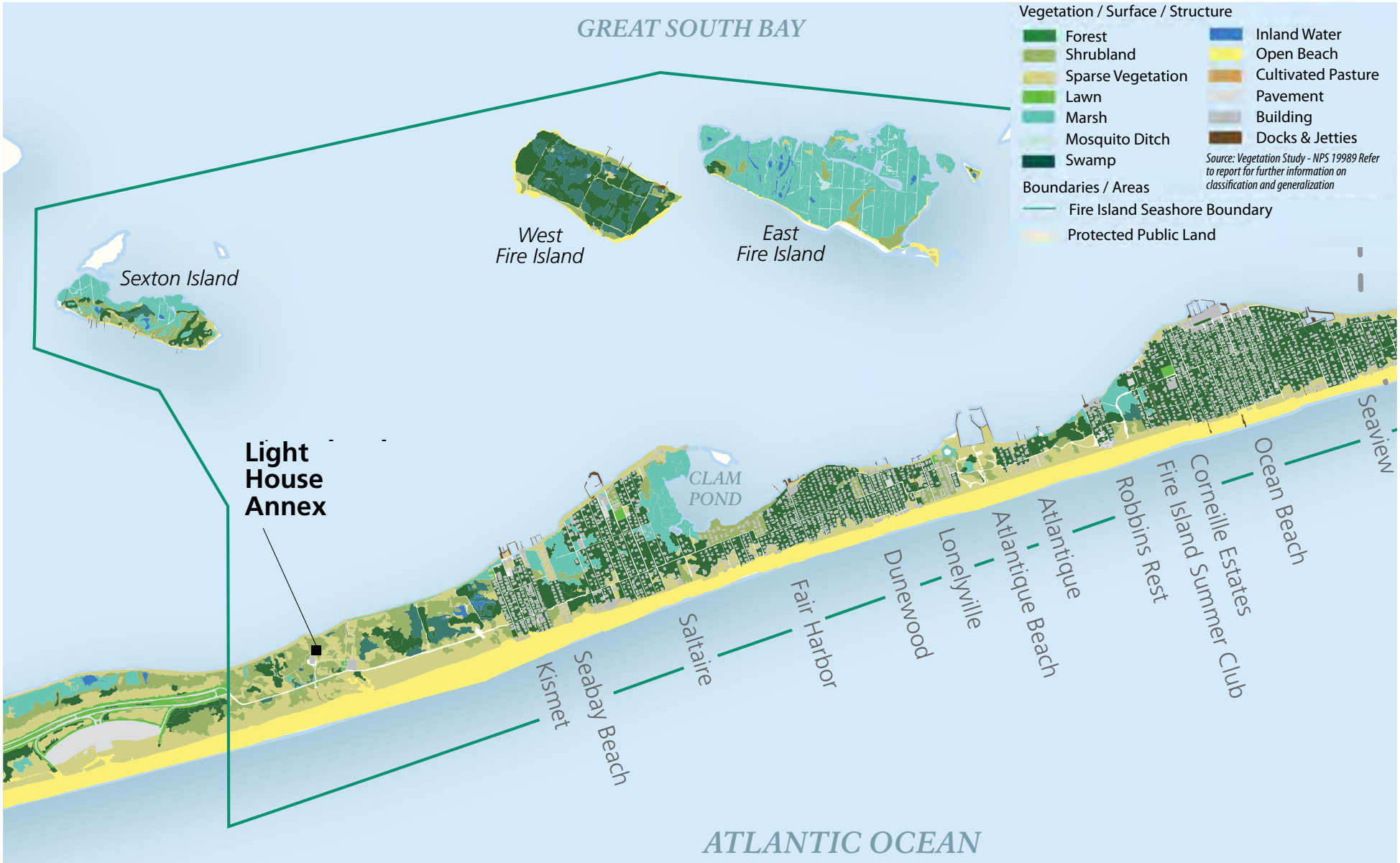


White-tailed Deer Management Plan and Environmental Impact Statement

National Park Service
U.S. Department of the Interior

Fire Island National Seashore

FIGURE 6
Vegetation



White-tailed Deer Management Plan and Environmental Impact Statement

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FIGURE 6a
Vegetation

White-tailed Deer Management Plan and Environmental Impact Statement

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FIGURE 6b
Vegetation

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FIGURE 6c
Vegetation

White-tailed Deer Management Plan and Environmental Impact Statement

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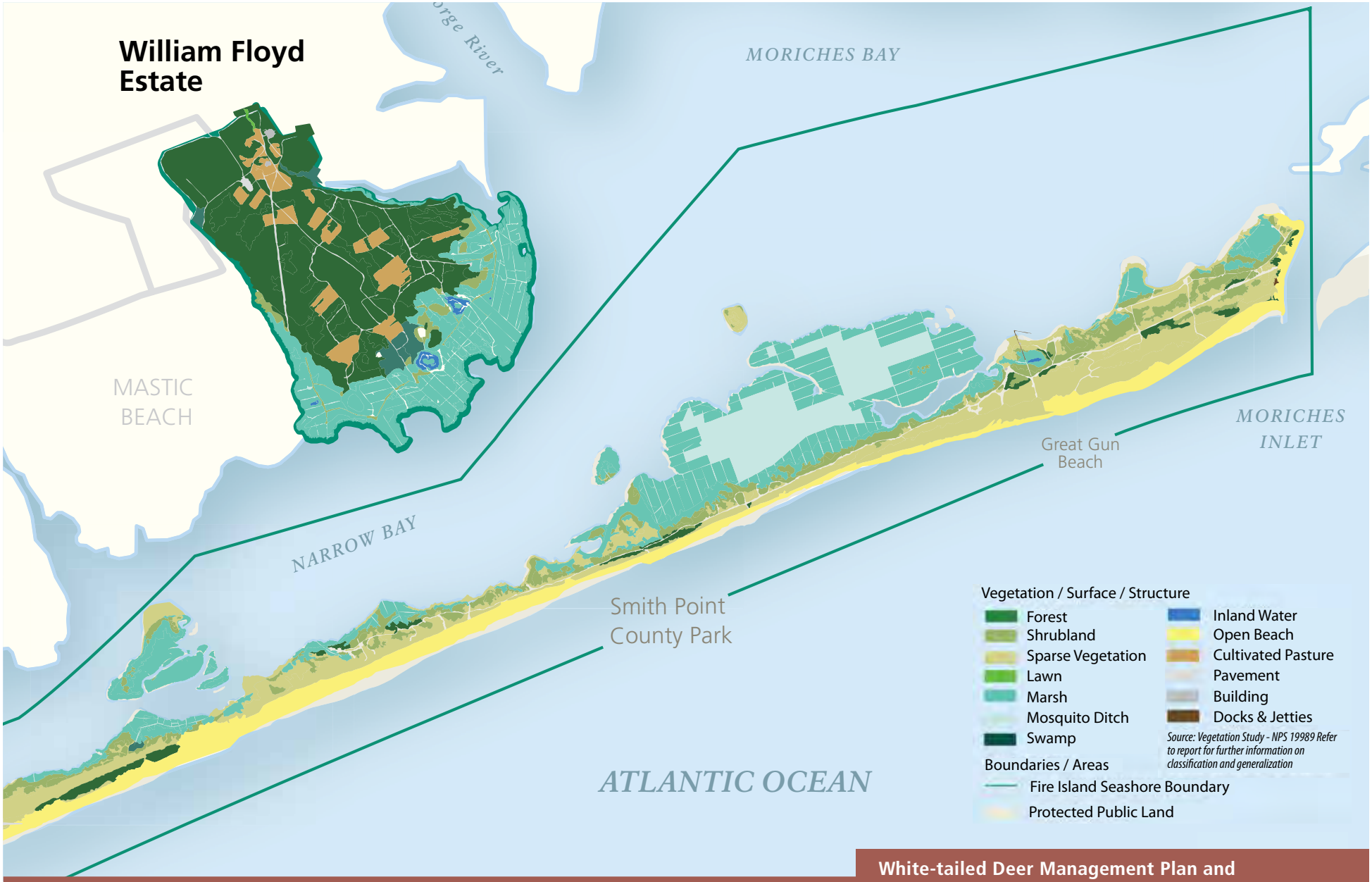
FIGURE 6d
Vegetation



White-tailed Deer Management Plan and Environmental Impact Statement

National Park Service
U.S. Department of the Interior

Fire Island National Seashore

FIGURE 6e
Vegetation

TABLE 10. VEGETATION COMMUNITY TYPES

Vegetation Type	Fire Island (Acres)	William Floyd Estate (Acres)	Percent of Total Area (%)	Dominant Plants
Sparse Vegetation - 22.4%				
Northern Beach Grass Dune	617.8	--	14.9	American beachgrass (*Ammophila breviligulata)* Beach pea (*Lathyrus japonicus*)
Beach Heather Dune	184.1	--	4.5	Beach heather (*Hudsonia tomentosa*) American beachgrass (*Ammophila breviligulata*)
Interdune Beachgrass - Beach Heather Mosaic	94.6	--	2.3	Beach heather (*Hudsonia tomentosa*) American beachgrass (*Ammophila breviligulata)*
Brackish Meadow	13.6	--	0.3	Switchgrass (*Panicum virgatum*) Sedge (*Scirpus pungens*) Salt meadow cordgrass (*Spartina patens*) Spike grass (*Eleocharis parvula*)
Brackish Interdunal Swale	10.1	--	0.2	Salt meadow cordgrass (*Spartina patens*) Small spikerush (*Eleocharis parvula*)
Overwash Dune Grassland	9.6	--	0.2	Salt meadow cordgrass (*Spartina patens)* Red fescue (*Festuca rubra*) Switchgrass (*Panicum virgatum*) Seaside goldenrod (*Solidago sempervirens*)
Northern Interdunal Cranberry Swale	8.2	--	0.2	Cranberry (*Vaccinium macrocarpon*) Highbush blueberry (*Vaccinium corymbosum*) Sedges (*Juncus canadensis, Scirpus pungens*)
Forest - 29.2%				
Maritime Deciduous Scrub Forest	575.4	29.5	14.8	Black cherry (*Prunus serotina*) Sassafras (*Sassafras albidum*) Shadblow (*Amelanchier canadensis*) Greenbriar (*Smilax rotundifolia*)
Coastal Oak Heath Forest	--	239.9	5.9	White oak (*Quercus alba*) Black oak (*Quercus velutina*) Mockernut hickory (*Carya tomentosa*) Sassafras (*Sassafras albidum*)
Japanese Black Pine Forest	182.1	7.2	4.6	Japanese black pine (*Pinus thunbergii*)
Maritime Holly Forest	64.2	--	1.6	American holly (*Ilex opaca*) Sassafras (*Sassafras albidum*) Shadblow (*Amelanchier canadensis*) Black cherry (*Prunus serotina*) Black oak (*Quercus velutina)* Black gum (*Nyssa sylvatica*)
Pitch Pine – Oak Forest	--	45.5	1.1	Pitch pine (*Pinus rigida*) Black oak (*Quercus velutina*) White oak (*Quercus alba*)

TABLE 10. VEGETATION COMMUNITY TYPES (CONT'D)

Vegetation Type	Fire Island (Acres)	William Floyd Estate (Acres)	Percent of Total Area (%)	Dominant Plants
Pitch Pine – Dune Woodland	37.1	--	0.9	Pitch pine (*Pinus rigida*) Northern bayberry (*Myrica pensylvanica)*
Old Field Red Cedar Forest		7.2	0.2	Eastern redcedar (*Juniperus virginiana*) Russian olive (*Elaeagnus umbellata*) Winged sumac (*Rhus copallina*)
Maritime Post Oak Forest	--	0.7	<0.1	Post oak (*Quercus stellata*) Mockernut hickory (*Carya tomentosa*) Black oak (*Quercus velutina*) Sassafras (*Sassafras albidum*) Northern bayberry (*Myrica pensylvanica*)
Shrubland - 11.3%				
Northern Dune Shrubland	448.8	1.4	11.0	Northern bayberry (*Myrica pensylvanica*) Beach plum (*Prunus maritima*) Wild rose *(Rosa rugosa*)
Maritime Vine Dune	7.9	0.5	0.2	Poison ivy (*Toxicodendron radicans*) Cat briar (*Smilax glauca*) Virginia creeper (*Parthenocissus quinquefolia*)
Northern Sandplain Grassland	4.0	--	0.1	Northern bayberry (*Myrica pensylvanica*) Little bluestem (*Schizachyrium scoparium*)
Marsh - 29.2%				
Low Salt Marsh	371.2	61.2	10.6	Salt marsh cordgrass (*Spartina alterniflora*)
High Salt Marsh	331.1	88.7	10.3	Salt meadow cordgrass (*Spartina patens*) Salt grass (*Distichlis spicata*) Goose tongue (*Plantago maritima*)
Reed Grass Marsh	307.1	30.9	8.3	Reed grass (*Phragmites australis*)
Swamp - 2.2%				
Highbush Blueberry Shrub Swamp	75.1	3.7	1.9	Highbush blueberry (*Vaccinium corymbosum*) Shadblow (*Amelanchier canadensis*) Swamp azalea (Rhododendron viscosum) Greenbriar (*Smilax rotundifolia*)
Acidic Red Maple Basin Swamp Forest	--	12.8	0.3	Red maple (*Acer rubrum*) Black gum (*Nyssa sylvatica*) Highbush blueberry (*Vaccinium corymbosum*) Swamp azalea (*Rhododendron viscosum*) Cinnamon fern (*Osmunda cinnamomea*)
Cultivated Pasture	--	47.0	1.2%	Fescue grass (*Festuca* spp.) Milkweed (*Asclepius* spp.) Serecia lespedeza (*Lespedeza cuneata*) Black locust (*Robinia pseudoacacia*)

Source: Klopfer et al. 2002

Fire Island

The most common upland vegetative community types, each making up 15% of the total, are the Northern Beach Grass Dune and Maritime Deciduous Scrub Forest. Northern Dune Shrubland is the third most common type at 11%. The Northern Beach Grass Dune, Maritime Deciduous Scrub Forest, Northern Dune Shrubland, and Low Salt Marsh account for approximately 51% of the vegetative cover on the Seashore (Klopfer et al. 2002). When combining the Low Salt Marsh and the High Salt Marsh cover types, salt marsh is the most dominant cover type at approximately 852 acres. The smallest vegetative community at the Seashore, 0.7 acres, is the Maritime Post Oak Forest found on the William Floyd Estate. Some of the most common plant species at the Seashore include American beach grass (*Ammophila breviligulata*), found on the foredunes of Fire Island, and beach plum (*Prunus maritima*), bayberry (*Myrica pensylvanica*), seaside goldenrod (*Solidago sempervirens*), and beach heather (*Hudsonia tomentosa*), commonly found on the leeward side of the primary dunes.

The Seashore just recently began monitoring vegetation within several Maritime Forests on Fire Island to determine potential browsing impacts of the high deer density on understory vegetation composition (NPS 2013e).Two maritime forests were selected for the study, one located within the Talisman area and the other at Blue Point. Preliminary data suggests that deer browsing has affected understory species diversity and density. The dominant forest canopy at Blue Point is shadblow (*Amelanchier canadensis*), black gum (*Nyssa sylvatica*), and sassafras (*Sassafras albidum*) while the overstory at Talisman is dominated by shadblow (*Amelanchier canadensis*), American holly (*Ilex opaca*), and various species of oak (*Quercus* spp.). The most common herbs and lianas occupying the ground include Virginia creeper (*Parthenocissus quinquefolia*), poison ivy (*Toxicodendron radicans*), and starflower (*Trientalis borealis*). The most common woody species found are black huckleberry (*Gaylussacia baccata*), shadblow (*Amelancheir canadensis*), and black cherry (*Prunus serotina*). The Seashore found that these two forests contain few seedlings from the overstory canopy, and instead black cherry (*Prunus serotina*), a deer resistant species, dominates the sapling and seedling layers mixed with heavy vine cover. Based on these results, the Seashore speculated that the future canopy of Blue Point and Talisman could see reductions in the current species mix from natural mortality and could one day be replaced by deer tolerant species such as black cherry.

William Floyd Estate

A comprehensive vegetation study of the William Floyd Estate was performed by Clark (1986), who found that many of the vegetative communities at the William Floyd Estate are primarily the result of historic land uses such as farming, artificial plantings, orchards, and land clearing. Fire also influenced vegetation at the William Floyd Estate. Overall, Clark (1986) found that "spatial and temporal patterns in forests were determined by information on disturbance frequency, dispersal, generation times, and rates of change in the physical environment." Clark (1986) also found evidence through a study of pollen and tree-ring data that tree populations are migrating upslope at the William Floyd Estate in response to sea-level rise. Eleven broad forest, shrub, and herbaceous vegetative community types were identified at the William Floyd Estate (see figure 6e), which Klopfer et al. (2002) confirmed. Clark (1986), however, categorized many of the forested areas into subgroups based on dominant species, whereas Klopfer et al. (2002) grouped most of the upland forests into two associations: the Coastal Oak Heath Forest and Pitch Pine-Oak Forest.

Salt marsh habitat dominates the southern end of the William Floyd Estate, with salt bush (*Baccharis halimifolia*) and marsh elder (*Iva frutescens*) along the upper marsh fringe. Open fields still remain from the Colonial period; however, Clark (1986) recognized that successional forests have developed from

areas once farmed which are largely occupied by black locust (*Robinia pseudoacacia*), black cherry (*Prunus serotina*), shadblow (*Amelanchier canadensis*), red maple (*Acer rubrum*), pitch pine (*Pinus rigida*), and blackgum (*Nyssa sylvatica*) in the overstory; and greenbriar (*Smilax rotundifolia*), highbush blueberry (*Vaccinium corymbosum*), and eastern redcedar (*Juniperus virginiana*) in the understory. Older, more mature forest stands are characterized by white oak (*Quercus alba*), black oak (*Quercus velutina*), and hickory (*Carya* spp.). Scattered evergreen stems of red spruce (*Picea rubens*) and eastern white pine (*Pinus strobus*) are also present.

Deer in the William Floyd Estate Lower Acreage (Photo credit NPS)

The Seashore has initiated the collection of vegetation data within the William Floyd Estate forests to establish baseline conditions for future monitoring similar to the studies being conducted at Talisman and Blue Point (NPS 2013f). Just as noted by Clark (1986), a clear forest canopy gradient exists from the southern end of the William Floyd Estate to the northern end (i.e., lower elevations to higher elevations). Black gum (*Nyssa sylvatica*) is dominant within the southern portion of the lower acreage with a strong component of shadblow (*Amelanchier canadensis*), while scarlet oak (*Quercus coccinea*) is the dominant tree species in the northern reaches of the property with a mixture of white oak (*Quercus alba*), black oak (*Quercus velutina*), hickory (*Carya tomentosa, C. glabra*), and red maple (*Acer rubrum*). A look at the understory has revealed similar species gradient for shrubs. Among the four most common shrubs, black huckleberry (*Gaylussaia baccata*) is the most dominant shrub in the northern portion; spice bush (*Lindera benzoin*) and arrowwood (*Viburnum dentatum*) dominate central section, and highbush blueberry (*Vaccinium corymbosum*) dominates the shrub layer in the southern section. The most striking discovery is that black cherry (*Prunus serotina*), black gum (*Nyssa sylvatica*), and sassafras (*Sassafras albidum*) are the dominate seedlings/saplings throughout most of the property, even in areas where these species are not common in the overstory, suggesting a species composition shift is occurring to favor those tree species most avoided by deer (NPS 2013f). Furthermore, because of deer browse, there is not sufficient recruitment of tree seedlings to sustain natural reproduction of the overstory canopy (NPS 2013f).

UNIQUE VEGETATION COMMUNITIES

NatureServe, a nonprofit conservation organization, has established a ranking system for identifying ecosystems, plants, and animals considered to be rare or imperiled. The conservation status of a species or ecosystem is designated by a number from 1–5, preceded by a letter reflecting the appropriate geographic scale of the assessment, in this case G = Global. The designations have the following meaning:

G1: critically imperiled
G2: imperiled
G3: vulnerable
G4: apparently secure
G5: secure

The New York Natural Heritage Program ranks rare ecosystems using the following designations (S = State):

S1: Typically five or fewer occurrences, very few remaining individuals, acres, or miles of stream, or some factor of its biology making it especially vulnerable in New York
S2: Typically 6–20 occurrences, few remaining individuals, acres, or miles of stream, or factors demonstrably making it very vulnerable in New York
S3: Typically 21–100 occurrences, limited acreage, or miles of stream in New York
S4: Apparently secure in New York
S5: Demonstrably secure in New York

As a barrier island that is an uncommon geologic formation, the Seashore is host to a number of rare ecological communities related to sand dunes and maritime forests. Those communities identified as having global designations are listed in table 11 below.

TABLE 11. UNIQUE ECOLOGICAL COMMUNITY TYPES

Community Type	Global Rank	State Rank	Location on Fire Island National Seashore
Maritime Beach	G5	S3/S4	Unstable sand shores above mean high tide.
Maritime Dunes	G4	S3	Comprises a variety of dunal communities to include others listed below. Majority of maritime dunes are occupied by beach grasses such as *Ammophila breviligulata.*
Beach Heather Dune	G2/G3	S1	Stabilized backdunes on Fire Island.
Maritime Heathland	G3	S1	Stabilized backdunes on Fire Island.
Overwash Dune Grassland	G2/G3	No listing	Overwash areas within the Fire Island Wilderness.
Northern Sandplain Grassland	G2	No listing	Interior portion of the Fire Island Wilderness and an area southwest of the cemetery at William Floyd Estate.
Maritime Grassland	G2/G3	S1	Part of Maritime Dunes complex found along the oceanside of Fire Island.
Maritime Deciduous Scrub Forest	G2/G3	No listing	Scrub community influenced by salt spray found behind the primary dunes on Fire Island.
Salt Scrub Community	G5	S4	Landward edges of salt marshes on the bay side of Fire Island.
High Salt Marsh	G5	S3/S4	Found between low marsh and high tide on the bay side of Fire Island and at the William Floyd Estate.
Salt Panne	G5	S3	Small, shallow depressions within the high salt marsh.
Pitch Pine Dune Woodland	G2/G3	S1	Sand dunes adjacent to shrubland or salt marsh on Fire Island.
Maritime Post Oak Forest	G3	S2	Sandy banks off of Moriches Bay at the William Floyd Estate.
Maritime Holly Forest	G1/G2	S1	Secondary dunes on the bay side near Sailors Haven Visitors Center on Fire Island, also known as "Sunken Forest."
Northern Interdunal Cranberry Swales	G2	No listing	Characterized as a Maritime Dune Wetland found in small seasonally flooded depressions and swales behind the primary dunes on Fire Island.
Maritime Freshwater Interdunal Swales	G3/G4	S2	Low-lying depressions behind the foredunes on Fire Island.

Source: Trocki 2008

The maritime holly forest community type, known to only occur on Fire Island and Sandy Hook, New Jersey (Forrester, Leopold, and Underwood 2006), is the rarest ecosystem at the Seashore with a global ranking of G1/G2 and New York State ranking of S1. Three other maritime forests are present on the Seashore at the Carrington Estate, Talisman, and Blue Point Beach. These forests are

generally located on the bay side of the Seashore where major secondary dune formations covered with shrub vegetation provide protection from wind, oceanic salt spray, and erosional forces.

The Sunken Forest is the best example of a rare, well-formed, old-growth maritime holly forest and is believed to have been part of Fire Island for several thousand years (Sirkin 1972). This virgin forest contains American holly specimens over 300 years old. The rarity and uniqueness of this vegetation community prompted Congress to specifically call out the Sunken Forest for protection in the Seashore's enabling legislation. The Seashore manages approximately 44 acres of this maritime holly forest as what is generally referred to as the Sunken Forest, although it should be noted that the tract designated formally as the Sunken Forest Preserve includes only a portion of this 44 acres. The Sunken Forest takes place within the wider area known as Sailors Haven, west of the Sailors Haven marina.

The Sunken Forest (Photo credit:VHB)

Local environmental enthusiasts recognized the Sunken Forest as a unique community long before establishment of the Seashore in 1964. Soon after the Sunken Forest came into federal management, opportunities were open to study and examine the vegetative composition and ecology of the system (Schulte 1965; Art 1976). The work by Art (1976) is a comprehensive look at the condition of the forest from data collected in 1967 through the early 1970s. Vegetation sampling was conducted using permanently marked plots, some of which are still being sampled today. Over the course of the following decades, scientists recognized changes in the forest understory due to heavy deer browse (Art 1987, 1990, 1995; Forrester, Leopold, and Underwood 2006). For instance, in 1967 black huckleberry (*Gaylussacia baccata*), ink berry (*Ilex glabra*), and highbush blueberry were common shrubs. Sarsaparilla (*Aralia nudicaulus*), Canada mayflower (*Maianthemum canadense*), Solomon's seal (*Maianthemum stellatum*), bracken fern (*Pteridium aquilinum*), and starflower (*Trientalis borealis*) were frequently associated with the herb layer (Art 1976, 1987, 1992). Today, these species have dramatically declined in abundance or have been altogether extirpated from the area by deer browse (Art 1990; Underwood, Ries, and Raphael 2011). Other than American holly, the Sunken Forest contains blackgum, shadblow, sassafras, red maple, oak species (*Quercus* spp.), black cherry, and pitch pine. Shadblow and highbush blueberry are the common shrubs, while poison ivy (*Toxicodendron radicans*) and greenbriar are common ground and climbing vine species.

Solomon's seal (Photo credit: NPS)

SPECIAL-STATUS PLANT SPECIES

Seven species of rare plants have been identified at the Seashore. A list of these species, their preferred habitats, and listing/ranking is provided in table 12. A survey for state and federally listed plants within the Seashore is performed annually. Results from 2012 documented 26 seabeach amaranth (*Amaranthus pumilus*) plants and 50 seabeach knotweed (*Polygonum glaucum*) plants occupying the lower foredunes. Seabeach amaranth is the only federally listed plant species on the Seashore. Although the numbers of seabeach amaranth and seabeach knotweed were higher in 2012 than in 2007, overall both populations have been in decline since 2003 (Trocki 2008). This survey was conducted prior to impacts from Hurricane Sandy which occurred in October 2012. Survey updates should indicate the level of impact that Hurricane Sandy had on the most vulnerable listed species.

Seashore staff have observed evidence of deer foraging on seabeach amaranth. Results from the 2012 survey indicated that approximately 50% of seabeach amaranth plants were browsed to the extent that plant reproduction was prevented (NPS 2012e). Starting in 2013, seabeach amaranth plants found during annual surveys are being screened to protect them from browsing when and where feasible.

TABLE 12. FEDERALLY AND STATE LISTED PLANT SPECIES

Listed Plant	Federal Listing	State Listing	Global Rank	State Rank	Habitat Preference and Location on Fire Island
Seabeach amaranth[1] (*Amaranthus pumilus*)	T	E	G2	S2	Unvegetated lower foredunes and beaches.
Seabeach knotweed[1] (*Polygonum glaucum*)	-	R	G3	S3	Unvegetated lower foredunes and beaches.
Swamp sunflower[1] (*Helianthus angustifolius*)	-	T	G5	S2	Freshwater wetlands. Four small populations discovered in maritime freshwater interdunal swale habitat.
Slender marsh pink[1] (*Sabatia campanulata*)	-	E	G5	S1	Freshwater marsh and interdunal swales. Single population of plants discovered on Fire Island in maritime freshwater interdunal swale habitat.
Rough rush-grass[1] (*Sporobolus clandestinus*)	-	E	G5	S1	Drier swales of maritime dunes found near the Light House Annex.
Dark-green sedge[1] (*Carex venusta*)	-	E	G4	S1	Wet meadows, salt marshes, swamps, or other wetland habitats near the coast. Single location in New York State along the upper salt marsh at William Floyd Estate.
Spring ladies' tresses[2] (*Spiranthes vernalis*)		E	G5	S1	Bogs and wet meadows. Plants observed near the Light House Annex.

Sources: 1. Trocki 2008, 2. Dowhan and Rozsa 1989

WETLANDS

The federal government has defined waters of the U.S. to include a wide variety of aquatic systems (33 CFR 328.3). Two sections of this definition that apply to Fire Island are

> All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters that are subject to the ebb and flow of the tide;
>
> All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce including any such waters.

Wetlands, as separately classified ecosystems, are designated as a special aquatic site under section 404 of the Clean Water Act and are therefore a subset to waters of the U.S. The identification of wetlands and other waters of the U.S. within the project area is necessary to ensure their protection in accordance with federal laws (section 404 of the Clean Water Act and the Rivers and Harbors Act of 1899) and state laws. Wetlands are defined under the section 404 program as:

> "Areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." (33 CFR 328.3[b]; 40 CFR 230.3[t])

The U.S. Fish and Wildlife Service has developed a wetland definition that is more comprehensive than the section 404 definition, recognizing that physical or chemical conditions such as wave action, currents, or high salinity may prevent development of hydric soils or hydrophytic vegetation in some wetland types (Cowardin et al. 1979). Therefore, some unvegetated and/or nonhydric soil sites, such as mudflats or high-energy shorelines, may not exhibit all attributes described in the section 404 definition, but are still classified as wetlands. Nonetheless, all unvegetated mudflats, marshes, shorelines and subtidal aquatic systems below the ordinary high tide elevation are regulated as waters of the U.S.

U.S. Fish and Wildlife Service uses the following definition of wetlands:

> "Lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification, wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year.
>
> "The term wetland includes a variety of areas that fall into one of five categories; (1) areas with hydrophytes and hydric soils, such as those commonly known as marshes, swamps, and bogs; (2) areas without hydrophytes but with hydric soils – for example flats where drastic fluctuation in water level, wave action, turbidity, or high concentration of salts may prevent the growth of hydrophytes; (3) areas with hydrophytes but nonhydric soils, such as margins of impoundments or excavations where hydrophytes have become established but hydric soils have not yet developed; (4) areas without soils but with hydrophytes such as the seaweed-covered portion of rocky shores; and (5) wetlands without soil and without hydrophytes, such as gravel beaches or rocky shores without vegetation." (Cowardin et al. 1979)

In 1977, President Carter issued Executive Order 11990, "Protection of Wetlands," for all federal agencies. As a result, the National Park Service issued *Director's Order 77-1: Wetland Protection* to establish "NPS policies, requirements, and standards for implementing Executive Order 11990" (NPS 2002b). This order instructs the National Park Service to use the U.S. Fish and Wildlife Service determination outlined in Cowardin et al. (1979) as the standard for defining, classifying, and inventorying wetlands and determining when NPS actions have the potential to adversely impact wetlands.

Wetlands in the Sunken Forest (Photo credit: VHB)

One proposed action would affect jurisdictional wetlands: the installation of the exclusion fence around the Sunken Forest. The fence would be expected to bisect sections of wetlands between the Sunken Forest and shoreline of Great South Bay. Wetland types in this area include the Reed Grass Marsh and Highbush Blueberry Shrub Swamp Associations (figure 7). Using the U.S. Fish and Wildlife Service wetland classification system (Cowardin et al. 1979), the Reed Grass Marsh wetland is classified as Estuarine Intertidal Persistent Emergent, Irregularly Flooded. Several Reed Grass Marsh wetlands are present north of the Sunken Forest that are influenced by a high water table of freshwater and occasional tidal fluctuations creating a mixohaline (i.e., salt concentration less than 30 parts per thousand) hydrologic regime. The dominant plant within these marshes is a thick bed of reed grass (*Phragmites australis*) mixed with salt bush (*Baccharis halimifolia*) and wax myrtle (*Myrica cerifera*). The Highbush Blueberry Shrub Swamp wetland is classified as Palustrine Broad-leafed Deciduous Scrub-Shrub, Seasonally Flooded/Saturated. These freshwater wetlands occur slightly landward from the Reed Grass Marshes within saturated soils driven by a high groundwater table and are dominated by highbush blueberry (*Vaccinium corymbosum*), salt bush (*Baccharis halimifolia*), swamp azalea (*Rhododendron viscosum*), and reed grass (*Phragmites australis*).

White-tailed Deer Management Plan and Environmental Impact Statement

National Park Service
U.S. Department of the Interior

Fire Island National Seashore

FIGURE 7
Existing Wetlands - Sunken Forest

WHITE-TAILED DEER POPULATION

Very few if any white-tailed deer (*Odocoileus virginianus*) inhabited Fire Island or the William Floyd Estate at the time the Seashore was established (Art 1995; Underwood 2005). By the early 1970s, scientists began to observe deer on Fire Island. Biologists theorize that a small population of deer on the eastern side of Fire Island in the 1970s expanded to the western part of Fire Island and into the Fire Island communities where, starting around the mid-1980s, the population rapidly grew. By 1995, the deer density had exceeded 207 deer per square mile in some portions of the Seashore, raising concern for human health and safety, impacts on native vegetation, and the overall condition of the deer herd (Underwood 2005). In addition to issues with deer numbers, the absence of hunting and natural predators has allowed deer to become accustomed to living unthreatened, not only within the natural environment but in many portions of the human environment (i.e., the Fire Island communities and Seashore facilities). Today, deer population control, deer habituation to humans, and food-conditioning have become major issues facing Seashore managers.

Adult female deer and fawn (Photo credit: NPS)

The Seashore has undertaken several studies to understand the population dynamics of deer on Fire Island and the William Floyd Estate. The Seashore's first examination of the number of deer on Fire Island occurred from 1983 through 1988 by O'Connell and Sayre (1988) using aerial helicopter surveys. This methodology was continued until 1998. Results from aerial surveys found that by 1991, the deer population increased annually between 11% and 43% for areas on the western side of Fire Island near the Fire Island communities, while the population in the Fire Island Wilderness on the eastern side of Fire Island remained relatively unchanged (table 13). During this same study, 20 deer (11 males, 9 females) were fitted with radio-telemetry collars to track and analyze their movements across the Seashore. In general, deer maintained high fidelity to home ranges with an average of 1.5 miles (2.4 km) movement distance across the Seashore, with longer movements attributed to young males. During a study on vector hosts of Lyme disease, one marked deer was found to travel 3.1 miles (5 km) from the lighthouse to Point O'Woods (Underwood 2005).

TABLE 13. PERCENTAGE RATE OF DEER POPULATION CHANGE PER YEAR FOR PORTIONS OF FIRE ISLAND NATIONAL SEASHORE BETWEEN 1983 AND 1991

Location	Rate of Deer Population Change (%)
Smith Point County Park	9.6
Fire Island Wilderness	0.3
Watch Hill - Davis Park	-8.3
Davis Park - Talisman	21.9
Talisman - Fire Island Pines	14.0
Fire Island Pines - Cherry Grove	11.1
Cherry Grove - Point 'O Woods	18.5
Point 'O Woods - Kismet	43.8
Lighthouse Tract	17.8
Robert Moses State Park	30.0

Source: Underwood 2005

As the Seashore contemplated options for controlling deer numbers, an experimental research hunt was conducted during the winter of 1988-89 in cooperation with the NYS-DEC. The hunt included archery within natural areas in close proximity to the Fire Island communities and firearms in the more remote areas of Sailors Haven, Talisman, and the Fire Island Wilderness. A total of 60 deer were harvested during the hunt (6 archery, 54 firearms). While the hunt may have been successful in terms of the established goals, it was very unpopular with the public (Knoch and Lowery 1989).

Deer in pedestrian corridor (Photo credit: NPS)

Deer management began a new phase in the 1990s as private citizens residing in the Fire Island communities began funding an exploratory study looking at immunological contraception to control deer numbers. The first five years of the study were designed to examine the biological effectiveness of the newly developed contraceptive PZP in blocking fertilization of individuals. The data showed positive results (Naugle et al. 2002), and in 1998 the study turned toward determining whether the overall deer population could be lowered using the PZP vaccine primarily within the Fire Island communities on the western side of the Seashore. The Seashore assumed partial funding and carried out the program during the last several years of the study. This study continued until 2009, with approximately 100 female deer treated each year. Underwood (2005) concluded, "In areas with the longest treatment history, the longest record of monitoring and the best access to breeding-aged females, the deer population has declined by almost 50% since 1998 (Naugle et al. 2002). In other treatment areas, population responses have been much less dramatic."

While the PZP immunocontraceptive study was ongoing, the methodology of conducting deer counts shifted from aerial surveys to distance sampling (Buckland et al. 1993) along ground transects where more emphasis could be placed on populations within the Fire Island communities (Underwood 2005). Biologists began performing distance sampling counts in 1995 at the Seashore

(including the William Floyd Estate) and have continued with the practice annually. Several areas were surveyed every year between 2003 and 2010, while two locales, Sailors Haven and Davis Park, were not surveyed during one of those years. The remaining locales were periodically surveyed over the same time period (Underwood, Ries, and Raphael 2011).

Approximate deer densities (plus or minus a standard error) from the most recent survey in 2012 are presented in table 14 and depicted on figure 8. Densities were found to vary widely across the Seashore, particularly between natural areas and Fire Island communities. Long-term trends show relatively stable population densities at Robert Moses State Park, the Light House Annex area, the Fire Island Wilderness, and the William Floyd Estate. Wider year-to-year fluctuations in deer numbers occur within the Fire Island communities, with Kismet – Lonelyville exhibiting the highest density of any locale on the Seashore possibly due to baiting at 4-Poster devices installed and operated by certain Fire Island communities to control ticks.

Deer browsing on vegetation (Photo credit: NPS)

TABLE 14. ESTIMATED DEER POPULATIONS AT SAMPLING AREAS ON FIRE ISLAND NATIONAL SEASHORE (2012)

Location (West to East)	Estimated Deer Density (deer per square mile)	Number of Deer
Robert Moses State Park	70 ± 10	60 ± 8
Lighthouse Tract	10 ± 5	2 ± 1
Kismet – Lonelyville	227 ± 42	80 ± 15
Lonelyville – Point 'O Woods	126 ± 14	37 ± 4
Sailors Haven	112 ± 24	27 ± 6
Fire Island Pines	149 ± 29	26 ± 5
Davis Park	137 ± 25	10 ± 2
Fire Island Wilderness	54 ± 6	91 ± 11
William Floyd Estate	106 ± 17	96 ± 16

Source: NPS 2013b

In terms of the number of individuals in 2012, the Seashore estimates the approximately 95–100 deer reside in the Fire Island Wilderness, and 250 deer occupy areas west of the Fire Island Wilderness including Robert Moses State Park. Approximately 100 deer reside at the William Floyd Estate.

With the termination of the immunocontraceptive study in 2009, the Seashore has experienced resumption of population increases within the western half of Fire Island. Population densities at the larger natural areas of Fire Island Wilderness and William Floyd Estate, which are outside of the immunocontraceptive study area, have remained relatively stable with normal year-to-year fluctuations (NPS 2013d).

Deer within Fire Island communities (Photo credit: NPS)

O'Connell and Sayre (1988) performed deer counts and examined the movements of 20 deer on the Seashore. From these data, they suggested that a dichotomy existed in the dynamics of the deer herd between the eastern and western halves of the Seashore. Underwood (2005), based on population trend data from the immunocontraceptive studies and deer density surveys, made similar conclusions. Underwood (2005) observed a relatively stable deer population at the Fire Island Wilderness and a rapidly increasing population in western areas of Fire Island, confirming O'Connell and Sayre's observations. Scientists have found that deer residing in the Fire Island Wilderness rely on natural food sources with few coming in contact with humans, and these deer generally exhibit a flight response to humans. In contrast, many of the deer on the western side of the Seashore use the Fire Island communities as part of their home range; exploit artificial food sources from human refuse, handouts, and 4-Poster devices; and are thus more habituated to human presence and conditioned to human food (Underwood 2005).

OTHER WILDLIFE AND WILDLIFE HABITAT

The Seashore contains a mosaic of natural habitats situated in close proximity to intensively developed suburban areas of Fire Island and Long Island. The ocean, bay, beaches, dunes, estuaries, tidal mudflats, scrub, and forested areas found on Fire Island and at the William Floyd Estate provide habitat for a diverse population of fish and wildlife species, which are described below.

MAMMALS

In 1974, 17 species of terrestrial mammals were recorded at the Seashore (McCormick and Associates, Inc 1975). Published reports documenting species ranges (Whitaker and Hamilton 1998) reviewed in combination with the Seashore species list from the 1970s identified 28 species of mammals likely to occur within the Seashore across a broad spectrum of habitat types. Species common to the Seashore and William Floyd Estate include white-tailed deer, eastern cottontail rabbit (*Sylvilagus floridanus*), red fox (*Vulpes vulpes*), white-footed mouse (*Peromyscus leucopus*), meadow vole (*Microtus pennsylvanicus*), raccoon (*Procyon lotor*), Norway rat (*Rattus norvegicus*), eastern gray squirrel (*Sciurus carolinensis*), muskrat (*Ondatra zibethicus*), shrews (*Sorex cinereus*, *Blarina brevicauda*), weasel (*Mustela* spp.), mink (*Neovison vison*), and a variety of bats (*Myotis* spp., *Lasiurus* spp., and others).

White-tailed Deer Management Plan and Environmental Impact Statement

National Park Service
U.S. Department of the Interior

Fire Island National Seashore

FIGURE 8
Estimated Deer Population Size - 2012

REPTILES

The most recent and comprehensive inventories of reptiles at the Seashore were performed by Cook, Brotherton, and Behler (2010a, 2010b). Species recorded included those confirmed by anuran calls, visual encounters, including records of recent observation by others, and trapping.

While five sea turtles are migrants to the ocean shorewaters of Fires Island (Trocki 2008), the loggerhead sea turtle (*Caretta caretta*) and leatherback sea turtle (*Dermochelys coriacea*) were most recently recorded in the area. In addition, ten resident species of reptiles were found using Fire Island (Cook, Brotherton, and Behler 2010a). Resident species surveyed include the Fowler's toad (*Bufo fowleri*), American bullfrog (*Lithobates catesbeianus*), snapping turtle (*Chelydra serpentina*), eastern box turtle (*Terrapene carolina*), northern diamond back terrapin (*Malaclemys terrapin terrapin*), spotted turtle (*Clemmys guttata*), eastern mud turtle (*Kinosternon subrubrum*), eastern hog-nosed snake (*Heterodon platirhinos*), eastern garter snake (*Thamnophis sirtalis*), and northern black racer (*Coluber constrictor constrictor*). No salamanders were recorded. The Fowler's toad, northern diamond-backed terrapin, and northern black racer were the most frequently recorded species of the taxonomic groups. The American bullfrog, snapping turtle, eastern mud turtle, spotted turtle, northern diamondback terrapin were observed inhabiting wetlands and riparian areas. In contrast, the eastern box turtle, eastern hog-nosed snake, eastern garter snake, and northern black racer were recorded within forests, scrub thickets, and developed areas.

Eleven species were recorded at the William Floyd Estate, including two salamander, one frog, four turtle, and four snake species (Cook, Brotherton, and Behler 2010b). Most observations were associated with the O'Dell and Home Creeks, upland woodlands, and fields. Species include the eastern red-backed salamander (*Plethodon cinereus*), four-toed salamander (*Hemidactylium scutatum*), spring peeper (*Pseudacris crucifer*), snapping turtle (*Chelydra serpentina*), painted turtle (*Chrysemys picta*), eastern box turtle (*Terrapene carolina*), northern diamondback terrapin (*Malaclemys terrapin terrapin*), eastern garter snake (*Thamnophis sirtalis*), northern brown snake (*Storeria dekayi dekayi*), northern black racer (*Coluber constrictor constrictor*), and eastern milk snake (*Lampropeltis triangulum triangulum*).

BIRDS

Habitats within the Seashore are important refuges for a wide variety of migratory and resident birds. A total of 333 avian species have been observed within the Seashore, 67 of which have been documented to breed at the Seashore (Mitra and Putnam 1999; Trocki 2008). The Seashore is within the Atlantic Flyway, a major North American migratory bird route that spans the northern habitats of the Arctic islands, coastal Greenland, and Canada to as far south as Jamaica and South America (Bird Nature 2013). The Seashore provides a resting and feeding area for migratory birds traveling along this route.

Tidal marshes and mudflats provide habitat for thousands of migratory birds, such as dowitcher (*Limnodromus* spp.), plover (*Pluvialis* spp., *Charadrius* spp.), sanderling (*Calidris alba*) and other sandpipers (*Calidris* spp.), red knot (*Calidris canutus*), and dunlin (*Calidris alpina*) (Trocki 2008). Birds that breed in or near Fire Island's salt marshes include American black duck (*Anas rubripes*), clapper rail (*Rallus longirostris*), and willet (*Catoptrophorus semipalmatus*) (Mitra and Putnam 1999; Niedowski 2000). Seaside sparrow (*Ammodramus maritimus*), sharp-tailed sparrow (*Ammodramus caudacutus*), and marsh wren (*Cistothorus palustris*) nest directly in the salt marsh. The marsh wren also nests in the cattail-dominated brackish tidal marsh. Red-winged blackbirds (*Agelaius phoeniceus*) commonly nest in the taller shrubs along the upper salt marsh margin. Other birds often seen and heard in the salt marsh include barn and tree swallows (*Hirundo rustica, Tachycineta*

bicolor), gray catbird (*Dumetella carolinensis*), common yellowthroat (*Geothlypis trichas*), and yellow-rumped warbler (*Dendroica coronata*). Other birds using area marshes and estuaries as a food source (e.g., cordgrass, insects, invertebrates, small fishes, etc.) include the glossy ibis (*Plegadis facinellus*), great egret (*Ardea alba*), green heron (*Butorides striatus*), laughing gull (*Larus atricilla*), snowy egret (*Egretta thula*), osprey (*Pandion haliaetus*), and terns (*Sterna* spp.) (Trocki 2008).

The Seashore also is a valuable habitat source for wintering and nesting waterfowl. During the winter, tidal creeks and the bay are frequently used by a wide variety of migrating diving ducks such as the greater scaup (*Aythya marila*), lesser scaup (*Aythya affinis*), red-breasted merganser (*Mergus serrator*), bufflehead (*Bucephala albeola*), and common goldeneye (*Bucephala clangula*). Open-water ponds at the William Floyd Estate, created decades ago for waterfowl hunting, provide refuge for waterfowl during harsh winter weather. These areas are also used by snow geese (*Chen caerulescens*), Canada geese (*Branta canadensis*), brant geese (*Branta bernicla*), and dabbling ducks such as the mallard (*Anas platyrhynchos*), black duck (*Anas rubripes*), American wideon (*Anas americana*), green-winged teal (*Anas crecca*), gadwall (*Anas strepera*), and northern pintail (*Anas acuta*), some of which use the ponds as nesting sites.

Dense shrub thickets and forests within the back dunes and swales within the Seashore are home to several songbirds such as the song sparrow (*Melospiza melodia*), gray catbird (*Dumetella carolinensis*), brown thrasher (*Toxostoma rufum*), mourning dove (*Zenaida macroura*), northern cardinal (*Cardinalis cardinalis*), northern mockingbird (*Mimus polyglottos*), redwing blackbird, rufous-sided towhee (*Pipilo erythrophthalmus*), white-throated sparrow (*Zonotrichia albicollis*), yellow-rumped warbler (*Dendroica coronate*), and yellow warbler (*Dendroica petechia*) (Trocki 2008).

Migrating and wintering birds of prey also are inhabitants of the Seashore. The northern harrier (*Circus cyaneus*) may use marsh habitats on Fire Island for nesting, while short-eared owls (*Asio flammeus*), long-eared owls (*Asio otus*), and snowy owls (*Nyctea scandiaca*) are occasional winter inhabitants. Other birds of prey using the Seashore may include the red-tailed hawk (*Buteo jamaicensis*), broad-winged hawk (*Buteo platypterus*), and the bald eagle (*Haliaeetus leucocephalus*) (Trocki 2008).

TICKS AND OTHER INVERTEBRATES

Fire Island is host to several tick species including the lone star tick (*Amblyomma americanum*), the American dog tick (*Dermacentor variabilis*), and the blacklegged tick (*Ixodes scapularis*), also known as the black-legged tick. Ticks occur in high numbers across the Seashore and are a particular concern as vectors of diseases to humans. Such diseases include anaplasmosis, ehrlichiosis, babesiosis, Rocky Mountain spotted fever, and Lyme disease (CDC 2013).

The most prevalent tick found at the Seashore is the lone star tick, which has been shown to carry ehrlichiosis and possibly other tick-borne diseases. Blacklegged ticks have been identified as carriers for Lyme disease, anaplasmosis, and babesiosis. Ticks become carriers for diseases from the hosts they feed on. For example, the blacklegged tick acquires the Lyme disease pathogen, *Borrelia burgdorferi,* primarily from the white-footed mouse (*Peromyscus leucopus*) and other small mammals. White-tailed deer do not carry the Lyme disease pathogen but serve as an important host for all tick lifestages, especially the adult stage, helping to perpetuate the tick population.

In addition to hosts, habitat and climatic conditions are important for tick survival. On Fire Island, blacklegged ticks were found in higher numbers (i.e., greater survivorship) within deciduous and

coniferous wooded habitats where relative humidity is higher compared to open habitats (Ginsberg and Zhioua 1996). Lone star ticks are common in most habitat types and can tolerate more open habitats unlike blacklegged ticks.

In a study in 1996, *B. burgdorferi* was isolated from one-third of adult blacklegged ticks collected from Fire Island (Ecohealth, Inc. 1998). Since then, other diseases like ehrlichiosis have been isolated from other ticks and animals. The threat of these diseases has affected levels of visitation, particularly at the William Floyd Estate where boardwalks cannot be constructed to keep visitors out of tick habitat due to the cultural landscape the Seashore must maintain.

Hundreds of species of insects occur on the Seashore that are ecologically valuable as pollinators for plant reproduction and food sources for birds, reptiles, and amphibians (Opler, Lotts, and Naberhaus 2013; NPS 2014). The Seashore offers important habitats for migrating monarch butterflies (*Danaus plexippus*) and odonates (e.g., dragonflies and damselflies), and various beetles, flies, mosquitos, and ants utilize the wetlands, beaches, and shorelines. An inventory of invertebrates by the U.S. Army Corps of Engineers (2005) found shore flies (*Ephydridae*), turfgrass ants (*Lasius neoniger*), and muscid flies (*Muscidae*) are most common on the bayside shorelines, and shoreflies (*Ephydridae*) and ground beetles (*Clivinia* sp.) occur along the Oceanside beaches. The most common taxonomic groups in the U.S. Army Corps of Engineers (2005) study were Coleoptera, Diptera, Amphipoda, Hymenoptera. Twenty seven species of odonates were inventoried at Fire Island, primarily near wetlands and ponds such as the freshwater pond at Kismet (Briggs et al. 2010).

WILDERNESS

The Wilderness Act of 1964 established the National Wilderness Preservation System to "secure for the American people of present and future generations the benefits of an enduring resource of wilderness." The purpose of the Act was to forever preserve the wildness of certain lands by restricting land-use activities. On December 23, 1980, under the Otis Pike Fire Island High Dune Wilderness Act (Public Law [PL] 96-585), Congress established approximately 1,363 acres of wilderness and 18 acres of potential wilderness within the Seashore. Subsequently, in October 1999, 17 of the 18 acres designated as potential wilderness were deemed in full compliance with wilderness standards and officially designated as wilderness. Approximately 1 acre within the Seashore remains designated potential wilderness. Specifically, potential wilderness encompasses the boardwalk nature trail at Smith Point and the dune crossing boardwalk and bathhouse at Old Inlet. In 2012, Hurricane Sandy removed all of these remaining structures, and the Seashore is now pursuing the designation of this last remaining acre as wilderness. (Note that in this document, the term "wilderness" refers to federally designated wilderness.)

At fewer than 1,400 acres, the Fire Island Wilderness is the smallest wilderness area managed by the National Park Service and is the only federally designated wilderness in New York State (Wilderness.net 2012). This is one of only a few barrier islands and locations along the eastern seaboard designated as wilderness. The extent of the wilderness, including the newly formed breach caused by Hurricane Sandy, and other landmarks described below are shown on figure 9.

Fire Island Wilderness visitor center (Photo credit: VHB)

The Fire Island Wilderness spans approximately 8 miles along the barrier island between Watch Hill and the Wilderness Visitor Center at Smith Point (figure 9). The Fire Island Wilderness is split into eastern and western portions by the ocean-to-bay parcel of nonfederally owned land, Bellport Beach, a village-owned property excluded from Wilderness designation which lies roughly in the middle of the wilderness. The wilderness boundary on the north side of the island coincides with the mean high water elevation of Great South Bay, and the southernmost boundary reaches the toe of the primary dunes along the beach facing the Atlantic Ocean. For the entire length of Atlantic Ocean beach adjacent to the southern wilderness boundary is the area designated as Seashore backcountry. The eastern boundary of the Wilderness extends along the western boundary of Smith Point County Park, except that it excludes the existing Wilderness Visitor Center and the 100 feet of land surrounding the perimeter of the building. The westernmost boundary extends along the edge of the Watch Hill Campground and nature trail.

Due to the dynamic nature of the shifting dunes and salt marshes and barrier island shorelines, both the southern and northern boundaries are subject to frequent fluctuation. Where there is an overwash, break in the dunes, breach, etc., the Fire Island Wilderness boundary is extended to the toe of the dunes on either side of the break. For instance, Hurricane Sandy recently breached the wilderness west of the Wilderness Visitor Center. The National Park Service has marked where the toe of the dune was estimated to be prior to the breach on either side of the breach and continues to manage the area upland of those markers as wilderness.

The Fire Island Wilderness exemplifies an undisturbed stretch of barrier island ecosystem characterized by massive primary dunes, interdunal swales of grasses and shrubs, freshwater cranberry marshes, and tidal marshes but does not include the Atlantic Ocean beach south of the toe of the dune. The southern boundary of the Fire Island Wilderness is characterized by massive primary dunes, some nearly 40 feet high, which are thickly blanketed with beach grass. Beyond these dunes lies the island swale and, in some areas, a line of secondary dunes is apparent. A variety of plant communities is found in the dune and swale zones including scrub and grasslands, high thickets, pine woodlands, and occasional patches of broadleaf forest. Interspersed among the dunes are unique freshwater cranberry marshes and interdunal grassy marshes. Vast expanses of reedgrass marshes and tidal marsh stretch beyond the swale and secondary dunes, extending into Great South Bay (NPS 1983). A variety of mammals, reptiles, amphibians, insects, and birds inhabit the area. White-tailed deer also reside within this area. Additional information on the vegetation and wildlife of the Seashore can be found in their respective sections of this chapter.

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

White-tailed Deer Management Plan and Environmental Impact Statement

National Park Service
U.S. Department of the Interior

Fire Island National Seashore

FIGURE 9
Fire Island Wilderness

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 includes a fifth quality. All five qualities are used to describe the condition of the 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.

The National Park Service prepared a wilderness management plan for the Fire Island Wilderness in 1983 that outlined management goals and objectives, potential expansion areas, wilderness use, and permitted management activities (NPS 1983). The Fire Island Wilderness provides outstanding opportunities for solitude and primitive, unconfined recreation. The area provides excellent backcountry camping opportunities and hiking along the old Burma Road, which runs the full length of the Fire Island Wilderness. Typical day use of the Fire Island Wilderness is the primary form of visitor use, though waterfowl hunting and overnight primitive camping is allowed via permits issued by the Seashore as described in the Seashore's backcountry camping plan.

Management activities conducted by Seashore staff within the Fire Island Wilderness are limited to the general maintenance and upkeep of the existing boardwalk, including reconstruction following recent storm damage, signs for regulating visitors, fencing of sensitive species, an experimental deer exclosure (13 feet by 13 feet), removal of invasive species, and vegetation monitoring plots. These management actions impose modern human control over ecological systems and interfere with the primeval quality and/or influence of natural resources. As such, the untrammeled, natural, and undeveloped qualities of wilderness may be somewhat diminished; however, such uses are consistent with wilderness stewardship policies and practices, and over the long term, these uses enhance natural resources. When relevant, a minimum tool analysis is conducted for management actions that have the potential to impact wilderness resources or character. In accordance with the management plan, restrictions have been established to protect the Fire Island Wilderness from new roads, unauthorized dune crossings, motorized equipment, utility installations, and other human actions that could harm its natural integrity.

In addition to setting aside wilderness area, PL 96-585 also specifically excluded two areas from wilderness designation: Bellport Beach and the Wilderness Visitor Center (NPS 1983). The 1,800-square-foot Wilderness Visitor Center supports the Seashore’s seasonal programs, ranger-led tours and programs, wilderness camping, and recreational and permitted driving. It also provides restrooms, exhibits, and unique views of the Fire Island Wilderness. A short, universally accessible boardwalk extends from the visitor center into the south section of the Fire Island Wilderness.

CULTURAL LANDSCAPES

The natural landscape of Fire Island has been altered or manipulated through natural events, human use, and engineering. Several thousand years before European contact and settlement, both Fire Island and southern Long Island were the scene of human occupation. Today, the Seashore serves to fulfill the recreational, economic, social, and scientific needs of a diverse regional population.

Fire Island became a stabilized landform around 10,000 years ago, and by 8,000 years ago the landscape on the island was characterized by much the same landscape as today. Human inhabitants moved between Fire Island and Long Island, exploiting the resources of the bay, Fire Island, and the Atlantic Ocean, similar to the hunters and fisherman in more recent historic periods. Fishing, hunting, and limited agriculture continued at Fire Island and the bays by the American Indians and the Colonial settlers, but by the early 1800s demand for Fire Island's agricultural goods decreased. Development on Fire Island focused on residential construction and tourism. In 1827, a federal lighthouse was constructed on the west end of Fire Island near the Fire Island Inlet and later, the U.S. Life-Saving Service built station houses along the length of Fire Island to assist mariners. There are currently 17 separate communities on Fire Island, as well as the Robert Moses State Park, established in 1908 and later renamed. The National Park Service has within its boundaries Smith Point County Park, three municipal beaches, and the 17 distinct preexisting residential communities.

Cultural landscape inventories have been completed within the Seashore for the William Floyd Estate and the Light House Annex. Due to the long history of human occupancy on Fire Island and southern Long Island, there are many cultural landscapes within the Seashore boundaries. However, for the plan/EIS, the landscape associated with the William Floyd Estate is the most notably impacted; therefore, it is described below.

WILLIAM FLOYD ESTATE

The William Floyd Estate is the historic home of the Floyd family and William Floyd, an American Revolutionary War general and signer of the Declaration of Independence. Family heirs continued to live at the estate until 1976 when the property was donated to the National Park Service. In 1980, the William Floyd Estate was listed in the National Register of Historic Places (National Register). This property comprises a 613-acre tract that includes the 34.5-acre historic core encompassing the Old Mastic House, the Floyd Family Cemetery, and 10 agricultural buildings. Also included in the nomination are the museum collections associated with the William Floyd Estate.

The Seashore initially performed a cultural landscape inventory for the William Floyd Estate and Fire Island in 1998 and revised the inventory in 2006. Based on the inventory completed in 2006, the New York SHPO concurred with the NPS findings that the period of significance for the property ended in 1975. Two additional resources, the windmill and the cistern/wells, were determined eligible for listing in the National Register in 1996.

Old Mastic House (Photo credit: NPS)

The northern boundary of the William Floyd Estate runs parallel to Washington Avenue. The property is additionally bounded by Home Creek on the east, Narrow Bay on the south, and Lawrence Creek on the west. This property includes the Old Mastic House and its associated structures and landscape features. In general, the landscape may be characterized as a series of agricultural fields historically maintained for the harvesting of wildlife, although presently hunting is not permitted, garden areas, managed turf, specimen trees, a vista, ditches, lopped tree lines, water control devices, wooded areas, salt marshes, and human-made ponds.

Historically, the William Floyd Estate's spatial organization and circulation were oriented to water access via Home Creek and Narrow Bay. Beginning in 1724, as the estate developed as an agricultural plantation, circulation came to include a dirt road and a log road called Corduroy Road. Later, as trains and automobiles became dominant modes of transportation, estate roads were developed to provide access to nearby railroad stations and highways on Long Island. A variety of land uses specific to different portions of the tract shaped the placement of characteristic landscape features. Important character-defining features were developed on the property, such as the Great Ditch which was constructed to keep cattle from straying into the marshes. More aesthetic elements like the ornamental lawn, the rough-cut known as the Pightle, and the vista to Narrow Bay, were set in an area closer to the main house where they might be enjoyed as amenities. Other features associated with the plantation, such as agricultural outbuildings and a system of trails, roads, and fences, were placed as required for use of the property. Features that began as functional elements but later acquired picturesque associations, such as the lopped tree line that delineated fields, are sited as their original purpose dictated.

Deer browse on ornamental plants at the William Floyd Estate (Photo credit: NPS)

VISITOR USE AND EXPERIENCE/RECREATION

The natural environs of Fire Island has made it an especially popular location for recreation and residential resort development. Since the Seashore was established in 1964, the National Park Service and its partners have worked to provide for a high quality visitor experience and to maintain and enhance the recreational opportunities that have always been a part of Fire Island.

The porous nature of the Seashore boundary, with numerous points of entry, makes it difficult to accurately measure visitation. In addition to the federally owned lands, the Seashore's boundary encompasses a county park, three community beaches, 17 private residential communities, and nearly 17,000 acres of bay and ocean waters. Current visitation tracking does not fully account for visitor use in these areas, but it is estimated that a total of approximately 2.2 million people visit Fire Island annually, including visits to the Seashore, Fire Island communities, or the waters surrounding the Seashore (NPS 2012c). The Seashore by itself has visitation counts which are much lower than the total Seashore-wide estimate, as derived from observations at a number of Seashore facilities. Visitation to the Seashore facilities is relatively stable, averaging approximately 810,000 visitors per year between 2008 and 2011 (NPS 2012c).

The Seashore offers a wide variety of recreational activities, some of which are regulated by the Seashore to provide equal opportunities and a safe environment for all visitors, while protecting the

Seashore's vast resources. Some activities, such as kite flying, camping, and picnicking are restricted to certain areas and times of year. Other activities, such as backcountry camping and private events, require NPS permits. The more regulated activities at the Seashore include recreational driving, fishing, and hunting.

Visitors feeding a deer (Photo credit: NPS)

Along with the driving restrictions, fishing and waterfowl hunting regulations are in place to protect the natural, scenic, and recreational resources in the Seashore. Hunting, fin fishing, and shellfishing are important recreational pastimes in the local area, and the Seashore is one of the few units of the National Park System in which public hunting is allowed through its enabling legislation. Waterfowl hunting is permitted at Fire Island with a permit issued by Seashore staff, a valid NYS hunting license, a signed federal duck stamp, a driving license, and a confirmation number from the Migratory Bird Harvest Information Program. No hunting is allowed at the William Floyd Estate. Hunting/fishing seasons and limits are established and regulated by the New York State Department of Environmental Conservation. The Seashore's park rangers have the policing authority to enforce state hunting and fishing laws in the Seashore.

Currently the Seashore only allows limited opportunities for waterfowl hunting in two designated areas, the East End Hunting Area and the West End Hunting Area. The East End Hunting Area is adjacent to the Fire Island Wilderness and extends from Long Cove east to Hayhole Point, north of the Burma Road. The West End Hunting Area is restricted to shoreline waterfowl hunting from the bay islands of East Fire Island, West Fire Island, and Sexton Island. In the 2013-14 season, a total of 56 hunting permits were issued. The majority of these permits (48) were issued for the East End Hunting Area. Rabbit hunting used to be allowed in the Fire Island Wilderness but sometime between 1987 and 1988 the Seashore ceased the issuance of permits for rabbit hunting because of safety issues and conflicts with hunting dogs and other users such as backcountry campers.

Deer feeding on garbage
(Photo credit: NPS)

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. An additional 29% of visitors reported no contact with deer or other wildlife (NPS 2009b).

Educational/interpretive activities occur at several locations on Fire Island. One of the primary destinations for educational/interpretive programming is the Light House Annex, which provides specialized educational programs to over 7,000 local elementary school children each year. The Sunken Forest also hosts several thousand school children a year. The Fire Island Wilderness, via access from the Wilderness Visitor Center, and, to a lesser extent, Watch Hill, also are host to school groups. All beach sites are popular attractions for many of the Seashore's recreational visitors.

The William Floyd Estate is open to the public from late May through mid-November. During these months, visitors may take guided tours of the house and discuss the history of the family and the 613-acre site with park rangers and interpreters. The house reflects a continuum of historical use by William Floyd's family, with structural and furnishings modifications over more than two centuries. The main interpretive themes of this continuum of use is "The Land, The House, and The Family." To support this story, Seashore staff conduct cultural landscape tours and tours of the archival collection that is housed in a facility located on the estate. The collections include items related to the Floyd family, as well as the general history of the region.

FIRE ISLAND COMMUNITIES AND ADJACENT LANDOWNERS

The Seashore is composed of public and private lands, including the 17 private communities and towns, Smith County Park, and three municipal beaches, Bellport Beach, Leja Beach/Davis Park, and Atlantique Beach. In total, nonfederal lands within the Seashore encompass approximately 13,338 acres, 12,423 acres of which are public lands (NPS 2012c). The 17 private communities, which occupy 916 acres of Fire Island, had been developed before the establishment of the Seashore (NPS 2012c). These communities currently include over 4,100 homes. When the Seashore was established in 1964, its enabling legislation stated that these communities and preexisting commercial uses would be allowed to remain, as long as development was consistent with zoning ordinances established by the Secretary of the Interior (NPS 1977).

Boardwalks and landowner fencing of ornamentals within the Fire Island communities (Photo credit: VHB)

In May 2010, a Character Study was prepared for the Fire Island communities. Nearly all participants, 95%, identified that they are either satisfied or highly satisfied with the general quality of life on Fire Island (Nelessen 2012). In addition to demographics questions, the project website presented viewers with various images from Fire Island that portrayed a range of features and characteristics that define Fire Island's built environment and larger landscape. Images of the natural beaches and dunes, dune vegetation efforts, wildlife, and naturalized portions of the bay shore all scored positively in the natural environment category (Nelessen 2012). Boardwalks with loose landscaped or natural edges, well-designed entrances and fencing associated with private residences, and naturalized, beach tolerant landscape treatments all elicited positive responses (Nelessen 2012).

In many residential settings near protected areas, such as the Fire Island communities within the Seashore, deer cause year-round damage to suburban landscaping, which can be costly to replace. The vegetation composition in the Fire Island communities is described in detail under the "Unique Vegetation Communities" section above. Suburban landscaping includes planted gardens, ornamental plantings, woodlots, orchards, and nurseries, which provide deer with a combination of shelter and food (McDonald and Hollingsworth 2007). As natural habitat

Clothes line tangled in deer antlers (Photo credit: NPS)

dwindles due to development pressure and as deer populations grow, deer may turn to surrounding residential areas for food, particularly in late fall, winter, and early spring, when other natural food sources may be scarce. Deer damage shrubs and landscape vegetation by eating the buds, leaves, flowers, and twigs and by rubbing on the bark of trees. In home gardens, deer eat leaves, flowers, stems, and other plant parts. An average adult deer consumes approximately 6–10 pounds of food per day during late spring, summer, and fall (McDonald and Hollingsworth 2007). Deer may also trample plants as they move through the landscape. Browse damage typically extends as high as 6 feet, which is the highest an average deer can reach.

In addition to causing damage to vegetation within local communities, some people consider deer a nuisance. Trash cans that are not properly secured can be knocked over by deer, spilling garbage. Some deer have been food-conditioned and seek food by approaching humans.

As the deer population has increased within the Seashore, the Seashore has received an increasing number of complaints, many of which come from residents of the Fire Island communities. In order to better understand how residents living near the Seashore perceived white-tailed deer, including perceptions about and use of NPS lands and NPS decision-making and land management related to deer, a study was conducted in 2007 via mailed questionnaires and follow-up telephone calls to people who did not respond. Results indicated that 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). Most participants indicated that the National Park Service should be managing deer-related impacts at the Seashore, and many felt that such management activities would have a positive effect both on the Seashore and the Fire Island communities (Siemer et al. 2007). The primary concerns of residents related to deer in Fire Island communities included access to trash, the transmission of disease, and browsing on landscaping (Siemer et al. 2007). A separate interview-based survey conducted in 2005 found that community resident concerns related to deer included both physical and emotional impacts on residents. An example of a physical impact would be a response such as, "There used to be the most beautiful ferns out here… That's all gone." An example of an emotional response is, "I feel blessed to be surrounded by this wildlife… They are a joy" (Leong and Decker 2007).

PUBLIC HEALTH AND SAFETY

The National Park Service is committed to providing appropriate, high-quality opportunities for visitors to enjoy parks in a safe and healthy environment. A visitor accident or incident is defined as an accidental event affecting any non-NPS employee that results in serious injury or illness requiring medical treatment, or in death. As described in the "Visitor Experience and Recreation" section, because there is no central entrance or orientation point in the Seashore, it is important to the National Park Service that information sources be readily available to the public. Park rangers and employees post public notices on bulletin boards at key locations around the Seashore and on the Seashore website to ensure that visitors to Fire Island are properly informed regarding safety concerns. For example, visitors arriving by ferry boat to NPS facilities are presented with staffed visitor contact stations and signage that includes Seashore maps and other information such as safety bulletins on tick-borne diseases, as well as prevention and identification, and protection from ticks.

The potential for the transmission of Lyme disease is often cited as a safety concern by both Seashore visitors and employees. The perceived threat of these diseases has affected levels of visitation, particularly at the William Floyd Estate where potential impacts to the cultural landscape

have prevented the Seashore's ability to install gravel walkways or pedestrian boardwalks to protect visitors from tick infested areas. A 2007 study found that Lyme disease was one of the main deer-related concerns for residents of the Fire Island communities (Siemer et al. 2007). As described in chapter 1, the Seashore has an extensive tick monitoring and management program in place to manage the risk of tick-borne illness at the William Floyd Estate.

Some deer in the Fire Island communities and adjacent lands have become habituated to human presence and have been food-conditioned by community members feeding them. These deer have been known to approach people, a safety concern for some community members. Additionally, people sometimes encounter deer on boardwalks to the beach. Some boardwalks are bordered on both sides by dense stands of bamboo, and there are anecdotal reports that startled deer have charged at people encountered on the boardwalk. Such an encounter could result in injuries to both the deer and the person, although no such incidents have been documented.

Deer eating from a resident's garbage (Photo Credit: NPS)

SEASHORE OPERATIONS

The facilities, roads, buildings, and utilities currently used for Seashore operations and by the visiting public are a mix of structures that existed prior to the establishment of the Seashore and new infrastructure installed by the National Park Service. Operations at the Seashore are divided into five functional areas: visitor and resource protection, education/interpretation, resource management, maintenance, and administration. In total, in fiscal year (FY) 2012, the Seashore employed approximately 40 full-time equivalent positions (FTE) and had an operational budget of approximately $4.8 million (NPS 2012c). The permanent staff is augmented by a seasonal or temporary workforce, which changes from year to year with available funding. In addition to full-time staff, the Seashore also maintains up to 60 seasonal and intern staff during the summer months.

Overall, the Seashore estimates that operations related to white-tailed deer and vegetation require $25,195 annually, although some costs recur every three or five years. These costs are split between the functional areas of visitor experience and enjoyment and resource management, as described below.

VISITOR AND RESOURCE PROTECTION

The visitor and resource protection functional area represents the personnel and budgetary resources that go toward protecting Seashore natural resources and ensuring visitor safety. In FY 2011, there were a total of 18.3 FTE available to address the responsibilities under this functional area. The total annual budget for this area was approximately 27% of the Seashore's total budget (NPS 2013c).

Sign on health and safety relating to deer (Photo credit: NPS)

Park rangers and ocean lifeguards protect Seashore visitors, resources, and property through professional services in law enforcement, emergency medical services, search and rescue, beach safety, and community assistance. Park rangers patrol the Seashore by all-terrain vehicle, boat, and automobile. Due to the unique Fire Island communities and resources within the Seashore's boundary, park rangers at the Seashore are among the National Park Service's most diverse in terms of necessary skills. Seashore staff manage reports of negative human-deer interactions and spend an estimated 185 hours annually completing Case Incident Reports related specifically to these incidents. Time spent on these reports is almost 0.4% of the budget for visitor and resource protection.

EDUCATION/INTERPRETATION

The education/interpretation functional area is represented by educational/interpretive program staff include Seashore interpretive rangers and guides who provide visitor information, develop and deliver public and educational programming, operate visitor centers, design and develop nonpersonal media (e.g., exhibits, signage, publications, social media, etc.), and oversee the volunteer program. In FY 2011, there were a total of 9.7 FTE available to undertake the responsibilities associated with this functional area. The total annual budget for this area was approximately 13% of the Seashore's total budget (NPS 2013c).

Staff currently spend approximately 270–300 hours per year on deer-related community outreach. This outreach is conducted by two staff members at a GS-9 and GS-5 level, respectively, and their efforts include planning, correspondence, transportation, Junior Ranger programming, public programming, informal interpretation, publications, and implementation of deer-related programming. These activities combined cost approximately 1% of the education/interpretation budget.

RESOURCE MANAGEMENT

Operations in the resource management division include the monitoring, management, protection, and preservation of natural and cultural resources. The Seashore is charged with the protection of miles of ocean and bayside shoreline, uplands, wetlands, maritime forests, and endemic, migratory, and endangered species. In addition to natural resources, the Seashore is charged with protecting 41 historic structures, three of which are listed on the National Register: the William Floyd Estate, the Carrington House and Cottage, and the Light House Annex. Resource management is one of the smallest functional areas of the Seashore, with only 7.4 FTE in FY 2011. Expenditures in this area accounted for approximately 13% of the total Seashore (NPS 2013c).

The Seashore uses limited amounts of fencing to protect sensitive species and landscapes and monitors vegetation and deer populations. Staff time related to maintenance and repair of fencing is relatively small, requiring approximately 4 hours per year at the William Floyd Estate and 32 hours (16 hours each for two staff) on Fire Island. The Seashore's current vegetation monitoring program includes annual plot sampling at one or more of the Seashore natural areas until each natural area is surveyed at least once every five years, requiring five dedicated staff for four months (460 hours each).

Seashore staff monitoring vegetation (Photo credit: NPS)

Deer monitoring takes place annually Seashore-wide, requiring approximately 200 hours for three staff. Additionally, monitoring takes place every three years within the Fire Island Wilderness and at the William Floyd Estate. Monitoring in the Fire Island Wilderness requires 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.

The total estimate of time, not including materials, spent on items related to deer management under this division is approximately 2% of the division's annual budget.

MAINTENANCE

Maintenance operations consist of activities that prolong the life of the Seashore's numerous assets, such as buildings, fleet, trails, utilities, roads, and water channels, many of which are more than 40 years old and were not built for current visitation levels. In FY 2011, 17.6 FTE were available for recurring maintenance, including facilities operations staff, accounting for 34% of the Seashore's budget (NPS 2013c).

Facility operations are included in the maintenance division and consist of the activities necessary to manage the Seashore's infrastructure efficiently and safely on a day-to-day basis, as well as to complete extensive opening and closing procedures before and after the peak summer season (June-September). Current maintenance staff effort on deer management is limited to support of natural resource staff when needed (e.g., for fencing installation and repairs).

MANAGEMENT AND ADMINISTRATION

The management and administration division is directed by the superintendent's office in cooperation with the division chiefs. This team must address internal issues as well as focus on all external commitments. Administrative staff provide essential support to all Seashore operations. Park planning is part of the duties of this management team, which provides support on issues related to building and zoning within the communities, as well as limited geographic information system support. Combined expenditures for these activities in FY 2011 included 7.9 FTE and approximately 20% of total Seashore funding, excluding investments (NPS 2013c). Management and administration of the items summarized above would be very difficult to quantify, but it can be assumed that the order of magnitude is similar to the divisions described above.

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Environmental Consequences

4

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 be10 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 exclosure 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 exclosure, 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 exclosure 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 exclosure.

Inside the first rotational fencing exclosure, 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 exclosure, 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 to10 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 (OCRM), 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

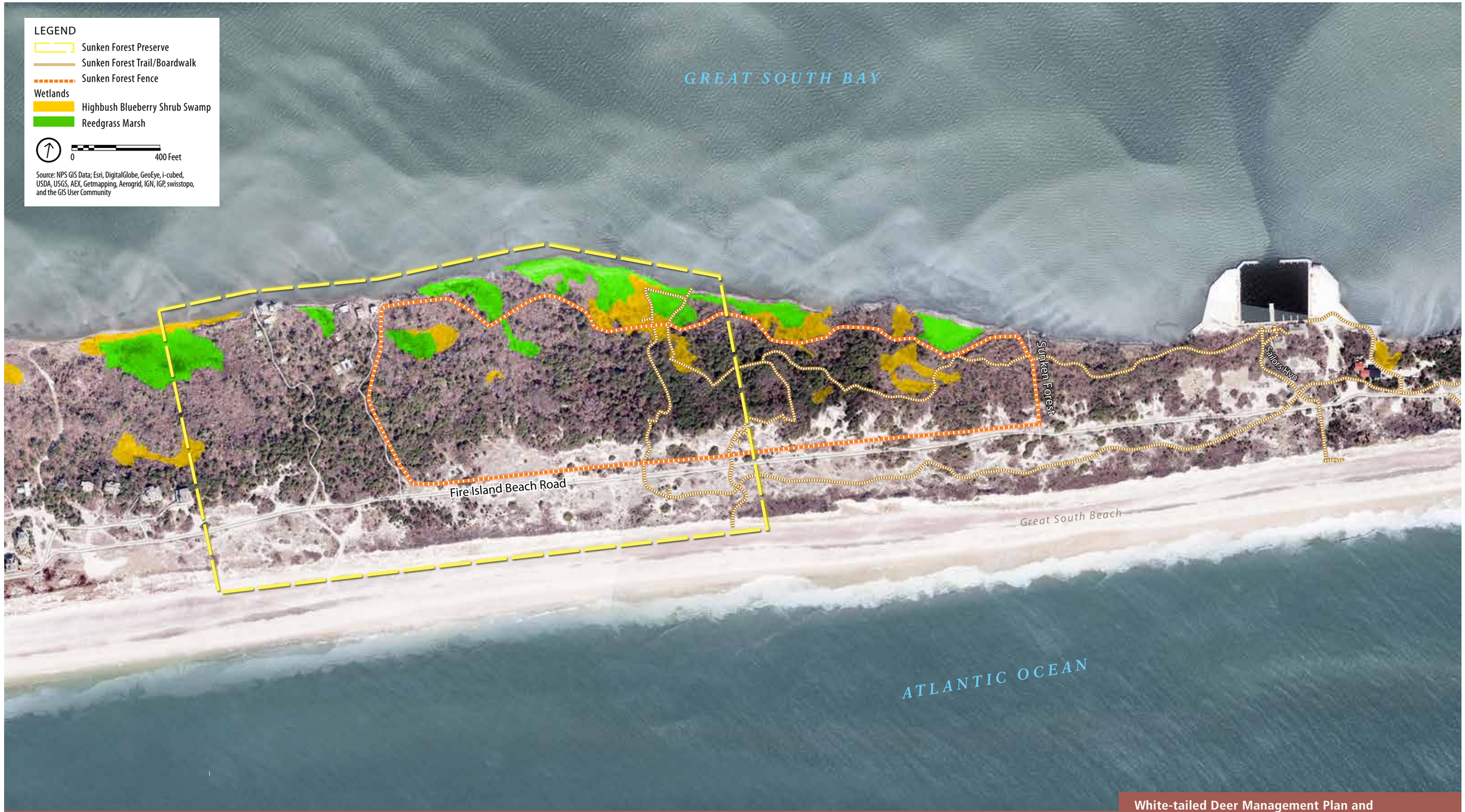
No past, present, and reasonably foreseeable future actions may affect wetlands in the area of analysis. Consequently, there would be no cumulative impacts on wetlands under alternative C.

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.



White-tailed Deer Management Plan and Environmental Impact Statement

National Park Service
U.S. Department of the Interior

Fire Island National Seashore

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 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) 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 exclosure (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 untrammeled 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 untrammeled 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 untrammeled 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 untrammeled 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 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 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 untrammeled 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 of 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 exclosure 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 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 exclosure 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/interpretative 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 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 exclosure 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.

Consultation and Coordination

5

INTRODUCTION

This "Consultation and Coordination" chapter describes the public involvement and agency consultation completed during the preparation of this plan/EIS for Fire Island National Seashore. A combination of activities, including public scoping, internal workshops, and agency briefings, has helped to guide the National Park Service in developing this plan/EIS.

BRIEF HISTORY OF PLANNING AND PUBLIC INVOLVEMENT

The National Park Service divides the scoping process into two parts: internal scoping and external (public) scoping. Internal scoping involves discussions among NPS personnel regarding the purpose of and need for action, issues, available references and guidance, and other related topics. Public scoping is the early involvement of the interested and affected public in the environmental analysis process. The public scoping process helps ensure that the public has been given an opportunity to comment and contribute early in the decision-making process. For this plan/EIS, project information was distributed to individuals, agencies, and organizations early in the scoping process. These groups were given the opportunity to express their views and identify important issues and alternatives or alternative elements for the purpose of informing the decision-making process.

INTERNAL SCOPING AND PLANNING

An internal scoping meeting was held in October 2010 to provide an opportunity for the NPS team to initiate the NEPA planning process and discuss the management of white-tailed deer and vegetation at the Seashore. Attendees included representatives from the NPS Denver Service Center, NPS Northeast Region Office, NPS Biological Resource Management Division, U.S. Geological Survey Patuxent Wildlife Research Center, the Seashore, and their consultants. Topics discussed during the meeting included the purpose, need, and objectives; public and agency involvement; potential issues; data needs; and preliminary alternative elements.

This group met again in December 2011 and June 2012 to develop the alternatives that are considered in this plan/EIS. The group reviewed the purpose, need, and objectives as well as potential constraints, available management techniques, public input, and science team recommendations to compile a full spectrum of potential alternatives. The alternatives that best met the objectives of the plan/EIS were included in this document. The meeting held in June 2012 also included the cooperating agencies, as described below.

The internal scoping process continued throughout the development of the plan/EIS through regular conference calls.

PUBLIC SCOPING AND OUTREACH

The Seashore published the Notice of Intent to prepare an EIS in the *Federal Register* on June 17, 2011. The Seashore also issued a press release on June 17, 2011, which was posted on the Seashore's website and emailed to the media and the Seashore's mailing list. Additionally, articles were published in local Fire Island newspapers, and links were shared via Twitter. These documents represented the beginning of the public scoping and outreach process. In addition, the Seashore published three newsletters (summer 2011, fall 2012, and fall 2013) that were provided to known stakeholders and posted on the NPS PEPC website (http://parkplanning.nps.gov/fiis).

The first newsletter was generated to gather public comments. It provided background information; the purpose, need, and objectives associated with the plan/EIS; information on alternatives development; and instructions about how to provide comments either through the NPS PEPC website or using standard mail. The public comment period was from June 17, 2011, through July 31, 2011. A total of 12 pieces of correspondence were received during the public comment period, comprising approximately 90 comments. Comments received during the public scoping process addressed a variety of issues. Topics included the potential use of volunteers or contractors to assist with deer population management, social impacts, visitor conflicts and safety, the NYS-DEC 4-Poster tick management study, and potential deer population management methods, including public hunting. A public scoping report summarizing these comments was uploaded to the NPS PEPC website for public viewing.

The second and third newsletters provided updates on the planning process. The second newsletter included the status of the planning process, a summary of public comments received on the first newsletter, additional information on the alternatives development process, and a list of preliminary alternatives. The third newsletter focused on what was accomplished in 2013 and the pending project schedule. The second and third newsletters did not solicit public comments.

COOPERATING AGENCIES

In accordance with the National Environmental Policy Act of 1969 (42 USC 4321-4370h) and the CEQ regulations sections 1501.5 and 1501.6, the National Park Service invited the New York State Department of Environmental Conservation and the U.S. Department of Agriculture Animal and Plant Health Inspection Services (APHIS) to be cooperating agencies for the plan/EIS in letters dated November 29, 2011. Each agency accepted this offer in memoranda of understanding which was signed by NYS-DEC on June 8, 2012, and by APHIS on June 19, 2012. The National Park Service finalized the memoranda of understanding on July 3, 2012. The cooperating agencies participated in the monthly interdisciplinary team status calls and the development of alternatives, provided information in their areas of technical expertise, and had the opportunity to comment on the internal review draft plan/EIS as it was prepared.

AGENCY AND TRIBAL CONSULTATION

In addition to establishing which agencies would serve as cooperating agencies, as described above, other agencies were consulted to aid in identification of potential issues to be addressed in the plan/EIS. Agency consultations are summarized below, and copies of relevant correspondence are included in appendix A.

FEDERAL AGENCIES

Section 7 of the Endangered Species Act. The Seashore initiated consultation under section 7 of the Endangered Species Act with a letter to the U.S. Fish and Wildlife Service (USFWS) on July 7, 2011. This letter notified the agency of the plan/EIS preparation and invited the agency to provide input and information on the presence of federally listed threatened and endangered species in the vicinity of the Seashore. A search of the USFWS Information, Planning, and Conservation System noted that six federally listed species are potentially found in the project area:

- federally threatened piping plover (*Charadrius melodus*)
- federally proposed threatened red knot (*Calidris canutus rufa*)

- federally endangered roseate tern (*Sterna dougallii dougallii*)
- federally endangered sandplain gerardia (*Agalinis acuta*)
- federally threatened seabeach amaranth (*Amaranthus pumilus*)
- federally proposed endangered northern long-eared bat (*Myotis septentrionalis*)

As discussed in chapter 1, the Seashore has determined that the proposed action is not likely to adversely affect these federally listed species. The Seashore will provide the U.S. Fish and Wildlife Service with a copy of the plan/EIS and will continue to coordinate with the agency as the project moves forward, as needed.

Section 106 of the National Historic Preservation Act. When the Seashore initiated consultation under section 106 of the National Historic Preservation Act with the New York SHPO in July 2011, the Seashore intended to use the plan/EIS for compliance with both section 106 and NEPA; however, based on the potential effects that came to light during the impact analysis, the Seashore sent a revised letter to the New York SHPO on May 30, 2014, to note that section 106 compliance was now being completed separately from but concurrently with the NEPA process. The Seashore will provide the New York State Historic Preservation Officer with a copy of the plan/EIS and will continue to coordinate with the agency as the project moves forward, as needed.

AMERICAN INDIAN TRIBES

In accordance with the Advisory Council on Historic Preservation regulations, 36 CFR 800, the Seashore initiated consultation under section 106 of the National Historic Preservation Act with the Unkechaug Indian Nation and the Shinnecock Indian Nation in July 2011. These initial letters notified the American Indian tribes of the Seashore's intent to use the plan/EIS for compliance with both section 106 and the National Environmental Policy Act; however, based on the potential effects that came to light during the impact analysis, the NEPA document, the Seashore sent a revised letter submitted to the aforementioned tribes on May 30, 2014, to note that section 106 compliance was now being completed separately from but concurrently with the NEPA process. The Seashore will provide both the Unkechaug Indian Nation and the Shinnecock Indian Nation with a copy of the plan/EIS and will continue to coordinate with the agency as the project moves forward, as needed.

STATE AND LOCAL AGENCIES

New York State Department of Environmental Conservation. The Seashore initiated consultation with the New York State Department of Environmental Conservation with a letter dated July 7, 2011. The agency responded on July 22, 2011, suggesting the Seashore review the state's draft deer management plan, seriously consider public hunting as a management alternative, and maintain a cooperative relationship with the New York State Department of Environmental Conservation. As described above, the New York State Department of Environmental Conservation is now a cooperating agency on the plan/EIS.

NYS-DEC Division of Fish, Wildlife and Marine Resources. The Seashore coordinated with the NYS-DEC Division of Fish, Wildlife and Marine Resources on July 14, 2011, to provide input and information on the presence of New York state-listed threatened and endangered species in the vicinity of the project area. The Habitat Inventory Unit responded to the Seashore's request on March 5, 2012. Their report included rare and state-listed animals and plants, significant natural communities, and other significant habitats that, according to the New York Natural Heritage Program database, occur or may occur on or in the vicinity of the project area (see appendix A). As

discussed in chapter 1, the Seashore has determined that the proposed action is not likely to adversely affect these listed species. The Seashore will provide the Habitat Inventory Unit with a copy of the plan/EIS and will continue to coordinate with the agency as the project moves forward, as needed.

New York State Department of State (Coastal Management Program). To comply with the Coastal Zone Management Act, the Seashore will provide the New York State Department of State's Coastal Management Program office with a copy of the Draft plan/EIS. At that time, the Seashore will request a review of the document (via a coastal consistency determination).

LIST OF PREPARERS

The National Park Service prepared this plan/EIS with assistance from a contractor in accordance with CEQ regulations (1506.5). The National Park Service provided constant guidance and direction to the contractor regarding the scope and content of the plan/EIS. The National Park Service has independently reviewed all sections of the plan/EIS prior to publication and is responsible for the content of the plan/EIS.

TABLE 15. PREPARERS, CONTRIBUTORS, AND REVIEWERS

Name	Title
Contractor Team	
Vanasse Hangen Brustlin, Inc. (VHB)	
Margaret Beavers	Environmental Scientist, GIS Analysis/Graphics
Nicole Benjamin-Ma	Preservation Planner
Tim Davis	Senior Environmental Scientist, Certified Wildlife Biologist
Douglas DeBerry	Senior Environmental Scientist
Diane Ditzel	Environmental Planner/Scientist
Tracy Hamm	Environmental Planner
Mariah Murphy	Environmental Planner
Kim Threlfall	Senior Environmental Planner
Tricia Wingard	NPS Program Manager, Project Manager
Jacob Hoogland and Associates	
Jacob Hoogland	NPS Market Leader
The Final Word	
Juanita Barboa	Copy Editor
Guttry Writing Services LLC	
Paul Guttry	Copy Editor
Janet Krenn	
Janet Krenn	Copy Editor

TABLE 15. PREPARERS, CONTRIBUTORS, AND REVIEWERS (CONT'D)

Name	Title
NPS Interdisciplinary Team	
NPS – Denver Service Center (DSC)	
Morgan Elmer	Project Manager
Ann Van Huizen	Project Manager (former)
NPS – Fire Island National Seashore (FIIS)	
K. Christopher Soller	Superintendent
Michael Bilecki	Chief of Resource Management
Kaetlyn Kerr	Biological Technician
Kathy Krause	Chief of Interpretation
Christopher Olijnyk	Site Manager, William Floyd Estate
Steve Olijnyk	Park Ranger Law Enforcement
Jordan Raphael	Park Biologist
Lindsay Ries	Wildlife Biologist
Elizabeth Rogers	Science Communications Park Ranger
Paula Valentine	Public Information Officer (former)
NPS – Environmental Quality Division (EQD)	
Dan Niosi	Environmental Protection Specialist
NPS – Northeast Region Office (NER)	
Sheila Colwell	Wildlife Biologist
Mary Foley	Chief Scientist
Kris Heister	Chief, Division of Natural Resources
Jacki Katzmire	Regional Environmental Coordinator
Mary (Missy) Morrison	Environmental Planning Specialist
NPS – Biological Resource Management Division (BRMD)	
Kirsten Leong	Human Dimensions Program Manager
Jenny Powers	Wildlife Veterinarian
Cooperating Agencies	
NYS-DEC	
Gordon Batcheller	Chief Wildlife Biologist
Michelle Gibbons	Wildlife Manager
Jeremy Hurst	Wildlife Biologist
Joshua Stiller	Wildlife Biologist
APHIS	
Martin Lowney	State Director
Other Reviewers and Contributors	
Scott Bates	NPS-National Capital Region, Regional Wildlife Biologist
Ellen Carlson	NPS-NER, Community Planner
John Hammond	NPS, Olmstead Center for Landscape Preservation, Historical Landscape Architect
Rick Kahn	NPS-BRMD, Wildlife Biologist
Brian Underwood	U.S. Geological Service (USGS), Research Wildlife Biologist

SCIENCE TEAM MEMBERS

TABLE 16. SCIENCE TEAM MEMBERS

Name	Affiliation	Role
Myla Aronson	Hofstra University	Native/invasive plants in the wildland/urban interface
Sheila Colwell	NPS-NER	Wildlife biologist
Jodi Forrester	University of Wisconsin-Madison	Research plant biologist
Howard Ginsberg	USGS/University of Rhode Island	Research entomologist, disease ecologist
Bruce Lauber	Cornell University	Human dimensions of natural resources and environmental management
Kirsten Leong	NPS-BRMD	Human dimensions of natural resources and environmental management
Donald Leopold	The State University of New York College of Environmental Science and Forestry (SUNY-ESF)	Research plant biologist
Chris Olijnyk	NPS-FIIS	Cultural resource specialist and site manager, William Floyd Estate
M. Nils Peterson	North Carolina State University	Human dimensions of natural resources and environmental management
Jenny Powers	NPS-BRMD	Fertility control and wildlife veterinarian
Jordan Raphael	NPS-FIIS	Park biologist
Lindsay Ries	NPS-FIIS	Park biologist
Ted Stankowich	University of Massachusetts	Behavior ecologist
Brian Underwood	USGS/SUNY-ESF	Research wildlife biologist

DOCUMENT REVIEW AND LIST OF RECIPIENTS

The draft plan/EIS will be released for a 60-day public and agency review period and will be made available for review on the NPS PEPC website. Hard copies will be made available for review at the Seashore's public facilities and local libraries. The draft plan/EIS will be distributed to the following government officials and agencies, and nongovernmental organizations and agencies. Individuals and other entities will be provided the draft plan/EIS upon request.

FEDERAL AGENCIES

Advisory Council on Historic Preservation
National Oceanographic and Atmospheric Administration, including National Marine Fisheries Service
U.S. Army Corps of Engineers
U.S. Department of Agriculture
U.S. Department of Public Health
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service

STATE AND LOCAL AGENCIES OR GOVERNMENTS

New York State Department of Environmental Conservation
New York State Department of Health
New York State Department of State
New York State Office of Parks, Recreation & Historic Preservation
Robert Moses State Park
Suffolk County
Town of Brookhaven
Town of Islip
Smith Point County Park

Village of Patchogue
Village of Mastic Beach
Village of Saltaire
Village of Ocean Beach
Village of Bellport

AMERICAN INDIAN TRIBES

Shinnecock Indian Nation
Unkechaug Indian Nation

ORGANIZATIONS/OTHER

Animal Welfare Institute
Appalachian Mountain Club
Audubon Society
Fire Island Association
Fire Island Wilderness Committee
Fire Island Wildlife Foundation, Inc.
Friends of Fire Island National Seashore
Friends of Watch Hill
Humane Society of the United States
National Park Foundation
National Park Conservation Association
The Nature Conservancy
Pattersquash Gun Club
People for the Ethical Treatment of Animals
Sierra Club
South Shore Estuary Reserve
Wilderness Society

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Appendixes

APPENDIX A
RELEVANT AGENCY CORRESPONDENCE

LIST OF RELEVANT AGENCY CORRESPONDENCE

- Letter from the Seashore, to New York State Department of Environmental Conservation, regarding Species List Request, dated July 7, 2011
- Letter from the Seashore, to U.S. Fish and Wildlife Service, regarding Species List Request, dated July 7, 2011
- Letter from the Seashore, to SHPO, regarding Notification of Intent to Use NEPA Process to Meet Section 106 Obligations, dated July 13, 2011
- Letter from the Seashore, to Unkechaug Indian Nation, regarding Notification of Intent to Use NEPA Process to Meet Section 106 Obligations, dated July 13, 2011
- Letter from the Seashore, to Shinnecock Indian Nation, regarding Notification of Intent to Use NEPA Process to Meet Section 106 Obligations, dated July 13, 2011
- Letter from the Seashore, to New York State Department of Environmental Conservation – Division of Fish, Wildlife, and Marine Resources, regarding Species List Request, dated July 14, 2011
- Letter from New York State Department of Environmental Conservation, to the Seashore, regarding the Public Scoping document, dated July 22, 2011
- Letter from New York State Department of Environmental Conservation – Division of Fish, Wildlife, and Marine Resources, to the Seashore, regarding Species List Request, dated March 5, 2012
- Letter from the Seashore, to SHPO, regarding Intent to Use 2008 Nationwide Programmatic Agreement to Meet Section 106 Obligations, dated May 30, 2014.
- Letter from the Seashore, to Unkechaug Indian Nation, regarding Intent to Use 2008 Nationwide Programmatic Agreement to Meet Section 106 Obligations, dated May 30, 2014.
- Letter from the Seashore, to Shinnecock Indian Nation, regarding Intent to Use 2008 Nationwide Programmatic Agreement to Meet Section 106 Obligations, dated May 30, 2014.

United States Department of the Interior
NATIONAL PARK SERVICE

FIRE ISLAND NATIONAL SEASHORE
120 Laurel Street
Patchogue, New York 11772
(631) 687-4750

IN REPLY REFER TO:

L-7615 (Deer/Vegetation Management Plan DEIS)

July 7, 2011

Mr. Peter Scully
New York State Department of Environmental Conservation
Region 1 Office
SUNY at Stony Brook
50 Circle Road
Stony Brook, New York 11790

Dear Mr. Scully:

The National Park Service (NPS), in accordance with the National Environmental Policy Act, is currently preparing a White-tailed Deer and Vegetation Management Plan and Environmental Impact Statement (plan/EIS) at Fire Island National Seashore (FIIS). The purpose of the plan/EIS is to develop and analyze a range of alternatives for managing deer to reduce their impacts on native vegetation, forest regeneration, cultural landscapes (William Floyd Estate), and human-deer encounters at the FIIS.

We welcome your input on any aspect of the project. However, we specifically seek information about the presence of New York State listed threatened and endangered species in the vicinity of the park units. Your input will help ensure that the environmental impacts of the proposal are properly considered.

If you have any questions or require any further information, please contact Lindsay Ries, Wildlife Biologist, Fire Island National Seashore at 631-687-4768; or Michael Bilecki, Chief of Resource Management at 631-687-4760. Thank you for your assistance.

Sincerely,

Jon Digby / acting Superintendent

K. Christopher Soller
Superintendent

cc: Ann Van Huizen, DSC-PDS

United States Department of the Interior
NATIONAL PARK SERVICE

FIRE ISLAND NATIONAL SEASHORE
120 Laurel Street
Patchogue, New York 11772
(631) 687-4750

IN REPLY REFER TO:

L-7615 (Deer/Vegetation Management Plan DEIS)

July 7, 2011

Mr. David Stillwell
U.S. Fish & Wildlife Service
New York Field Office
3817 Luker Road
Cortland, New York 13045

Dear Mr. Stillwell:

The National Park Service (NPS), in accordance with the National Environmental Policy Act, is currently preparing a White-tailed Deer and Vegetation Management Plan and Environmental Impact Statement (plan/EIS) at Fire Island National Seashore (FIIS). The purpose of the plan/EIS is to develop and analyze a range of alternatives for managing deer to reduce their impacts on native vegetation, forest regeneration, cultural landscapes (William Floyd Estate), and human-deer encounters at the FIIS.

We welcome your input on any aspect of the project. However, we specifically seek information about the presence of federally listed threatened and endangered species in the vicinity of the park units. Your input will help ensure that the environmental impacts of the proposal are properly considered.

If you have any questions or require any further information, please contact Lindsay Ries, Wildlife Biologist, Fire Island National Seashore at 631-687-4768; or Michael Bilecki, Chief of Resource Management at 631-687-4760. Thank you for your assistance.

Sincerely,

Jan Dupsky /acting superintendent

K. Christopher Soller
Superintendent

cc: Ann Van Huizen, DSC-PDS

United States Department of the Interior
NATIONAL PARK SERVICE

FIRE ISLAND NATIONAL SEASHORE
120 Laurel Street
Patchogue, New York 11772
(631) 687-4750

IN REPLY REFER TO:

L-7615 (Deer/Vegetation Management Plan DEIS)

July 13, 2011

Ms. Ruth Pierpont
Director, Division for Historic Preservation
New York State Historic Preservation Office
Peebles Island Resource Center
P.O. Box 189
Waterford, New York 12188-0189

Dear Ms. Pierpont:

The National Park Service (NPS), in accordance with the National Environmental Policy Act, is currently preparing a White-tailed Deer and Vegetation Management Plan and Environmental Impact Statement (plan/EIS) at Fire Island National Seashore (FIIS). The purpose of the plan/EIS is to develop and analyze a range of strategies for managing deer to reduce their impacts on native vegetation, forest regeneration, cultural landscapes (William Floyd Estate), and human-deer encounters at the FIIS.

The NPS believes that the actions described in the plan/EIS may have the potential to affect properties that are listed or may be eligible for inclusion in the National Register of Historic Places. Therefore, in accordance with the Advisory Council on Historic Preservation regulations, 36 CFR Part 800, the NPS is initiating consultation with your office. The NPS plans to use the environmental impact statement process to accomplish compliance with both Section 106, in accordance with the National Historic Preservation Act, and NEPA.

If you have any questions or require any further information, please contact Christopher Olijnyk, Cultural Resource Manager, Fire Island National Seashore at 631-395-9693; or Michael Bilecki, Chief of Resource Management, at 631-687-4760. Thank you for your assistance.

Sincerely,

K. Christopher Soller
Superintendent

cc: Ann Van Huizen, DSC-PDS

United States Department of the Interior
NATIONAL PARK SERVICE

FIRE ISLAND NATIONAL SEASHORE
120 Laurel Street
Patchogue, New York 11772
(631) 687-4750

IN REPLY REFER TO:

L-7615 (Deer/Vegetation Management Plan DEIS)

July 13, 2011

Matthew Carroll, Chief
Unkechaug Indian Nation
P.O. Box 86
Mastic, New York 11950

Dear Mr. Carroll:

The National Park Service (NPS), in accordance with the National Environmental Policy Act, is currently preparing a White-tailed Deer and Vegetation Management Plan and Environmental Impact Statement (plan/EIS) at Fire Island National Seashore (FIIS). The purpose of the plan/EIS is to develop and analyze a range of strategies for managing deer to reduce their impacts on native vegetation, forest regeneration, cultural landscapes (William Floyd Estate), and human-deer encounters at the FIIS.

The NPS believes that the actions described in the plan/EIS may have the potential to affect properties that are listed or may be eligible for inclusion in the National Register of Historic Places. Therefore, in accordance with the Advisory Council on Historic Preservation regulations, 36 CFR Part 800, the NPS is initiating consultation with your office. The NPS plans to use the environmental impact statement process to accomplish compliance with both Section 106, in accordance with the National Historic Preservation Act, and NEPA.

If you have any questions or require any further information, please contact Christopher Olijnyk, Cultural Resource Manager, Fire Island National Seashore at 631-395-9693; or Michael Bilecki, Chief of Resource Management, at 631-687-4760. Thank you for your assistance.

Sincerely,

K. Christopher Soller
Superintendent

cc: Ann Van Huizen, DSC-PDS

United States Department of the Interior
NATIONAL PARK SERVICE

FIRE ISLAND NATIONAL SEASHORE
120 Laurel Street
Patchogue, New York 11772
(631) 687-4750

IN REPLY REFER TO:

L-7615 (Deer/Vegetation Management Plan DEIS)

July 13, 2011

Randy King
Trustee Chairman
Shinnecock Indian Nation
P.O. Box 5006
Southampton, New York 11969

Dear Mr. King:

The National Park Service (NPS), in accordance with the National Environmental Policy Act, is currently preparing a White-tailed Deer and Vegetation Management Plan and Environmental Impact Statement (plan/EIS) at Fire Island National Seashore (FIIS). The purpose of the plan/EIS is to develop and analyze a range of strategies for managing deer to reduce their impacts on native vegetation, forest regeneration, cultural landscapes (William Floyd Estate), and human-deer encounters at the FIIS.

The NPS believes that the actions described in the plan/EIS may have the potential to affect properties that are listed or may be eligible for inclusion in the National Register of Historic Places. Therefore, in accordance with the Advisory Council on Historic Preservation regulations, 36 CFR Part 800, the NPS is initiating consultation with your office. The NPS plans to use the environmental impact statement process to accomplish compliance with both Section 106, in accordance with the National Historic Preservation Act, and NEPA.

If you have any questions or require any further information, please contact Christopher Olijnyk, Cultural Resource Manager, Fire Island National Seashore at 631-395-9693; or Michael Bilecki, Chief of Resource Management, at 631-687-4760. Thank you for your assistance.

Sincerely,

K. Christopher Soller
Superintendent

cc: Ann Van Huizen, DSC-PDS

United States Department of the Interior
NATIONAL PARK SERVICE

FIRE ISLAND NATIONAL SEASHORE
120 Laurel Street
Patchogue, New York 11772
(631) 687-4750

IN REPLY REFER TO:

L-7615 (Deer/Vegetation Management Plan DEIS)

July 14, 2011

D. J. Evans
NYSDEC – DFWMR
Director, NY Natural Heritage Program
625 Broadway, 5th Floor
Albany, New York 12233-4757

Dear Ms. Evans:

The National Park Service (NPS), in accordance with the National Environmental Policy Act, is currently preparing a White-tailed Deer and Vegetation Management Plan and Environmental Impact Statement (plan/EIS) at Fire Island National Seashore (FIIS). The purpose of the plan/EIS is to develop and analyze a range of alternatives for managing deer to reduce their impacts on native vegetation, forest regeneration, cultural landscapes (William Floyd Estate), and human-deer encounters at the FIIS.

This plan will ultimately include actions taken within the boundaries of FIIS in Suffolk County, New York. The boundaries of FIIS extend from the eastern Robert Moses State Park boundary throughout the rest of Fire Island (includes all Fire Island communities, all federal tracts of land, and Smith Point County Park). In addition, the William Floyd Estate is also part of FIIS on Long Island, adjacent to the Village of Mastic Beach. Parts of the Towns of Islip and Brookhaven lie within the boundary of FIIS. Please see the attached USGS topographic maps.

We welcome your input on any aspect of the project. However, we specifically seek information about the presence of New York State listed threatened and endangered species in the vicinity of the park units. Your input will help ensure that the environmental impacts of the proposal are properly considered.

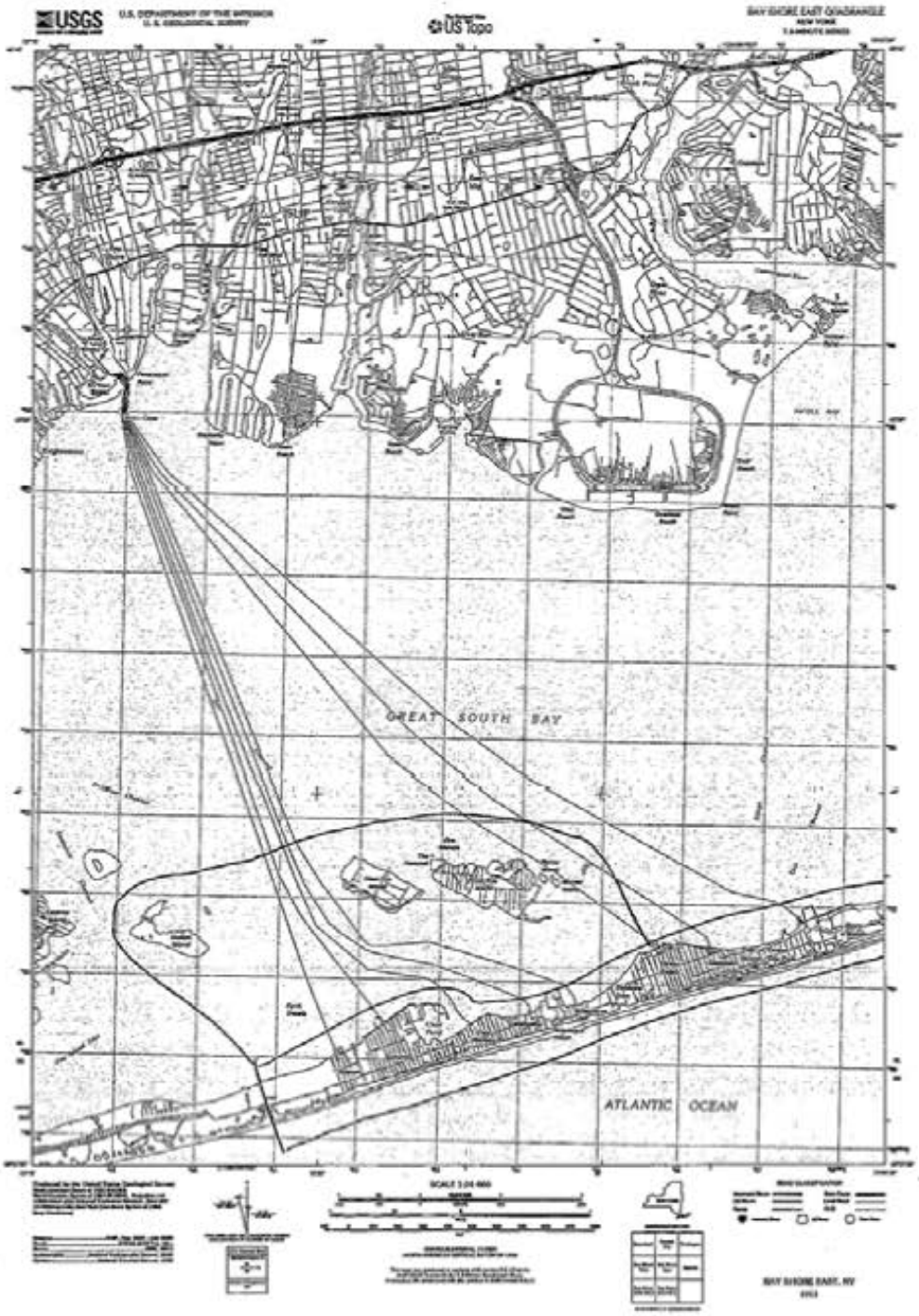
If you have any questions or require any further information, please contact Lindsay Ries, Wildlife Biologist, Fire Island National Seashore at 631-687-4768; or Michael Bilecki, Chief of Resource Management at 631-687-4760. Thank you for your assistance.

Sincerely,

K. Christopher Soller
Superintendent

Enclosures (5)

cc: Ann Van Huizen, DSC-PDS
Michelle Gibbons, NYSDEC - LI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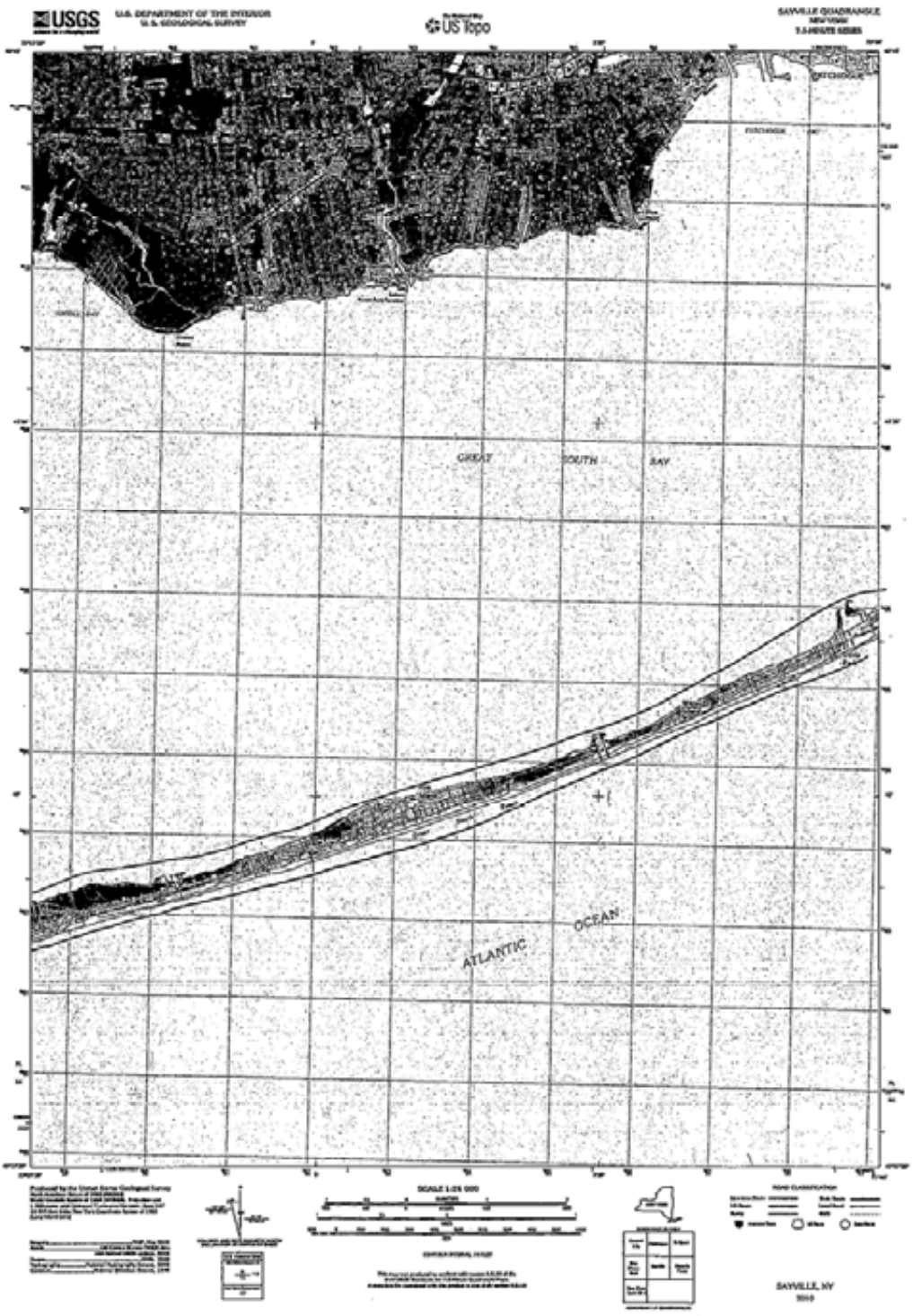
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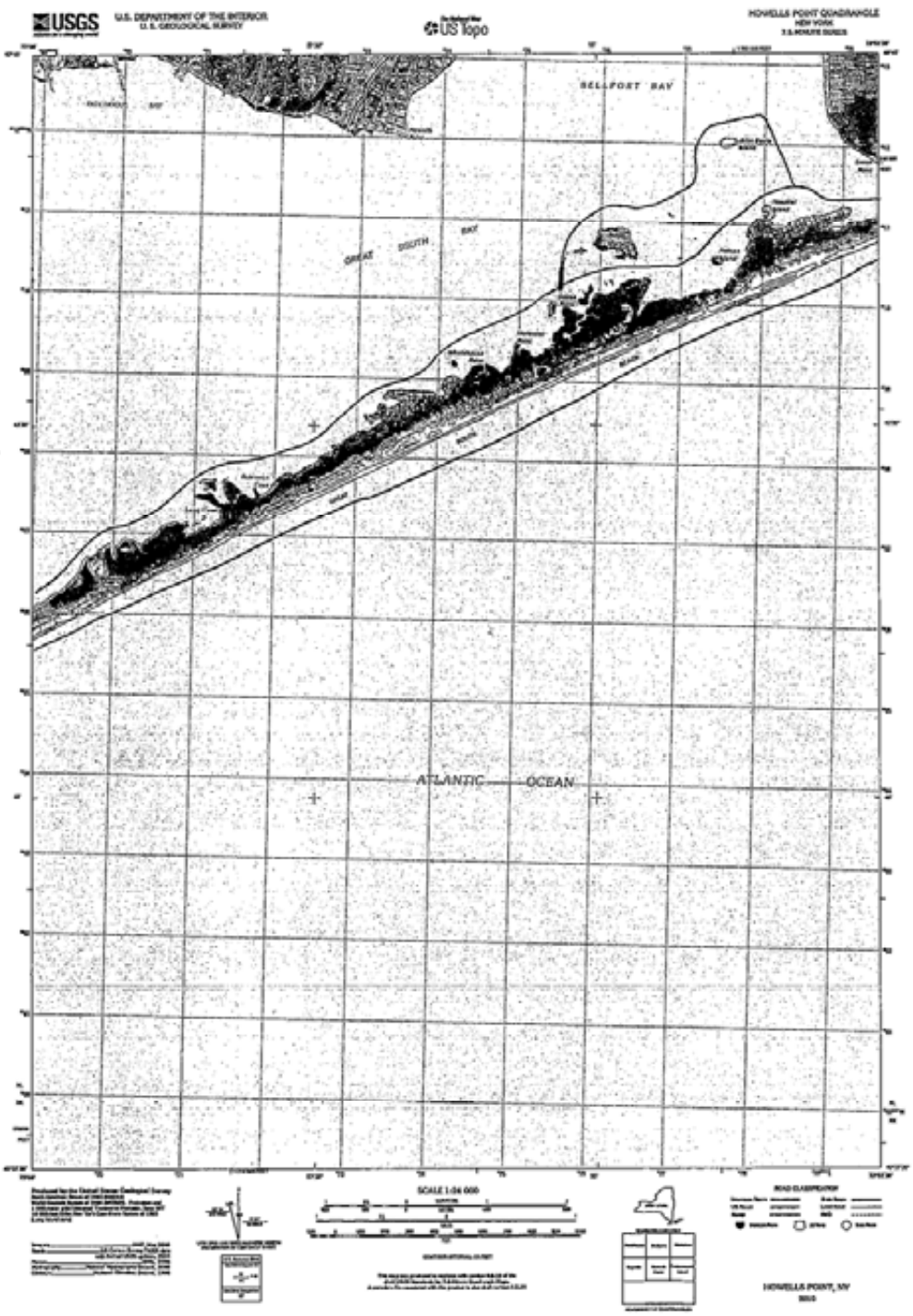
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HOWELLS POINT, NY
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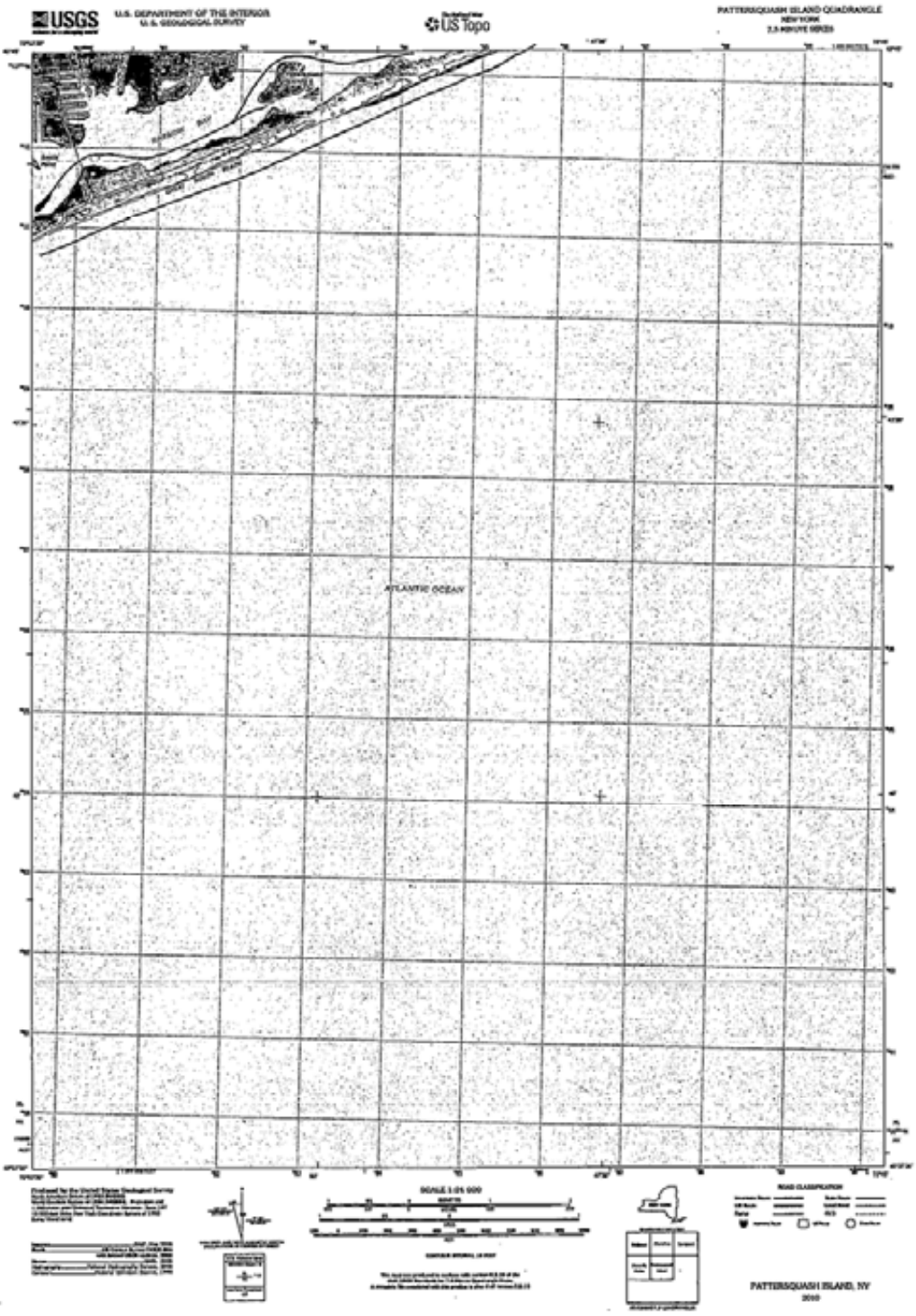
USGS
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
US Topo
PATTERSQUASH ISLAND QUADRANGLE
NEW YORK
7.5-MINUTE SERIES
ATLANTIC OCEAN
PATTERSQUASH ISLAND, NY
2010

USGS
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
US topo
MORICHES QUADRANGLE
MORICHES BAY
ATLANTIC OCEAN
SCALE 1:24 000
MORICHES, NY

New York State Department of Environmental Conservation
Division of Fish, Wildlife and Marine Resources
Bureau of Wildlife, Region 1 Headquarters
50 Circle Road, Stony Brook, NY 11790-3409
Phone: (631) 444-0310 • **Fax:** (631) 444-0272
Website: www.dec.ny.gov

Joe Martens
Commissioner

RECEIVED
JUL 27 2011
FIRE ISLAND NATIONAL SEASHORE
PATCHOGUE, NEW YORK 11772

July 22, 2011

Fire Island National Seashore
Attn: Paula Valentine
Deer/Vegetation Management Plan
120 Laurel Street
Patchogue, NY 11772-3596

Dear Ms. Valentine;

The New York State Department of Environmental Conservation (Department) has reviewed the Public Scoping document for the White-tailed Deer and Vegetation Management Plan for Fire Island National Seashore (FINS) and would like to provide the following comments.

First, we appreciate the opportunity to be involved with development of a deer management plan for FINS. As directed by 43 CFR Part 24 (Department of the Interior Fish and Wildlife Policy: State and Federal Relationships), the National Park Service is required to cooperate with the respective State wildlife agency when preparing plans for resource management and public activities on Federal lands. Interior agencies are further directed to consult with States and comply with State permit requirements for the planned and orderly removal of surplus or harmful populations of fish and wildlife. In accordance with these mandates, we look forward to working with your staff to help develop an effective deer management plan for FINS that serves our mutual interests.

The scoping document lists several potential strategies related to managing white-tailed deer browsing, including deer population management. Population management options listed in the scoping document include fertility control, direct reduction, capture/euthanize, capture/relocate and public hunting. Most of these management activities would require a special license or permit from the Department. Therefore, we would like to work with FINS to make certain that the chosen management option considers the requirements, conditions and criteria for license or permit issuance to ensure compliance with State laws and regulations. In evaluating these alternatives, we urge you to review the Department's draft deer management plan, available at http://www.dec.ny.gov/animals/7211.html#DeerPlan/, for information, guidance and policy considerations applicable to each.

Public deer hunting should be given serious consideration as the preferred management alternative. The legislation which established FINS specifically authorized the National Park Service to allow hunting. Public deer hunting is the most cost-effective method of deer control on Park Service properties. We would welcome the opportunity to help develop a practical and effective deer hunting program at FINS.

The Department looks forward to providing additional input as a full partner in development of the draft White-tailed Deer and Vegetation Management Plan, and we hope we can work in

cooperation with your office to ensure that the plan is effective for protecting the natural resources at Fire Island, consistent with State laws, regulations, and policies.

Please feel free to contact the Region 1 Wildlife Office at (631) 444-0310 if you have any questions, or wish to initiate consultations with the Department for help in developing the draft deer management plan for FINS.

Sincerely,

Michelle Gibbons
Regional Wildlife Manager

cc: Peter A. Scully, NYS DEC, via e-mail
Gordon Batcheller, NYS DEC, via e-mail

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Division of Fish, Wildlife & Marine Resources
Habitat Inventory Unit
625 Broadway, 5th Floor, Albany, New York 12233-4757
Phone: (518) 402-8935 • **Fax:** (518) 402-8925
Website: www.dec.ny.gov

Joe Martens
Commissioner

March 5, 2012

Lindsay Ries
Fire Island National Seashore
120 Laurel Street
Patchogue, NY 11772

Dear Ms. Ries:

In response to your recent request, we have reviewed the New York Natural Heritage Program database with respect to an Environmental Assessment of the Fire Island National Seashore as indicated in the email you provided, located along the Great South Bay and the Atlantic Ocean.

Enclosed is a report of rare or state-listed animals and plants, significant natural communities, and other significant habitats, which our databases indicate occur, or may occur, on your site or in the immediate vicinity of your site. For most sites, comprehensive field surveys have not been conducted; the enclosed report only includes records from our databases. We cannot provide a definitive statement as to the presence or absence of all rare or state-listed species or natural communities. This information should not be substituted for on-site surveys that may be required for environmental impact assessment.

The enclosed report may be included in documents that will be available to the public. However, any enclosed maps displaying locations of rare species are considered sensitive information, and are intended only for the internal use of the recipient; they should not be included in any document that will be made available to the public, without permission from the New York Natural Heritage Program.

The presence of the plants and animals identified in the enclosed report may result in this project requiring additional review or permit conditions. For further guidance, and for information regarding other permits that may be required under state law for regulated areas or activities (e.g. regulated wetlands), please contact the appropriate NYS DEC Regional Office, Division of Environmental Permits, as listed at www.dec.ny.gov/about/39381.html.

This project location is adjacent to a designated Significant Coastal Fish and Wildlife Habitat. This habitat is part of New York State's Coastal Management Program (CMP), which is administered by the NYS Department of State (DOS). Projects which may impact the habitat are reviewed by DOS for consistency with the CMP. For more information regarding this designated habitat and applicable consistency review requirements, please contact:

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Jeff Zappieri - (518) 474-6000
NYS Department of State
Office Coastal, Local Government and Community Sustainability
1 Commerce Plaza, 99 Washington Avenue,
Albany, NY 12231

Our databases are continually growing as records are added and updated. If this proposed project is still under development one year from now, we recommend that you contact us again so that we may update this response with the most current information.

Sincerely,

Katherine F. Barnes, GISP
Cartographic technician 3
Habitat Inventory Unit

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Natural Heritage Report on Rare Species and Ecological [illegible]

NYS Dept. of Environmental Conservation and
Natural Heritage Program

625 Broadway
Albany, NY 12233-4754
518-402-8964

~The information in this report includes only records entered into the NY Natural Heritage databases as of the date of the report. This report is not a definitive statement on the presence or absence of all rare species or significant natural communities at or in the vicinity of this site.

~Refer to the User's Guide for explanations of codes, ranks and fields.

~Location maps for certain species and communities may not be provided 1) if the species is vulnerable to disturbance, 2) if the location and/or extent is not precisely known, 3) if the location and/or extent is too large to display, and/or 4) if the animal is listed as Endangered or Threatened by New York State.

BIRDS

Ammodramus maritimus — Office Use: 5863

Seaside Sparrow

Breeding

NYS Legal Status	Special Concern	**NYS Rank**	S2S3 — Imperiled
Federal Listing		**Global Rank**	G4 — Apparently secure
Last Report	2001-06-10	**EO Rank**	E
County	Suffolk		
Town	Babylon, Islip		
Location	Captree Island		
Directions	The birds were observed at Captree Island, along the Robert Moses Causeway south of West Islip. The birds were recorded to the east of the Causeway during 2001 but the exact location for the 1980 data is not available		

Comments This occurrence is based on records from the New York State Breeding Bird Atlas Project and the information available is not sufficient to assign a rank. The area of suitable marsh habitat is large however, and this area may well support a very good population.

General Quality and Habitat Salt marsh

Ammodramus maritimus — Office Use: 11174

Seaside Sparrow

Breeding

NYS Legal Status	Special Concern	**NYS Rank**	S2S3 — Imperiled
Federal Listing		**Global Rank**	G4 — Apparently secure
Last Report	2001-su	**EO Rank**	E
County	Suffolk		
Town	Brookhaven		
Location	Forge Point Marsh		
Directions	From Mastic Beach, go east on Neighborhood Road to the end of the road. Turn left and then take the first right into the entrance of the William Floyd Estate (Forge Point). Seaside sparrows were found in two areas of the marsh within the estate. To visit		

Natural Heritage Program Species and Ecological Communities

Comments

General Quality and Habitat The birds have been observed in two areas of a salt marsh located at the northern shore of a bay. The marsh is tidal in nature and contains drainage ditches. Some ditches are active and some are blocked with dams. Taller scrub areas border some of the di

tches. Along the mouth of a creek, the vegetation is thick and composed of marsh grass and a mixture of coniferous and deciduous trees.

Ammodramus maritimus — Office Use 11175

Seaside Sparrow

Breeding

NYS Legal Status	Special Concern	**NYS Rank**	S2S3 — Impaired
Federal Listing		**Global Rank**	G4 — Apparently secure
Last Report	2000-06-26	**EO Rank**	E
County	Suffolk		
Town	Brookhaven		
Location	Fire Island and New Made Island		
Directions	Birds were found on New Made Island and at two places on Fire Island to the southeast. The area is in Moriches Bay, east of Forge Point. Access is by boat.		

Comments

General Quality and Habitat The breeding area is composed of a dredge spoil island with a sand-gravel substrate and 70% plant cover, and two areas of a salt marsh on a peninsula of a nearby larger barrier island. Calidris alba and Arenaria interpres were observed loafing

Ammodramus maritimus — Office Use 11177

Seaside Sparrow

Breeding

NYS Legal Status	Special Concern	**NYS Rank**	S2S3 — Impaired
Federal Listing		**Global Rank**	G4 — Apparently secure
Last Report	2002-07-05	**EO Rank**	E
County	Suffolk		
Town	Brookhaven		
Location	Fire Island and Ridge Island		
Directions	From Mastic Beach, go south on Route 46 across the Smith Point Bridge to Fire Island. Go west along the jeep trail for about 2.1 miles. The birds were found in the marshes north of the trail, at Goose Point, and Whalehouse Point farther to the west. Bird		

Comments

General Quality and Habitat The birds were observed at Spartina marshes on a barrier island and on an island in a bay. The marshes are covered by the highest tides.

Charadrius melodus — Office Use 2496

Piping Plover	**NYS Legal Status**	Endangered	**NYS Rank**	S3B	Vulnerable
	Federal Listing	Endangered/Threatened	**Global Rank**	G3	Rare
Breeding	**Last Report**	2005-sp	**EO Rank**	C	
	County	Suffolk			
	Town	Brookhaven			
	Location	Fire Island Sunken Forest			
	Directions	The plovers are at Fire Island Sunken Forest west of Cherry Grove. Access is by boat or 4-wheel drive vehicle. Drive down the beach to the vehicle-free area, park, and walk to the nesting area.			

Comments The rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of one pair per year over the last three years surveyed. Disturbances include illegal ORV use, recreation, pets boats, and predation by feral cats, crows, fox, gulls, raccoons and snakes. Some Cherry Grove residents are against the protection of the birds. Sailors Haven contains a visitors center and marina along with a concession stand that is heavily visited. A dense residential neigh

General Quality and Habitat The plovers were observed on a sandy maritime beach on a barrier island. The surrounding area is maritime forest with boardwalks wandering through it. There is stabilized dune vegetation in some sections. Phragmites is along the bay shore.

Charadrius melodus Office Use 8716

Piping Plover	**NYS Legal Status**	Endangered	**NYS Rank**	S3B	Vulnerable
	Federal Listing	Endangered/Threatened	**Global Rank**	G3	Rare
Breeding	**Last Report**	2008-06-16	**EO Rank**	A	
	County	Suffolk			
	Town	Brookhaven			
	Location	Westhampton Island West			
	Directions	The plovers were observed at Cupsoque County Park on the western edge of Westhampton Island, east of Moriches Inlet. The nests are along the beach. For access to the site, take Dune Road west to the end and park in the parking lot			

Comments The rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of six pairs per year over the last three years surveyed. Disturbances include ORVs, boaters, campers and dogs, fishermen entering protected areas, flooding, erosion, and predation by crows, gulls, feral cats, fox, and raccoons. Moriches Inlet and Fire Island is to the west. The Atlantic Ocean is to the south. Non-barrier islands are to the north.

General Quality and Habitat The plovers were observed at a barrier island maritime beach and dredge spoil with a gravel substrate. There is sparse to moderately dense vegetation that includes Ammophila breviligulata, Cakile edentula and Solidago sempivirens. The habitat is narrow and eroding with steep dunes that are progressively getting wider

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Charadrius melodus Office Use 8201

Piping Plover	**NYS Legal Status**	Endangered	**NYS Rank**	S3B	Vulnerable
	Federal Listing	Endangered/Threatened	**Global Rank**	G3	Rare
Breeding	**Last Report**	2008-06-09	**EO Rank**	B	
	County	Suffolk			
	Town	Islip			
	Location	Fire Island Lighthouse			

Directions Take Robert Moses Parkway south to Fire Island. Turn east at the traffic circle. Park at Field 5 in Robert Moses State Park. The birds nest along the beach and partway into the dunes from 800 meters west of Field 4 east to Field 5. Birds are also nesting

Comments The rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of four pairs per year over the last three years surveyed. Disturbances include beach goers, official vehicle use, beach raking and removal of wrack, boats, development, and predation by crows, fox, feral cats, raccoons, dogs, snakes, gulls, and possibly peregrine falcons. Flooding occasionally occurs and washes away the nests. Two parking lots are adjacent to the nesting area.

General Quality and Habitat The plovers were observed on a barrier island with maritime beaches and dunes. The dunes are steep and vegetated with Ammophila breviligulata. The beach width is variable and quite dynamic. The beach is used as a bathing beach. Two parking lots are adjacent to the nesting area.

Charadrius melodus — Office Use 1224

Piping Plover

Breeding

NYS Legal Status	Endangered	**NYS Rank**	S3B	Vulnerable
Federal Listing	Endangered/Threatened	**Global Rank**	G3	Rare
Last Report	2008-06-09	**EO Rank**	A	
County	Suffolk			
Town	Brookhaven			
Location	Fire Island East			
Directions	The birds nest along the Great South Beach on Fire Island National Seashore. From the Long Island Expressway, take exit 68 South (William Floyd Parkway). Take the William Floyd Parkway to the end. The birds nest along the beach east of the parking lot to			

Comments The rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of 17 pairs per year over the last three years surveyed. The birds are disturbed by recreational use, pedestrians, vehicles, boats, and flooding. Some beach goers ignore the posted signs that state dogs need to be leashed at all times. Beach goers also enter protected areas. Many campers pull right up to the string fence. Extremely heavy ORV use limits the nesting area. Moderate ORV use

General Quality and Habitat The birds were observed at a sandy maritime beach on a barrier island that is sparsely vegetated with Cakile edentula and Artemisia stelleriana at the base of the dunes vegetated with Ammophila. The beach is wide and narrows in some areas. New habitat was created in 1994 on the area that was overwashed in 1992 and 1993.

Charadrius melodus — Office Use 9303

Piping Plover

Breeding

NYS Legal Status	Endangered	**NYS Rank**	S3B	Vulnerable
Federal Listing	Endangered/Threatened	**Global Rank**	G3	Rare
Last Report	1993-06-20	**EO Rank**	F	
County	Suffolk			
Town	Brookhaven			
Location	Fire Island Wilderness Watch Hill			
Directions	The plovers were observed at Fire Island Wilderness, Watch Hill on Fire Island National Seashore. Access is by ferry from Patchogue. The plovers nest north of and adjacent to the marina.			

Comments The plovers have not been reported active at this site since 1993.

General Quality and Habitat The plovers were observed on dredge spoil on the bay side of a barrier beach island. The substrate is sandy with grass cover around the site. It is open in the center. The dredge spoil is colonized by

Ammophila breviligulata and weedy annuals.

Charadrius melodus — Office Use 9514

Piping Plover	**NYS Legal Status**	Endangered	**NYS Rank**	S3B	Vulnerable
	Federal Listing	Endangered/Threatened	**Global Rank**	G3	Rare
Breeding	**Last Report**	2008-06-03	**EO Rank**	CD	
	County	Suffolk			
	Town	Brookhaven, Islip			
	Location	Fire Island Villages			
	Directions	The plovers were observed at Atlantique Beach and Point of Woods on the ocean side of Fire Island National Seashore.			

Comments The rank is based on the draft state element occurrence rank specifications of February 15, 2001. One pair was observed over the last year surveyed. The last time this site was surveyed prior to 2008 was 2004, so one year's worth of data was used to assess the rank. The beach is prone to many disturbances and is heavily developed with beach houses.

General Quality and Habitat The plovers were observed at a maritime beach on a barrier island. The beach is about 150 feet wide and eroded. The beach is within a series of beach communities and is heavily developed with beach houses over or in place of the primary dune.

Charadrius melodus — Office Use 7258

Piping Plover	**NYS Legal Status**	Endangered	**NYS Rank**	S3B	Vulnerable
	Federal Listing	Endangered/Threatened	**Global Rank**	G3	Rare
Breeding	**Last Report**	2007-sp	**EO Rank**	D	
	County	Suffolk			
	Town	Brookhaven			
	Location	Fire Island Pines			
	Directions	The plovers nest at Cherry Grove and a 0.8 mile stretch of beach located about 0.5 miles west of Davis Park on the ocean side of Fire Island National Seashore.			

Comments The rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of less than one pair per year over the last three years surveyed. This site was not surveyed in 2006. Disturbances include boats, development, flooding, pedestrians, dogs, vehicles, dredging, and predation by crows, gulls, fox and many feral cats. A 400-home community uses this area as their primary recreation beach. The Atlantic Ocean is to the south.

General Quality and Habitat The plovers were observed on a sandy maritime beach on a barrier island. There is little vegetation cover. The Water Island area is wide enough to support nesting. The area in general is heavily developed. Beach nourishment occurred in 1998.

Charadrius melodus — Office Use 4472

Piping Plover	**NYS Legal Status**	Endangered	**NYS Rank**	S3B	Vulnerable
	Federal Listing	Endangered/Threatened	**Global Rank**	G3	Rare
Breeding	**Last Report**	2008-sp	**EO Rank**	A	

County	Suffolk
Town	Brookhaven
Location	Fire Island Wilderness
Directions	The plovers were observed along the ocean side of the Fire Island Wilderness, Fire Island National Seashore. The nesting area covers a stretch of beach starting approximately 1 mile east of Davis Town Park to approximately 0.5 miles west of Smith Point C

Comments The rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of 14 pairs per year over the last three years surveyed. Disturbances include a high red fox population, human recreation including beach combing and boating, ORVs (so far used only by the US National Park Service and Suffolk County Park police), deer, and predation by snakes, gulls, crows, feral cats, raccoons and house dogs. A small residential community is to the west. The Atlantic O

General Quality and Habitat The plovers were observed at a sandy maritime beach on a barrier island backed by an extensive maritime dune system. The vegetation is mostly Ammophila spp

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Circus cyaneus — Office Use 12686

Northern Harrier

Breeding

NYS Legal Status	Threatened	NYS Rank	S3B,S3N — Vulnerable
Federal Listing		Global Rank	G5 — Demonstrably secure
Last Report	2000-06-28	EO Rank	E
County	Suffolk		
Town	Brookhaven		
Location	Fire Island East		
Directions	Fire Island is off the southern coast of Long Island. To access the eastern part of the island, follow Suffolk Boulevard south from Brookhaven across the Smith Point Bridge.		

Comments

General Quality and Habitat The birds were seen over a dune located on a large costal island. The area was covered with thick under growth vegetation.

Egretta caerulea — Office Use 439

Little Blue Heron

Breeding

NYS Legal Status	Protected Bird	NYS Rank	S2 — Imperiled
Federal Listing		Global Rank	G5 — Demonstrably secure
Last Report	2007-05-30	EO Rank	D
County	Suffolk		
Town	Brookhaven		
Location	West Inlet Island		
Directions	The birds were observed at West Inlet Island which is in Moriches Bay just north of Moriches Inlet. Access is by boat launched at the Maple Avenue Dock which is off of Atlantic Avenue in East Moriches.		

Comments The rank is based on the element global ranking form of April 21, 1988. There was an average of two pairs per year over the last three years surveyed. The birds are surveyed every third year. The birds are disturbed by boats and flooding. Predators inclu

de gulls and crows. Fire Island and Westhampton Island are to the south and the Long Island mainland is to the north.

General Quality and Habitat The birds were observed on a non-barrier island consisting of dredge spoil and sparse to dense beach grass. There is a salt marsh in the north center of the island. A large gull colony is nearby

Egretta thula Office Use 3442

Snowy Egret	**NYS Legal Status**	Protected Bird	**NYS Rank**	S2S3	Imperiled
	Federal Listing		**Global Rank**	G5	Demonstrably secure
Breeding	**Last Report**	1985-05-21	**EO Rank**	F	
	County	Suffolk			
	Town	Islip			
	Location	Sexton Island			
	Directions	Sexton Island is in the Great South Bay, about 0.4 miles east of Captree Island and about 1.1 miles north of Fire Island. The birds nested on the east side of the island.			

Comments The rank is based on the draft element global ranking form of April 21, 1988. The birds are surveyed every third year. Birds have not been seen nesting here since 1986. There is predation by gulls, crows, feral cats, snakes, fox, and rats. Disturbances include boats, development, flooding, and pedestrians. Fire Island National Seashore is to the south. Other salt marsh non-barrier islands are to the west.

General Quality and Habitat Sexton Island is a salt marsh and maritime beach on a non-barrier island. There are few trees probably evergreen, and a dense shrubby interior. Birds nest in trees and shrubs.

Egretta thula Office Use 6792

Snowy Egret	**NYS Legal Status**	Protected Bird	**NYS Rank**	S2S3	Imperiled
	Federal Listing		**Global Rank**	G5	Demonstrably secure
Breeding	**Last Report**	2007-05-30	**EO Rank**	C	
	County	Suffolk			
	Town	Brookhaven			
	Location	West Inlet Island			
	Directions	The birds were observed at West Inlet Island which is in Moriches Bay just north of Moriches Inlet. Access is by boat launched at the Maple Avenue Dock which is off of Atlantic Avenue in East Moriches			

Comments The rank is based on the draft element global ranking form of April 21, 1988. There was an average of 24 pairs per year over the last three years surveyed. The birds are surveyed every third year. The birds are disturbed by boats and flooding. Predators include gulls and crows. Fire Island and Westhampton Island are to the south and the Long Island mainland is to the north

General Quality and Habitat The birds were observed on a non-barrier island consisting of dredge spoil and sparse to dense beach grass. There is a salt marsh in the north center of the island. A large gull colony is nearby

Egretta thula Office Use 12161

Snowy Egret	**NYS Legal Status**	Protected Bird	**NYS Rank**	S2S3	Imperiled

Breeding	**Federal Listing**		**Global Rank**	G5	Demonstrably secure
	Last Report	2001-06-01	**EO Rank**	C	
	County	Suffolk			
	Town	Islip			
	Location	Islip Spoil Island			
	Directions	Islip Spoil Island is approximately 0.2 miles northeast from the western most point of Captree Island, and approximately 0.5 miles north of Sexton Island. It is accessible only by boat. The birds nest in the southeast corner of the island.			

Comments The rank is based on the draft element global ranking form of April 21, 1988. This site has been active for one year, therefore, the rank is based on a single survey instead of a three-year average. Twenty pairs were observed. The birds are surveyed ever

y third year. Disturbances include recreation and predation by gulls and crows. Captree Island is to the west and Sexton Island is to the southeast.

General Quality and Habitat Islip Spoil Island is a saltwater, non-barrier island with spoil and fill area habitat types

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Egretta thula Office Use 7557

Snowy Egret	**NYS Legal Status**	Protected Bird	**NYS Rank**	S2S3	Imperiled
	Federal Listing		**Global Rank**	G5	Demonstrably secure
Breeding	**Last Report**	1998-06-05	**EO Rank**	D	
	County	Suffolk			
	Town	Brookhaven			
	Location	Fire Island Wilderness Watch Hill			
	Directions	The egrets were observed at Fire Island Wilderness, Watch Hill on Fire Island National Seashore. Access is by ferry from Patchogue. The birds are east of the Watch Hill Marina			

Comments The rank is based on the element global ranking form of April 21, 1988. One pair was observed over the course of two survey years. The birds are surveyed every third year. This site has not been surveyed since 2001.

General Quality and Habitat The egrets were observed on dredge spoil on the bay side of a barrier island with a sandy substrate with grass that is open in the center. The dredge spoil is colonized by Ammophila breviligulata and weedy annuals.

Egretta tricolor Office Use 11583

Tricolored Heron	**NYS Legal Status**	Protected Bird	**NYS Rank**	S2	Imperiled
	Federal Listing		**Global Rank**	G5	Demonstrably secure
Breeding	**Last Report**	2004-05-27	**EO Rank**	D	
	County	Suffolk			
	Town	Brookhaven			
	Location	West Inlet Island			
	Directions	The birds were observed at West Inlet Island which is in Moriches Bay just north of Moriches Inlet. Access is by boat launched at the Maple Avenue Dock which is off of Atlantic Avenue in East Moriches.			

Comments The rank is based on the element global ranking form of April 21, 1988. There was an average of one pair per year during the the last two years surveyed. The birds are surveyed every third year. The birds

	are disturbed by boats and flooding. Predators in clude gulls and crows. Fire Island and Westhampton Island are to the south and the Long Island mainland is to the north.
General Quality and Habitat	The birds were observed on a non-barrier island consisting of dredge spoil and sparse to dense beach grass. There is a salt marsh in the north center of the island. A large gull colony is nearby

Leucophaeus atricilla — Office Use 12773

Laughing Gull	**NYS Legal Status**	Protected Bird	**NYS Rank**	S1	Critically imperiled
	Federal Listing		**Global Rank**	G5	Demonstrably secure
Breeding	**Last Report**	2007-07-04	**EO Rank**	D	
	County	Suffolk			
	Town	Islip			
	Location	East Fire Island			
	Directions	The birds were observed on a small island just west of East Fire Island which is part of the Fire Island National Seashore. The island is north of the town of Dunewood. Access is by boat			

Comments	The rank is based on the element global ranking form of April 21, 1988. This site has been active for one year; therefore, the rank is based on a single survey instead of a three-year average. There were six pairs observed during the first year this site has been active. The birds are disturbed by pets, vandalism, flooding, pedestrians, recreation and boats. There is a vessel channel nearby. Predators include gulls and crows. Fire Island National Seashore is to the south, and Great South Bay is to the
General Quality and Habitat	The birds were observed on a salt marsh, non-barrier island. The nesting substrate is sand

Plegadis falcinellus — Office Use 14

Glossy Ibis	**NYS Legal Status**	Protected Bird	**NYS Rank**	S2	Imperiled
	Federal Listing		**Global Rank**	G5	Demonstrably secure
Breeding	**Last Report**	2007-05-30	**EO Rank**	C	
	County	Suffolk			
	Town	Brookhaven			
	Location	West Inlet Island			
	Directions	The birds were observed at West Inlet Island which is in Moriches Bay just north of Moriches Inlet. Access is by boat launched at the Maple Avenue Dock which is off of Atlantic Avenue in East Moriches			

Comments	The rank is based on the element global ranking form of April 21, 1988. There was an average of 35 pairs per year over the last three years surveyed. The birds are surveyed every third year. The birds are disturbed by boats and flooding. Predators includ e gulls and crows. Fire Island and Westhampton Island are to the south and the Long Island mainland is to the north.
General Quality and Habitat	The birds were observed on a non-barrier island consisting of dredge spoil and sparse to dense beach grass. There is a salt marsh in the north center of the island. A large gull colony is nearby

Rynchops niger — Office Use 5228

Black Skimmer	**NYS Legal Status**	Special Concern	**NYS Rank**	S2	Imperiled

Breeding	**Federal Listing**		**Global Rank**	G5	Demonstrably secure
	Last Report	1997-07-18	**EO Rank**	F	
	County	Suffolk			
	Town	Brookhaven			
	Location	Ridge Island			
	Directions	The birds were observed at Ridge Island, north of Fire Island, Great South Beach. Access is by boat.			

Comments The birds have not been reported as active at this site since 1997. This site has not been surveyed since 2001.

General Quality and Habitat The birds were observed on a non-barrier island. The natural community is probably salt marsh.

Rynchops niger Office Use 11584

Black Skimmer	**NYS Legal Status**	Special Concern	**NYS Rank**	S2	Imperiled
	Federal Listing		**Global Rank**	G5	Demonstrably secure
Breeding	**Last Report**	2004-06-30	**EO Rank**	F	
	County	Suffolk			
	Town	Brookhaven			
	Location	Pattersquash Island			
	Directions	The birds were observed at Pattersquash island which is just north of Great South Beach, Fire Island National Seashore. Access is by boated launched at the Mastic Yacht Club located to the north on Long Island.			

Comments The birds have not been active at this site since 2004.

General Quality and Habitat The area is a non-barrier island and probably a salt marsh. The surrounding water is shallow.

Rynchops niger Office Use 237

Black Skimmer	**NYS Legal Status**	Special Concern	**NYS Rank**	S2	Imperiled
	Federal Listing		**Global Rank**	G5	Demonstrably secure
Breeding	**Last Report**	2004-06-15	**EO Rank**	F	
	County	Suffolk			
	Town	Brookhaven			
	Location	Carters Island			
	Directions	The birds were observed at Carters Island in Moriches Bay. Access is by boat.			

Comments The birds have not been active at this site since 2004.

Natural Heritage Program Species and Ecological Communities

General Quality and Habitat The birds were observed on a flooded, salt marsh island with dense vegetation. The c ee is d tched

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Rynchops niger Office Use 11950

Black Skimmer	**NYS Legal Status**	Special Concern	**NYS Rank**	S2	Impe d
	Federal Listing		**Global Rank**	G5	Demonstrably secure
Breeding	**Last Report**	1992-06-26	**EO Rank**	F	
	County	Suffolk			
	Town	Islip			
	Location	East Fire Island			
	Directions	The birds were observed on East Fire Is and, which s part of the Fi e sland Nat onal Seashore. The island is north of the town of Dunewood. Access is by oat.			

Comments The birds have not been observed as active at this site since 1992. This site has not been surveyed since 2001.

General Quality and Habitat The birds were observed on a salt marsh, non-barrier island. The nesting substrat s sand.

Rynchops niger Office Use 1920

Black Skimmer	**NYS Legal Status**	Special Concern	**NYS Rank**	S2	Impe d
	Federal Listing		**Global Rank**	G5	Demonstrably secure
Breeding	**Last Report**	1996-06-26	**EO Rank**	F	
	County	Suffolk			
	Town	Brookhaven			
	Location	John Boyle Island			
	Directions	The birds were observed at John Boyle Island in Great South Bay, to th of Fire Island and about 1.0 mi west of Smith Point. Access is by boat.			

Comments This site has not been active since 1996.

General Quality and Habitat The area is an island in a large bay between a barrier island and the mainland.

Rynchops niger Office Use 8792

Black Skimmer

Breeding

NYS Legal Status	Special Concern	**NYS Rank**	S2 Imperiled
Federal Listing		**Global Rank**	G5 Demonstrably secure
Last Report	2008-06-12	**EO Rank**	D
County	Suffolk		
Town	Islip		
Location	Sexton Island		
Directions	Sexton Island is in the Great South Bay, about 0.4 miles east of Captree Island and about 1.1 miles north of Fire Island. Access is by boat.		

Comments The rank is based on the draft global element occurrence rank specifications of April 2, 1987. There was an average of five pairs per year over the last three years surveyed. This site was not surveyed in 2007. There is predation by gulls, crows, feral cats, snakes, fox, and rats. Disturbances include boats, development, flooding, and pedestrians. Fire Island National Seashore is to the south. Other salt marsh non-barrier islands are to the west.

General Quality and Habitat The birds were observed on a salt marsh and maritime beach on a non-barrier island. There are a few trees and a dense shrubby interior. It is poor habitat for shorebird nesting.

Rynchops niger Office Use 515

Black Skimmer

Breeding

NYS Legal Status	Special Concern	**NYS Rank**	S2 Imperiled
Federal Listing		**Global Rank**	G5 Demonstrably secure
Last Report	1999-06-16	**EO Rank**	F
County	Suffolk		
Town	Brookhaven		
Location	New Made Island		
Directions	The skimmers were observed at New Made island, which is 0.8 miles east of Forge Point, across the Moriches Bay. Access is by boat.		

Comments This site has not been active since 1999.

General Quality and Habitat The area is an old dredge spoil island with a large pit in the center. The vegetation cover is overgrown and encroaching on the nesting habitat. Plant species include Phragmites, milkweed, goldenrod and grasses.

Rynchops niger Office Use 12344

Black Skimmer

Breeding

NYS Legal Status	Special Concern	**NYS Rank**	S2 Imperiled
Federal Listing		**Global Rank**	G5 Demonstrably secure
Last Report	2005-06-21	**EO Rank**	F
County	Suffolk		
Town	Brookhaven		
Location	Westhampton Island West		
Directions	The skimmers were observed at Cupsogue County Park on the western edge of Westhampton Island, east of Moriches Inlet.		

Comments The birds have not been observed as active at this site since 2005.

General Quality and Habitat The birds were observed at a barrier island maritime beach and dredge spoil with a gravel substrate Haematopus palliatus is occasional.

Rynchops niger Office Use 99

Black Skimmer	**NYS Legal Status**	Special Concern	**NYS Rank**	S2	Imperiled
	Federal Listing		**Global Rank**	G5	Demonstrably secure
Breeding	**Last Report**	2005-06-13	**EO Rank**	F	
	County	Suffolk			
	Town	Brookhaven			
	Location	West Inlet Island			
	Directions	The birds were observed at West Inlet Island which is in Moriches Bay just north of Moriches Inlet. Access is by boat launched at the Maple Avenue Dock which is off of Atlantic Avenue in East Moriches. The birds are found in groups around the periphery o			

Comments The birds were last observed as active in 2005.

General Quality and Habitat The birds were observed on a non-barrier island consisting of dredge spoil and soars to dense beach grass. There is a salt marsh in the north center of the island. There is also a heron colony nearby.

Rynchops niger Office Use 12775

Black Skimmer	**NYS Legal Status**	Special Concern	**NYS Rank**	S2	Imperiled
	Federal Listing		**Global Rank**	G5	Demonstrably secure
Breeding	**Last Report**	2007-06-21	**EO Rank**	D	
	County	Suffolk			
	Town	Brookhaven			
	Location	Tuthill Cove Island			
	Directions	From East Moriches, follow Atlantic Avenue south to the marina at Tuthill Cove. Travel south by boat to the island in Tuthill Cove where the birds nest.			

Comments The rank is based on the element global ranking form of April 22, 1987. This site has been active for two years, therefore, the rank is based on two years instead of a three-year average. Six pairs were observed both years this site was surveyed. Current disturbances include flooding and boating near the island. Predators include crows and gulls. The island is in a small bay surrounded by a lightly developed portion of the southern Long Island mainland.

General Quality and Habitat The birds are nesting on a salt marsh island in a cove.

Sterna dougallii Office Use 9049

Roseate Tern

Breeding

NYS Legal Status	Endangered	**NYS Rank**	S1B
Federal Listing	Endangered	**Global Rank**	G4
Last Report	2000-06-20	**EO Rank**	D
County	Suffolk		
Town	Brookhaven		
Location	Ridge Island		
Directions	The birds were observed at Ridge Island, north of Fire Island, Great South Beach. Access is by boat.		

Critically Imperiled

Apparently secure

Comments The rank is based on the draft state element occurrence rank specifications of February 15, 2006. There was an average of two pairs per year over the last three years surveyed. This site has not been surveyed since 2001. The birds are disturbed by boats.
Predators include crows and gulls

General Quality and Habitat The terns were observed at a non-barrier island. The natural community is probably salt marsh

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Sterna dougallii

Office Use 2867

Roseate Tern

Breeding

NYS Legal Status	Endangered	**NYS Rank**	S1B
Federal Listing	Endangered	**Global Rank**	G4
Last Report	2005-06-02	**EO Rank**	D
County	Suffolk		
Town	Islip		
Location	Sexton Island		
Directions	The birds were observed at Sexton Island which is in Great South Bay, about 0.4 miles east of Captree Island and about 1.1 miles north of Fire Island. Access is by boat		

Critically Imperiled

Apparently secure

Comments The rank is based on the draft state element occurrence rank specifications of February 15, 2006. There was an average of less than one pair per year over the last three years surveyed. This site was not surveyed in 2007. There is predation by gulls, crows, feral cats, snakes, fox, and rats. Disturbances include boats, development, flooding, and pedestrians. Fire Island National Seashore is to the south. Other salt marsh non-barrier islands are to the west.

General Quality and Habitat The birds were observed on a salt marsh and maritime beach on a non-barrier island. There are a few trees and a dense shrubby interior. It is poor habitat for shorebird nesting.

Sterna dougallii

Office Use 12025

Roseate Tern

Breeding

NYS Legal Status	Endangered	**NYS Rank**	S1B
Federal Listing	Endangered	**Global Rank**	G4
Last Report	2005-06-28	**EO Rank**	D
County	Suffolk		
Town	Brookhaven		
Location	Pattersquash Island		
Directions	The terns were observed at Pattersquash Island, located just north of Great South Beach, Fire Island National Seashore. Access is by boat from the Masic Yacht Club located to the north on Long Island.		

Critically Imperiled

Apparently secure

Comments	The birds were last observed as active at this site in 2005.
General Quality and Habitat	The area is a non-barrier island and probably a salt marsh. The surrounding water is shallow.

Sterna dougallii — Office Use 2066

Roseate Tern	**NYS Legal Status**	Endangered	**NYS Rank**	S1B	Critically imperiled
	Federal Listing	Endangered	**Global Rank**	G4	Apparently secure
Breeding	**Last Report**	1996-06-24	**EO Rank**	F	
	County	Suffolk			
	Town	Brookhaven			
	Location	West Inlet Island			
	Directions	The birds were observed at West Inlet Island which is in Moriches Bay just north of Moriches Inlet. Access is by boat launched at the Maple Avenue Dock which is off of Atlantic Avenue in East Moriches.			

Comments	The birds have not been reported as active at this site since 1996.
General Quality and Habitat	The birds were observed on a non-barrier island consisting of dredge spoil and sparse to dense beach grass. There is a salt marsh in the north center of the island. There is a heron colony nearby.

Sterna dougallii — Office Use 13154

Roseate Tern	**NYS Legal Status**	Endangered	**NYS Rank**	S1B	Critically imperiled
	Federal Listing	Endangered	**Global Rank**	G4	Apparently secure
Breeding	**Last Report**	2008-06-24	**EO Rank**	D	
	County	Suffolk			
	Town	Brookhaven			
	Location	Carters Island			
	Directions	The birds were found at Carters Island in Moriches Bay. Access is by boat.			

Comments	The rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of two pairs observed over one year surveyed. This site has been active for one year, therefore the rank is based on a single survey in stead of a three-year average. Disturbances include boats, flooding, and predation by gulls.
General Quality and Habitat	The birds were observed on a flooded, salt marsh island with dense vegetation. The area is diched.

Sterna hirundo — Office Use 1840

Natural Heritage Program: Species and Ecological Communities

Common Tern

Breeding

NYS Legal Status	Threatened	**NYS Rank**	S3B — Vulnerable
Federal Listing		**Global Rank**	G5 — Demonstrably secure
Last Report	1999-06-07	**EO Rank**	F
County	Suffolk		
Town	Brookhaven		
Location	Fire Island Sunken Forest		
Directions	The terns are at Fire Island Sunken Forest, west of Cherry Grove. Access is by boat or a 4-wheel drive vehicle. Drive down the beach to the vehicle-free area, park, and walk to the nesting area. The birds have also nested on the bay side.		

Comments This site has not been reported as active since 1999.

General Quality and Habitat The terns were observed on a sandy maritime beach on a barrier island. The surrounding area is maritime forest with boardwalks wandering through it. There is stabilized dune vegetation in some sections. Phragmites is along the bay shore.

Sterna hirundo Office Use 8465

Common Tern

Breeding

NYS Legal Status	Threatened	**NYS Rank**	S3B — Vulnerable
Federal Listing		**Global Rank**	G5 — Demonstrably secure
Last Report	2008-06-12	**EO Rank**	B
County	Suffolk		
Town	Islip		
Location	Sexton Island		
Directions	Sexton Island is in the Great South Bay, about 0.4 miles east of Captree Island and about 1.1 miles north of Fire Island. Access is by boat.		

Comments The rank is based on the draft state element occurrence rank specifications of February 15, 2006. There was an average of 69 pairs per year over the last three years surveyed. This site was not surveyed in 2007. There is predation by gulls, crows, feral cats, snakes, fox, and rats. Disturbances include boats, development, flooding, and pedestrians. Fire Island National Seashore is to the south. Other salt marsh non-barrier islands are to the west

General Quality and Habitat The birds were observed on a salt marsh and maritime beach on a non-barrier island. There are a few trees and a dense shrubby interior. It is poor habitat for shorebird nesting.

Sterna hirundo Office Use 2861

Common Tern

Breeding

NYS Legal Status	Threatened	**NYS Rank**	S3B — Vulnerable
Federal Listing		**Global Rank**	G5 — Demonstrably secure
Last Report	2001-05-31	**EO Rank**	A
County	Suffolk		
Town	Brookhaven		
Location	Ridge Island		
Directions	The birds were observed at Ridge Island, north of Fire Island, Great South Beach. Access is by boat.		

Comments The rank is based on the draft state element occurrence rank specifications of February 15, 2006.

There was an average of 230 pairs per year over the last three years surveyed. This site has not been surveyed since 2001. The birds are disturbed by boats.
Predators include crows and gulls. Fire Island is to the south, there are several salt marsh non-barrier islands to the north

General Quality and Habitat The terns were observed at a non-barrier island. The natural community is probably salt marsh

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Sterna hirundo Office Use 9588

Common Tern	**NYS Legal Status**	Threatened	**NYS Rank**	S3B	Vulnerable
	Federal Listing		**Global Rank**	G5	Demonstrably secure
Breeding	**Last Report**	2003-06-20	**EO Rank**	F	
	County	Suffolk			
	Town	Brookhaven			
	Location	New Made Island			
	Directions	The terns were observed at New Made Island and the marsh to the southeast, located east of Forge Point in Moriches Bay. Access is by boat			

Comments This site has not been active since 2003.

General Quality and Habitat The area is an old dredge spoil island with a large pit in the center. The vegetation cover is overgrown and encroaching on the nesting habitat and includes Phragmites, milkweed, goldenrod and grasses

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Sterna hirundo Office Use 3068

Common Tern	**NYS Legal Status**	Threatened	**NYS Rank**	S3B	Vulnerable
	Federal Listing		**Global Rank**	G5	Demonstrably secure
Breeding	**Last Report**	2002-06-24	**EO Rank**	A	
	County	Suffolk			
	Town	Brookhaven			
	Location	Carters Island			
	Directions	The birds were observed at Carters Island in Moriches Bay. Access is by boat.			

Comments The rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of 670 pairs per year over the last three years surveyed. The birds are disturbed by flooding and boats. There is also a lack of enough wrack material (nest substrate). Predators include gulls, crows, and rats. Fire Island National Seashore is to the south.

General Quality and Habitat The birds were observed on a flooded, salt marsh island with dense vegetation. The area is ditched.

Sterna hirundo Office Use 11951

Natural Heritage Report on Rare Species and Ecological Communities

Common Tern	**NYS Legal Status**	Threatened	**NYS Rank**	S3B	Vulnerable
	Federal Listing		**Global Rank**	G5	Demonstrably secure
Breeding	**Last Report**	1994-06-03	**EO Rank**	F	
	County	Suffolk			
	Town	Islip			
	Location	East Fire Island			
	Directions	The birds were observed on East Fire Island, which is part of the Fire Island National Seashore. The island is north of the town of Dunewood. Access is by boat			

Comments The birds have not been observed as active at this site since 1994. This site has not been surveyed since 2001.

General Quality and Habitat The birds were observed on a salt marsh, non-barrier island. The nesting substrate is sand.

Sterna hirundo Office Use 12085

Common Tern	**NYS Legal Status**	Threatened	**NYS Rank**	S3B	Vulnerable
	Federal Listing		**Global Rank**	G5	Demonstrably secure
Breeding	**Last Report**	1999-06-23	**EO Rank**	F	
	County	Suffolk			
	Town	Brookhaven			
	Location	Fire Island East			
	Directions	The birds nest along the Great South Beach on Fire Island National Seashore. From the Long Island Expressway, take exit 68 south (William Floyd Parkway). Take the William Floyd Parkway to the end. The birds nest along the beach approximately 1 mile east			

Comments The birds have not been reported active at this site since 1999.

General Quality and Habitat The birds were observed at a sandy maritime beach on a barrier island that is sparsely vegetated with Cakile edentula. The beach is wide and narrows in some areas.

Sterna hirundo Office Use 11365

Common Tern	**NYS Legal Status**	Threatened	**NYS Rank**	S3B	Vulnerable
	Federal Listing		**Global Rank**	G5	Demonstrably secure
Breeding	**Last Report**	2008-06-17	**EO Rank**	C	
	County	Suffolk			
	Town	Brookhaven			
	Location	Tuthill Cove Island			
	Directions	From East Moriches, follow Atlantic Avenue south to the marina at Tuthill Cove. Travel south by boat to the island in Tuthill Cove where the terns nest.			

Comments The rank is based on the draft state element occurrence rank specifications of February 15, 2005.

There was an average of 45 pairs per year over the last three years surveyed. Current disturbances include flooding and boating near the island. Predators include crows and gulls. The island is in a small bay surrounded by a lightly developed portion of the southern Long Island mainland.

General Quality and Habitat The birds are nesting on a salt marsh island in a cove.

Sterna hirundo — Office Use 5980

Common Tern	**NYS Legal Status**	Threatened	**NYS Rank**	S3B	Vulnerable
	Federal Listing		**Global Rank**	G5	Demonstrably secure
Breeding	**Last Report**	2008-06-17	**EO Rank**	B	
	County	Suffolk			
	Town	Brookhaven			
	Location	Pattersquash Island			
	Directions	The terns were observed at Pattersquash Island, located just north of Great South Beach, Fire Island National Seashore. Access is by boat launched at the Mastic Yacht Club located to the north on Long Island.			

Comments The rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of 69 pairs per year over the last three years surveyed. The birds are disturbed by flooding and boats. Predators include crows, gulls, raccoons, and possibly fox. Fire Island is to the south and the Long Island mainland is to the north.

General Quality and Habitat The area is a non-barrier island and probably a salt marsh. The surrounding water is shallow.

Sterna hirundo — Office Use 485

Common Tern	**NYS Legal Status**	Threatened	**NYS Rank**	S3B	Vulnerable
	Federal Listing		**Global Rank**	G5	Demonstrably secure
Breeding	**Last Report**	2008-06-29	**EO Rank**	D	
	County	Suffolk			
	Town	Brookhaven			
	Location	Westhampton Island West			
	Directions	The terns were observed at Cupsoque County Park on the western edge of Westhampton Island, east of Moriches Inlet. Most of the nests are along the beach, except for a few on the bay side north of the parking lot. For access to the site, take Dune Road we			

Comments The rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of six pairs per year over the last three years surveyed. Disturbances include ORVs, boaters, campers and dogs, fishermen entering protected areas, flooding, erosion, and predation by crows, gulls, feral cats, fox, and raccoons. Moriches Inlet and Fire Island is to the west. The Atlantic Ocean is to the south. Non-barrier islands are to the north.

General Quality and Habitat The birds were observed on a barrier island maritime beach and dredge spoil with a gravel substrate.

Natural Heritage Report of Rare Species and Ecological Communities

Sterna hirundo — Office Use 6593

Common Tern	**NYS Legal Status**	Threatened	**NYS Rank**	S3B	Vulnerable
	Federal Listing		**Global Rank**	G5	Demonstrably secure
Breeding	**Last Report**	2008-sp	**EO Rank**	D	
	County	Suffolk			
	Town	Brookhaven			
	Location	Fire Island Wilderness Watch Hill			
	Directions	The terns were observed at Fire Island Wilderness located on Watch Hill on Fire Island National Seashore. Access is by ferry from Patchogue. The colony is north of and adjacent to the marina.			

Comments The rank is based on the draft state element occurrence rank specifications of February 15, 2001. Two pairs were observed over the last year surveyed. Prior to 2008, this site was last surveyed in 2002. There is a busy marina adjacent to the occurrence a
nd development, pedestrians, and predation are threats and disturbances.

General Quality and Habitat The terns were observed on dredge spoil on the bay side of a barrier beach island. The substrate is sandy with grass cover around the site. It is open in the center. The dredge spoil is colonized by Ammophila breviligulata and weedy annuals.

Sterna hirundo — Office Use 6335

Common Tern	**NYS Legal Status**	Threatened	**NYS Rank**	S3B	Vulnerable
	Federal Listing		**Global Rank**	G5	Demonstrably secure
Breeding	**Last Report**	1998-06-20	**EO Rank**	F	
	County	Suffolk			
	Town	Islip			
	Location	Fire Island Villages			
	Directions	The terns nest east of Atlantique Beach Municipal Park on the ocean side of Fire Island National Seashore, between East End Walk and Compass Avenue. Access is by boat or ORV.			

Comments The terns have not been reported active at this site since 1998.

General Quality and Habitat The terns were observed at a maritime beach on a barrier island. The beach is about 150 feet wide and eroded. There is little to no wrack material and no beach vegetation. The beach is within a series of beach communities and is heavily developed with be
ach houses over or in place of the primary dune.

Sterna hirundo — Office Use 1841

Common Tern	**NYS Legal Status**	Threatened	**NYS Rank**	S3B	Vulnerable
	Federal Listing		**Global Rank**	G5	Demonstrably secure
Breeding	**Last Report**	2008-06-29	**EO Rank**	B	
	County	Suffolk			
	Town	Brookhaven			
	Location	Fire Island Wilderness Long Cove			
	Directions	The terns nest on an island north of Long Cove on the bay side of Fire Island National			

Seashore. Access is by a boat that can navigate through shallow waters.

Comments The rank is based on the draft state element occurrence rank specifications of February 15, 2001. There was an average of 148 pairs per year over the past two years surveyed. Surveys were not conducted in 2006 or 2007. Disturbances include flooding, vege

tative encroachment, boats, and predation by gulls, crows, fox, snakes, feral cats and raccoons. Great South Bay is to the north and Fire Island National Seashore is to the south.

General Quality and Habitat The terns were observed on a dredge spoil barrier island with a salt marsh natural community. The nesting substrate is dead herbacious vegetation and wrack material.

Sterna hirundo — Office Use 12415

Common Tern — Breeding

NYS Legal Status	Threatened	**NYS Rank**	S3B	Vulnerable
Federal Listing		**Global Rank**	G5	Demonstrably secure
Last Report	2008-sp	**EO Rank**	D	
County	Suffolk			
Town	Brookhaven			
Location	Fire Island Wilderness			
Directions	The terns were observed south of Pelican Island, on the ocean side of the Fire Island Wilderness, Fire Island National Seashore. No vehicles are allowed and access is by boat.			

Comments The rank is based on the draft state element occurrence rank specifications of February 15, 2001. There was an average of one pair per year over the last three years surveyed. This site was not surveyed in 2006. Disturbances include a high red fox popula

tion, human recreation including beach combing and boating, ORVs (so far used only by the US National Park Service and Suffolk County Park police), deer, and predation by snakes, gulls, crows, feral cats, raccoons and loose dogs. A small residential comm

General Quality and Habitat The terns were observed at a sandy maritime beach on a barrier island backed by an extensive maritime dune system. The vegetation is mostly Ammophila spp.

Sterna hirundo — Office Use 9585

Common Tern — Breeding

NYS Legal Status	Threatened	**NYS Rank**	S3B	Vulnerable
Federal Listing		**Global Rank**	G5	Demonstrably secure
Last Report	2007-06-20	**EO Rank**	B	
County	Suffolk			
Town	Brookhaven			
Location	West Inlet Island			
Directions	West Inlet Island is in Moriches Bay just north of Moriches Inlet. Access is by boat launched at the Maple Avenue Dock which is off of Atlantic Avenue in East Moriches			

Comments The rank is based on the draft state element occurrence rank specifications of February 15, 2001. There was an average of 82 pairs per year over the last three years surveyed. The birds are disturbed by boats, flooding, and erosion. Predators include gul

ls and crows. Fire Island and Westhampton Island are to the south and the Long Island mainland is to the north.

General Quality and Habitat The birds were observed on a non-barrier island consisting of dredge spoil and sparse to dense beach grass. There is a salt marsh in the north center of island. There is a heron colony nearby.

Sterna hirundo — Office Use 11890

Common Tern	**NYS Legal Status**	Threatened	**NYS Rank**	S3B	Vulnerable
	Federal Listing		**Global Rank**	G5	Demonstrably secure
Breeding	**Last Report**	2005-06-07	**EO Rank**	D	
	County	Suffolk			
	Town	Brookhaven			
	Location	Hospital Island			
	Directions	Hospital Island is in Great South Bay north of Fire Island Great South Beach. Access is by boat.			

Comments The rank is based on the draft state element occurrence rank specifications of February 15, 2003. One pair has nested over the course of the last three years this site was surveyed. The birds are disturbed by flooding, boats, and pedestrians. Predators i
nclude crows, gulls, and fox. Fire Island is to the south.

General Quality and Habitat The habitat appears to be a marsh based on 1994-1999 orthoimagery.

Sternula antillarum — Office Use 8732

Least Tern	**NYS Legal Status**	Threatened	**NYS Rank**	S3B	Vulnerable
	Federal Listing		**Global Rank**	G4	Apparently secure
Breeding	**Last Report**	2007-sp	**EO Rank**	D	
	County	Suffolk			
	Town	Brookhaven			
	Location	Fire Island Sunken Forest			
	Directions	The birds were observed at Fire Island Sunken Forest, west of Cherry Grove. Access is by boat or a 4-wheel drive vehicle. Drive down the beach to the vehicle free area, park, and walk to the nesting area. The birds have also nested on the Great South Bay			

Comments The rank is based on the draft state element occurrence rank specifications of February 15, 2003. The colony is small. Exact numbers are unknown. Disturbances include illegal ORV use, recreation, pets boats, and predation by feral cats, crows, fox, gulls
, raccoons and snakes. Some Cherry Grove residents are against the protection of the birds. Sailors Haven contains a visitors center and marina along with a concession stand that is heavily visited. A dense residential neighborhood is to the east.

General Quality and Habitat The terns were observed on a sandy maritime beach on a barrier island. The surrounding area is maritime forest with boardwalks wandering through it. There is stabilized dune vegetation in some sections. Phragmites is along the bay shore.

Sternula antillarum — Office Use 2659

Least Tern	**NYS Legal Status**	Threatened	**NYS Rank**	S3B	Vulnerable
	Federal Listing		**Global Rank**	G4	Apparently secure
Breeding	**Last Report**	1999-06-05	**EO Rank**	F	
	County	Suffolk			
	Town	Brookhaven			

Location	Fire Island Pines
Directions	The terns were observed at a 0.8 mile stretch of beach located about 0.5 miles west of Davis Park on the ocean side of Fire Island National Seashore.

Comments The terns have not been reported active at this site since 1999.

General Quality and Habitat The terns were observed on a sandy maritime beach on a barrier island. There is little vegetation cover. The Water Island area is wide enough to support nesting. The area in general is heavily developed. Beach nourishment occurred in 1998. A 400-home community uses this area as their primary recreation beach.

Sternula antillarum — Office Use 9000

Least Tern — Breeding

NYS Legal Status	Threatened	**NYS Rank**	S3B — Vulnerable
Federal Listing		**Global Rank**	G4 — Apparently secure
Last Report	1995-06-20	**EO Rank**	F
County	Suffolk		
Town	Brookhaven		
Location	Carters Island		
Directions	The birds were found at Carters Island in Moriches Bay. Access is by boat.		

Comments Terns have not been observed as active at this site since 1995

General Quality and Habitat The birds were observed on a flooded, salt marsh island with dense vegetation. The area is ditched.

Sternula antillarum — Office Use 3190

Least Tern — Breeding

NYS Legal Status	Threatened	**NYS Rank**	S3B — Vulnerable
Federal Listing		**Global Rank**	G4 — Apparently secure
Last Report	1996-06-26	**EO Rank**	F
County	Suffolk		
Town	Brookhaven		
Location	John Boyle Island		
Directions	The birds were observed at John Boyle Island in Great South Bay south of Fire Island and about 1.0 mi west of Smith Point. Access is by boat.		

Comments This site has not been active since 1996.

General Quality and Habitat The area is an island in a large bay between a barrier island and the mainland.

Sternula antillarum Office Use 3040

Least Tern	**NYS Legal Status**	Threatened	**NYS Rank**	S3B	Vulnerable
	Federal Listing		**Global Rank**	G4	Apparently secure
Breeding	**Last Report**	2008-06-12	**EO Rank**	D	
	County	Suffolk			
	Town	Islip			
	Location	Sexton Island			
	Directions	Sexton Island is in the Great South Bay, about 0.4 miles east of Captree Island and about 1.1 miles north of Fire Island. Access is by boat.			

Comments The rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of less than one pair per year over the last three years surveyed. This site was not surveyed in 2007. There is predation by gulls, crows, feral cats, snakes, fox, and rats. Disturbances include boats, development, flooding, and pedestrians. Fire Island National Seashore is to the south. Other salt marsh non-barrier islands are to the west.

General Quality and Habitat The birds were observed on a salt marsh and maritime beach on a non-barrier island. There are a few trees and a dense shrubby interior. It is poor habitat for shorebird nesting.

Sternula antillarum Office Use 2535

Least Tern	**NYS Legal Status**	Threatened	**NYS Rank**	S3B	Vulnerable
	Federal Listing		**Global Rank**	G4	Apparently secure
Breeding	**Last Report**	2008-06-29	**EO Rank**	D	
	County	Suffolk			
	Town	Brookhaven			
	Location	Westhampton Island West			
	Directions	The terns were observed at Cupsogue County Park on the western edge of Westhampton Island, east of Moriches Inlet. Most of the nests are along the beach, except for a few on the bay side north of the parking lot. For access to the site take Dune Road we			

Comments The rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of 11 pairs per year over the last three years surveyed. Disturbances include ORVs, boaters, campers and dogs, fishermen entering protected areas, flooding, erosion, and predation by crows, gulls, feral cats, fox, and raccoons. Moriches Inlet and Fire Island is to the west. The Atlantic Ocean is to the south. Non-barrier islands are to the north.

General Quality and Habitat The terns were observed at a barrier island maritime beach and dredge spoil with a gravel substrate. There is sparse to moderately dense vegetation that includes Ammophila breviligulata, Cakile edentula and Solidago sempivirens. The habitat is narrow and eroding with steep dunes that are progressively getting wider.

Sternula antillarum Office Use 6290

Least Tern	**NYS Legal Status**	Threatened	**NYS Rank**	S3B	Vulnerable
	Federal Listing		**Global Rank**	G4	Apparently secure
Breeding	**Last Report**	2006-06-20	**EO Rank**	D	

County	Suffolk
Town	Islip
Location	Fire Island Lighthouse
Directions	Take Robert Moses Parkway south to Fire Island. Turn east at the traffic circle and park at Field 5 in Robert Moses State Park. The birds nest along the beach and also part way into the dunes between Field 4 and Field 5. Occasionally they use the grass

Comments The rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of one pair per year over the last three years surveyed. Human disturbances include beach-goers, official vehicle use, boats, and development. Predation by gulls, crows, fox, feral cats, raccoons, dogs, and snakes is also a threat. Flooding has been a problem. There are two parking lots adjacent to the nesting area.

General Quality and Habitat The least terns are nesting on a barrier island with a maritime beach, dunes, and grassland. The dunes are steep and vegetated with Ammophila breviligulata. The beach width is variable and quite dynamic. The beach is used as a bathing beach. There are two parking lots adjacent to the nesting area. In 1992 the beach was unsuitable for nesting due to severe erosion resulting in a too narrow beach.

Sternula antillarum — Office Use 1119

Least Tern — Breeding

NYS Legal Status	Threatened	NYS Rank	S3B	Vulnerable
Federal Listing		Global Rank	G4	Apparently secure
Last Report	1998-06-20	EO Rank	F	
County	Suffolk			
Town	Brookhaven, Islip			
Location	Fire Island Villages			
Directions	The terns nest at Atlanticue Beach Municipal Park and Point o' Woods on the ocean side of Fire Island National Seashore. Access is by boat or ORV			

Comments The terns have not been reported active at this site since 1998.

General Quality and Habitat The terns were observed on a maritime beach on a barrier island. The beach is about 150 feet wide and eroded. There is little to no wrack material and no beach vegetation. The beach is within a series of beach communities and is heavily developed with beach houses over or in place of the primary dune.

Sternula antillarum — Office Use 5389

Least Tern — Breeding

NYS Legal Status	Threatened	NYS Rank	S3B	Vulnerable
Federal Listing		Global Rank	G4	Apparently secure
Last Report	2008-06-28	EO Rank	C	
County	Suffolk			
Town	Brookhaven			
Location	Fire Island East			
Directions	The birds nest along the Great South Beach on Fire Island National Seashore. From the Long Island Expressway, take exit 68 South (William Floyd Parkway). Take the William Floyd Parkway to the end. The birds nest along the beach east of the parking lots.			

Comments The rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of 18 pairs per year over the last three years surveyed. The birds are disturbed by recreational use, pedestrians, vehicles, boats, and

flooding. Some beach goers ignore the posted signs that state dogs need to be leashed at all times. Beach goers also enter protected areas. Many campers pull right up to the string fence. Extremely heavy ORV use limits the nesting area. Moderate ORV use

General Quality and Habitat The birds were observed at a sandy maritime beach on a barrier island that is sparsely vegetated with Cakile edentula. The beach is wide and narrows in some areas. New habitat was created in 1994.

Sternula antillarum Office Use 7154

Least Tern	**NYS Legal Status**	Threatened	**NYS Rank**	S3B	Vulnerable
	Federal Listing		**Global Rank**	G4	Apparently secure
Breeding	**Last Report**	1996-06-26	**EO Rank**	F	
	County	Suffolk			
	Town	Brookhaven			
	Location	Fire Island Wilderness Long Cove			
	Directions	The terns nest on an island north of Long Cove on the bay side of Fire Island National Seashore. Access is by a boat that can navigate through shallow waters.			

Comments This site has not been reported as active since 1996

General Quality and Habitat The terns were observed on a dredge spoil barrier island with a salt marsh natural community. The nesting substrate is dead herbacious vegetation and wrack material.

Sternula antillarum Office Use 5692

Least Tern	**NYS Legal Status**	Threatened	**NYS Rank**	S3B	Vulnerable
	Federal Listing		**Global Rank**	G4	Apparently secure
Breeding	**Last Report**	2008-sp	**EO Rank**	D	
	County	Suffolk			
	Town	Brookhaven			
	Location	Fire Island Wilderness Watch Hill			
	Directions	The terns were observed at Fire Island Wilderness, Watch Hill on Fire Island National Seashore. Access is by ferry from Patchogue. The colony is north of and adjacent to the marina.			

Comments The rank is based on the draft state element occurrence rank specifications of February 15, 2001. Five pairs were observed over the last year surveyed. Prior to 2008, this site was last surveyed in 2002. Threats include boats, development, pedestrians, v

ehicles, deer, and predation by crows, gulls, feral cats, raccoons and snakes. There is a high red fox population. This site is adjacent to a 180-vessel marina.

General Quality and Habitat The terns were observed on dredge spoil on the bay side of a barrier beach island. The substrate is sandy with grass cover around the site. It is open in the center. The dredge spoil is colonized by Ammophila breviligulata and weedy annuals.

Sternula antillarum Office Use 2536

Least Tern	**NYS Legal Status**	Threatened	**NYS Rank**	S3B	Vulnerable

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Breeding	**Federal Listing**		**Global Rank**	G4	Apparently secure
	Last Report	1996-07-26	**EO Rank**	F	
	County	Suffolk			
	Town	Brookhaven			
	Location	Smith Point Shirley			
	Directions	The birds were observed at Smith Point in Shirley. From the junction of Route 27 and William Floyd Parkway, follow William Floyd Parkway 5 miles south to John O'Hara Drive. Go west on John O'Hara Drive to a dirt entrance road to a marina. The colony is b			

Comments The birds have not been recorded as active at this site 1996.

General Quality and Habitat This is a heavily used area with little available habitat. The area is a dredge spoil on the mainland. It is heavily overgrown with a small open area at the southeast corner of the site. Plant species include Hudsonia tomentosa, Ammophila breviligulata,

and Phragmites. Many ORV trails cross the site. A narrow bay and boat inlet are adjacent to the site. William Floyd Parkway is 100 m to the east. Residential areas are 200 m east and 40 m north of the site. Clay/silt spoil deposits create a flooding pro

Sternula antillarum Office Use 7157

Least Tern	**NYS Legal Status**	Threatened	**NYS Rank**	S3B	Vulnerable
	Federal Listing		**Global Rank**	G4	Apparently secure
Breeding	**Last Report**	2008-ep	**EO Rank**	B	
	County	Suffolk			
	Town	Brookhaven			
	Location	Fire Island Wilderness			
	Directions	The terns were observed at two locations, south of Long Cove to Robinson Cove and south of Goose Point to Pelican Island, on the ocean side of the Fire Island Wilderness. Fire Island National Seashore. No vehicles are allowed and access is by boat.			

Comments The rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of 50 pairs per year over the last three years surveyed. No surveys were conducted in 2006. Disturbances include a high red fox population, human recreation including beach combing and boating, ORVs (so far used only by the US National Park Service and Suffolk County Park police), deer, and predation by snakes, gulls, crows, feral cats, raccoons and loose dogs. A small residential commu

General Quality and Habitat The terns were observed at a sandy maritime beach on a barrier island backed by an extensive maritime dune system. The vegetation is mostly Ammophila spp.

Total of 65 BIRDS

COMMUNITIES

High salt marsh Office Use 3614

High Salt Marsh	**NYS Legal Status**	Unlisted	**NYS Rank**	S3S4	Vulnerable
	Federal Listing		**Global Rank**	G4	Apparently secure
	Last Report	1998-09-18	**EO Rank**	AB	
	County	Suffolk			
	Town	Brookhaven			
	Location	Fire Island Wilderness			
	Directions	From shirely, go south on Route 46 (William Floyd Parkway) and then over Smith Point			

bridge. Stop at Fire Island visitor center. Ask for permission to drive on the beach. With permission from the National Park Service, let a little air out of the tires a

Comments This is a large complex of marsh barrier beach segments with minimal to marginal diking disturbance and minimal disruption to overwash and other dynamic processes. Human disturbance on marsh is minimal although it can be heavy in some adjacent and near by communities.

General Quality and Habitat The community is located in a 545 acre salt marsh complex formed on an extensive barrier beach complex stretching from Smith Point west to Davis Park. This segment is part of a larger barrier complex forming south shore of Long Island from Shinnecock Bay west to Coney Island. The community is formed at the bay side (lagoon side) and is classified as back barrier marsh or a flood tidal delta marsh on some islands (Oertel and Woo 1994). The high salt marsh covers about 375 acres and is primarily developed

Maritime beach Office Use 5364

Maritime Beach

NYS Legal Status	Unlisted	**NYS Rank**	S3S4	Vulnerable
Federal Listing		**Global Rank**	G5	Demonstrably secure
Last Report	2001-09-28	**EO Rank**	AB	
County	Suffolk			
Town	Babylon, Brookhaven, Islip			
Location	Fire Island			
Directions	The beach is along the south shore of Fire Island from Democrat Point east to Moriches Inlet. Access to Fire Island is from Robert Moses Causeway, William Floyd Parkway, or by ferry.			

Comments A 32 mile long maritime beach along the south shore of Fire Island, 7 miles of which is designated as Federal Wilderness Area where driving is not allowed for most of the year. Natural processes are affected by stablization and nourishment in some areas.

General Quality and Habitat A large sandy maritime beach along the south shore of a barrier island. The maritime beach extends 32 miles along the south shore of Fire Island from Democrat Point east to Moriches Inlet. The maritime beach grades into marine intertidal gravel/sand beac h oceanward and maritime dunes inland. The island is mostly state, federal, and county owned parkland. A seven mile stretch is Federal Wilderness Area. Several towns with residences occur near the beach for approximately 7 miles from Kismet to Oakleyvill

Maritime dunes Office Use 8079

Maritime Dunes

NYS Legal Status	Unlisted	**NYS Rank**	S3	Vulnerable
Federal Listing		**Global Rank**	G4	Apparently secure
Last Report	2001-09-28	**EO Rank**	BC	
County	Suffolk			
Town	Babylon, Islip			
Location	Fire Island Democrat Point			
Directions	The dunes are at the west end of Fire Island from Democrat Point east to the town of Kismet. Take Robert Moses Causeway south to Robert Moses State Park.			

Comments The dunes are large with good diversity and processes fairly intact, but with some recreational development and many exotic plants near roads. The western portion is unfragmented by paved roads. The eastern portion is fragmented by roads and parking area s.

General Quality and Habitat A large maritime dunes along a 5-mile stretch of Fire Island extending from Democrat Point east to the Town of Kismet. The maritime dunes are bordered by maritime beach towards the ocean. The dunes

include small scattered patches of brackish interdunal s

wales/reedgrass purple loosestrife marsh. The maritime dunes grade into maritime shrubland inland. The dunes include blowouts and old sand roads. A paved divided highway occurs for approximately 3 miles in the middle of the occurrence. The landscape also

Maritime freshwater interdunal swales — Office Use 1140

Maritime Freshwater Interdunal Swales	**NYS Legal Status**	Unlisted	**NYS Rank**	S2	Imperiled
	Federal Listing		**Global Rank**	G3G4	Rare
	Last Report	2006-08-31	**EO Rank**	B	
	County	Suffolk			
	Town	Brookhaven			
	Location	Fire Island Wilderness			
	Directions	The interdunal swales are in wetlands among dunes 0.5 mi south of Hospital Island on Fire Island.			

Comments This is a small patch of maritime freshwater interdunal swales in good condition with good diversity of native species in a large, protected landscape.

General Quality and Habitat This is a small patch of maritime freshwater swales among low elevation maritime dunes. Other communities in the area include maritime shrubland, brackish interdunal swales, maritime pitch pine dune woodland, and reedgrass-purple loosestrife marsh. A hig

h salt marsh/low salt marsh complex occurs along the north shore of the barrier island and a large, sandy maritime beach runs along the south shore. The landscape also includes patches of successional maritime forest, maritime holly forest, parking lots,

Maritime holly forest — Office Use 5615

Maritime Holly Forest	**NYS Legal Status**	Unlisted	**NYS Rank**	S1	Critically imperiled
	Federal Listing		**Global Rank**	G1G2	Critically imperiled
	Last Report	2000-08-08	**EO Rank**	AB	
	County	Suffolk			
	Town	Brookhaven			
	Location	Fire Island Sunken Forest			
	Directions	Sunken Forest. From Sailor's Haven Ferry Terminal in Sayville, take the ferry to Sunken Forest/Sailor's Haven Visitor's Center and follow the signs. Follow the boardwalk west through the forest. On the 7 1/2 minute USGS topographic map, the community is			

Comments This is a moderate-sized, old growth maritime holly forest in excellent condition within a protected landscape with some disturbance.

General Quality and Habitat An old-growth holly forest primarily located behind the secondary dune of a barrier island. Trees on the dune ridges are very gnarled due to wind exposure and the pruning influence of salt spray. The surrounding communities, which comprise a >75 acre coa

stal forest/shrub/grassland complex, include maritime shrubland/successional maritime forest, scrub forest, maritime dunes, and highbush blueberry shrub swamp. There is severe deer browsing of understory, and some areas completely lack understory, except

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Maritime pitch pine dune woodland — Office Use 8198

Maritime Pitch Pine Dune Woodland	**NYS Legal Status**	Unlisted	**NYS Rank**	S1	Critically imperiled
	Federal Listing		**Global Rank**	G2G3	Imperiled
	Last Report	1998-09-18	**EO Rank**	B	
	County	Suffolk			
	Town	Brookhaven			
	Location	Fire Island Wilderness			
	Directions	From Shirley, go south on Route 46 (William Floyd Parkway) and then over Smith Point bridge. Stop at the visitor center. With permission from the National Park Service let a little air out of the tires and drive on the beach west about 2.8 mi. Walk north			

Comments This is a small and very narrow maritime pitch pine dune woodland with good diversity, natural processes in an excellent, intact landscape.

General Quality and Habitat This maritime pitch pine dune woodland is in a narrow band of stablized dunes on a barrier island. The woodland grades into maritime dunes, maritime shrubland, and maritime interdunal swales. The dunes are on the north half of the island facing Great South Bay. Salt marsh occurs to the north. Maritime beach occurs to the south. There are no roads in the wilderness area, but vehicles drive on the beach.

Salt panne — Office Use 5199

Salt Panne	**NYS Legal Status**	Unlisted	**NYS Rank**	S3	Vulnerable
	Federal Listing		**Global Rank**	G3G4	Rare
	Last Report	1998-09-18	**EO Rank**	BC	
	County	Suffolk			
	Town	Brookhaven			
	Location	Fire Island Wilderness			
	Directions	From shirely, go south on Route 46 (William Floyd Parkway) and then over Smith Point bridge. Stop at the visitor center and ask permission to drive on the beach. With permission from the National Park Service, let a little air out of the tires and drive			

Comments The salt pannes are in a good landscape setting. The pannes are ditched, but recovering with good vegetation diversity. The pannes often found with a complex of high marsh as well as panne species.

General Quality and Habitat The salt panne is located in a 545 acre salt marsh complex formed on an extensive barrier beach complex stretching from Smith Point west to Davis Park. This segment is part of a larger barrier complex forming the south shore of Long Island from Shinnecock Bay west to Coney Island. The salt marsh complex is formed at the bay-side (lagoon side) and is classified as a back-barrier marsh or a flood tidal delta marsh on some islands (Oertel and Woo 1992). The high marsh is formed on 200-400 m wide patches an

Salt shrub — Office Use 3677

Salt Shrub	**NYS Legal Status**	Unlisted	**NYS Rank**	S4	Apparently secure
	Federal Listing		**Global Rank**	G5	Demonstrably secure
	Last Report	1998-09-18	**EO Rank**	B	
	County	Suffolk			
	Town	Brookhaven			

Natural Heritage Program Rare Species and Ecological Communities

Location	Fire Island Wilderness
Directions	From shirely, go south on Route 46 (William Floyd Parkway) and then over Smith Point bridge. Stop at the visitor center and ask permission to drive on the beach. With permission from the National Park Service, let a little air out of the tires and drive
Comments	This is a large salt shrub in a dynamic, relatively intact barrier beach. The community is degraded by Phragmites australis invasion, but contains relatively intact natural processes, good connectivity and harbors some rare elements, such as Helianthus a ngustifolius and Sabatia stellaris.
General Quality and Habitat	The community is located in a 545 acre salt marsh complex formed on an extensive barrier beach complex stretching from Smith Point west to Davis Park. This segment is part of a larger barrier complex forming the south shore of Long Island from Shinnecock Bay west to Coney Island. Salt shrub covers about 50 acres and is primarily developed on broad relict inlet flood deltas (Joneja 1981) and to some extent storm overwash deposits (Clark 1986), and on complexes of these landforms (Clark 1986). Additonally

Total of 8 COMMUNITIES

OTHER

Gull Colony — Office Use 7195

Gull Colony	**NYS Legal Status**	Unlisted	**NYS Rank**	SNR	Rank not assigned
Breeding	**Federal Listing**		**Global Rank**	GNR	Globally not ranked
	Last Report	2004-05-27	**EO Rank**	B	
	County	Suffolk			
	Town	Brookhaven			
	Location	West Inlet Island			
	Directions	The gulls were observed at West Inlet Island, north of Moriches Inlet. Access is by boat launched at the Maple Avenue dock, off of Atlantic Avenue in East Moriches.			

Comments	The rank is based on the element global ranking form of April 22, 1988. There was an average of 987 pairs per year over the last 3 years surveyed. The gulls are surveyed every third year, but were not surveyed in 1998.
General Quality and Habitat	West Inlet Island is a non-barrier island consisting of dredge spoil and sparse to dense beach grass. There is a salt marsh in the north center of the island. There is a heron colony nearby

Total of 1 OTHER

REPTILES

Kinosternon subrubrum — Office Use 10130

Eastern Mud Turtle	**NYS Legal Status**	Endangered	**NYS Rank**	S1	Critically imperiled
	Federal Listing		**Global Rank**	G5	Demonstrably secure
	Last Report	1993-05-13	**EO Rank**	BD	
	County	Suffolk			
	Town	Brookhaven			

Location	Old Inlet Marsh
Directions	The turtles were found near Old Inlet Marsh. They were also found on a marsh near Hospital Island and Pelican Island. Take William Floyd Parkway south to Fire Island, turn west on Fire Island Road. Park at the end and walk west to the marshes.

Comments

The rank is based on NatureServe's Generic Element Occurrence Rank Specifications of January 11, 2008. The population appears to be small and dispersed, although hard data is lacking. Evidence of successful reproduction has been observed, and the male:fe

male ratio is 1:1. The site is located within a protected, undeveloped national seashore on a barrier island. Stochastic events such as winter storms or other climate-related changes such as sea level rise may or may not disrupt the population.

General Quality and Habitat

The marsh near Old Inlet is a freshwater Scirpus marsh in a larger coastal marsh ranging from salt to freshwater. The entire marsh has been ditched. The marsh near Hospital Island and Pelican Island has also been ditched. The area occupied by the turtles

contains a 1.5 ft-deep ponded area that goes dry, ditches, wetlands, swales, and semi-ponded damp areas.

Total of 1 REPTILES

VASCULAR PLANTS

Amaranthus pumilus — Office Use 3631

Seabeach Amaranth

NYS Legal Status	Endangered	**NYS Rank**	S2	Imperiled
Federal Listing	Threatened	**Global Rank**	G2	Imperiled
Last Report	2005-08	**EO Rank**	A	
County	Suffolk			
Town	Brookhaven, Southampton			
Location	Westhampton Island West			
Directions	The plants were surveyed Westhampton Island along the beach from the point at Moriches Inlet east to the beginning of "The Dunes" development.			

Comments

This is a good population of vigorous individuals in limited, but good habitat. There is an average of 20,000 plants over 5 years.

General Quality and Habitat

2005: Most of the plants were inside string fencing. 2000: All plants were on the old beach near the point or on newly replenished beach within fencing. 1998: Only a few plants were found north of dune road. There are many plants in between houses south

of Dune Road which will probably be extirpated by next year. Plants seem to be successfully colonizing the new replenished beach. There is little in the way of dune development or dune vegetation. Regrading of Dune Road has affected the habitat. Cupsogue

Amaranthus pumilus — Office Use 222

Seabeach Amaranth

NYS Legal Status	Endangered	**NYS Rank**	S2	Imperiled
Federal Listing	Threatened	**Global Rank**	G2	Imperiled
Last Report	2003-08	**EO Rank**	C	
County	Suffolk			
Town	Brookhaven			
Location	Fire Island East			

Directions	The plants are on the south shore of Fire Island, located within 0.5 mi west of Moriches Inlet, between 27 and 34.5 m leeward of the mean tide line. The plants are east of a jeep trail cut-in point (Burma Road) generally near or within the piping plover
Comments	A few plants are in good habitat if it is protected from ORVs. An average of 120 plants were observed over five years were observed.
General Quality and Habitat	A barrier beach where the wider sections (1000 feet) support diffuse drifting vegetation stands. Part of the shoreline exhibits wave erosion in the form of a dropoff (about 5 ft in places) near the mean high tide line. The plants were found in driftlines . The beach has a very windblown appearance. ORV use of the beach is very heavy

Amaranthus pumilus — Office Use 7024

Seabeach Amaranth

NYS Legal Status	Endangered	**NYS Rank**	S2	Imperiled
Federal Listing	Threatened	**Global Rank**	G2	Imperiled
Last Report	2006-08	**EO Rank**	C	
County	Suffolk			
Town	Brookhaven			
Location	Fire Island Sunken Forest			
Directions	The plants are at Fire Island National Seashore at the Sunken Forest Natural Area west of Cherry Grove. 1990: The plants are along the beach. 1996: The plants are in the western half of Sailors Haven vehicle-free beach.			

Comments	There are 52 plants averaged over five years.
General Quality and Habitat	A barrier beach

Amaranthus pumilus — Office Use 4094

Seabeach Amaranth

NYS Legal Status	Endangered	**NYS Rank**	S2	Imperiled
Federal Listing	Threatened	**Global Rank**	G2	Imperiled
Last Report	2006-08	**EO Rank**	C	
County	Suffolk			
Town	Brookhaven			
Location	Fire Island Wilderness			
Directions	From Patchogue, take the ferry to Watch Hill. 1992: One plant is at the vehicle free area at Watch Hill and two other plants are just east of Bellport Beach. 1995 and 1996: The plants are at Old Inlet Beach, 1.5 mile west of Old Inlet and at Barrett's [illegible]			

Comments	There is an average of 42 plants.
General Quality and Habitat	A barrier beach

Amaranthus pumilus Office Use 5961

Seabeach Amaranth

NYS Legal Status	Endangered	**NYS Rank**	S2	Imperiled
Federal Listing	Threatened	**Global Rank**	G2	Imperiled
Last Report	2006-08	**EO Rank**	C	
County	Suffolk			
Town	Islip			
Location	Fire Island Villages			
Directions	2001: The plants are along Atlantique Beach just east of the National Seashore area. 1990: The plants are along the beach area on the ocean side of the Fair Harbor section of Fire Island. The plants are about 100 feet east of the "Broadway" beach access.			

Comments There were 67 plants averaged over five years in an isolated and threatened habitat

General Quality and Habitat This is a barrier island beach that is built up and heavily used.

Amaranthus pumilus Office Use 1963

Seabeach Amaranth

NYS Legal Status	Endangered	**NYS Rank**	S2	Imperiled
Federal Listing	Threatened	**Global Rank**	G2	Imperiled
Last Report	2006-08	**EO Rank**	C	
County	Suffolk			
Town	Brookhaven			
Location	Fire Island Pines			
Directions	The plants are at the Barrett Beach Park section of Fire Island Pines in front of a foredune.			

Comments There are 98 plants averaged over five years.

General Quality and Habitat This is a narrow barrier beach in front of a foredune.

Amaranthus pumilus Office Use 6806

Seabeach Amaranth

NYS Legal Status	Endangered	**NYS Rank**	S2	Imperiled
Federal Listing	Threatened	**Global Rank**	G2	Imperiled
Last Report	2006-08	**EO Rank**	C	
County	Suffolk			
Town	Islip			
Location	Fire Island Lighthouse			

Directions	The plants are within bird fencing on the barrier beach from the parking lot lower east to the first parking lot (Field 4).
Comments	There were 80 plants averaged over 5 years.
General Quality and Habitat	This is a heavily used barrier beach. The plants survive within string fencing for birds

Carex hormathodes — Office Use 12722

Marsh Straw Sedge

NYS Legal Status	Threatened	**NYS Rank**	S2S3	Imperiled
Federal Listing		**Global Rank**	G4G5	Apparently secure
Last Report	1985-08-07	**EO Rank**	E	
County	Suffolk			
Town	Brookhaven			
Location	Forge Point			
Directions	Forge Point is east of Mastic Beach. Go to William Floyd Estate located between Laurence Creek and Home Creek in Mastic Beach at the southeast edge of Forge Point. The probable location was in the salt marsh at the end of the "vista cutting" from the hou			

Comments

General Quality and Habitat The probable location was in the salt marsh.

Carex venusta — Office Use 2523

Dark-green sedge

NYS Legal Status	Endangered	**NYS Rank**	S1	Critically imperiled
Federal Listing		**Global Rank**	G4	Apparently secure
Last Report	1999-su	**EO Rank**	E	
County	Suffolk			
Town	Brookhaven			
Location	Forge Point			
Directions	From the junction of Wavecrest Drive and Washington Avenue in Mastic, go west on Washington Avenue 0.1 mi to the entrance of the park unit. Park in a public lot and find the manager. The plants are near the edge of the marsh east of a mowed vista near a			

Comments

General Quality and Habitat Old estate that is now part of Fire Island National Seashore. Many abandoned fires and fire suppressed pine barrens with channelized streams. The marsh is ditched and has a fair amount of Phragmites. Vista to water mowed from old house to marsh.

Helianthus angustifolius — Office Use 6725

Swamp Sunflower

NYS Legal Status	Threatened	**NYS Rank**	S2 — Imperiled
Federal Listing		**Global Rank**	G5 — Demonstrably secure
Last Report	2006-08-31	**EO Rank**	C
County	Suffolk		
Town	Brookhaven		
Location	Fire Island Wilderness		
Directions	August 30, 1985: The plants are in the Fire Island Wilderness about 0.[illegible] mi. WSW of the circle at the south end of William Floyd Parkway, along a jeep trail in the north center of Fire Island, and about 0.5 mi south of Hospital Island growing in wet[illegible] side		

Comments There are only 30-50 plants in excellent, but small habitat.

General Quality and Habitat 1985: A small shallow depressions in dunes; some have open cranberry mats, some have shrub thickets. The plants are in a shrubby, wet maritime interdunal swale. Associated species: Panicum virgatum, Myrica pensylvanica, Sabatia stellaris, Vaccinium macro carpon, Xyris sp. and Prunus maritima. 2006: The plants occurred in a good wet maritime interdunal swale dominated by Cladium mariscoides and Panicum virgatum. The swale is distinctive in the area and much wetter than the dunes, but drier than the other

Helianthus angustifolius — Office Use 517

Swamp Sunflower

NYS Legal Status	Threatened	**NYS Rank**	S2 — Imperiled
Federal Listing		**Global Rank**	G5 — Demonstrably secure
Last Report	1997-su	**EO Rank**	C
County	Suffolk		
Town	Brookhaven		
Location	Forge Point		
Directions	Forge Point is east of Mastic Beach. Go to William Floyd Estate located between Laurence Creek and Home Creek in Mastic Beach at the southeast edge of Forge Point. The plants are in three groups between the upper salt marsh and field and woods at the end		

Comments There are 69 plants in protected habitat that is threatened with Phragmites.

General Quality and Habitat This is a large estate run by the National Park Service. The marsh is Phragmites-fringed and ditched.

Polygonum glaucum — Office Use 3692

Seabeach Knotweed

NYS Legal Status	Rare	**NYS Rank**	S3 — Vulnerable
Federal Listing		**Global Rank**	G3 — Rare
Last Report	1985-08-30	**EO Rank**	C
County	Suffolk		
Town	Brookhaven		
Location	Fire Island Wilderness		

Directions	The plants are on Fire Island in a beach embayment on the ocean beach at Long Point. Only one embayment was present in 1985, (the embayment will move from year to year). The plants are in the drift line among debris.

Comments This is a very small population in habitat that is abused by ORVs.

General Quality and Habitat An ORV-impacted beach/backshore and piles of tidal debris with drift line vegetation.

Polygonum glaucum — Office Use 8797

Seabeach Knotweed

NYS Legal Status	Rare	**NYS Rank**	S3	Vulnerable
Federal Listing		**Global Rank**	G3	Rare
Last Report	1990-09	**EO Rank**	CD	
County	Suffolk			
Town	Brookhaven			
Location	Fire Island Sunken Forest			
Directions	Fire Island National Seashore, Sunken Forest Natural Area west of Cherry Grove. The plants are along the beach.			

Comments 4 plants in defensible habitat, may have been washed away by October. Check again in 1991.

General Quality and Habitat A barrier beach.

Polygonum glaucum — Office Use 8725

Seabeach Knotweed

NYS Legal Status	Rare	**NYS Rank**	S3	Vulnerable
Federal Listing		**Global Rank**	G3	Rare
Last Report	1990-09-11	**EO Rank**	CD	
County	Suffolk			
Town	Islip			
Location	Fire Island Villages			
Directions	The plant is in the village area of Fire Island on the beach at Robbins Rest between Atlantique and Ocean Beach.			

Comments 1 plant

General Quality and Habitat Barrier beach.

Polygonum glaucum — Office Use 440

Seabeach Knotweed	**NYS Legal Status**	Rare	**NYS Rank**	S3	Vulnerable
	Federal Listing		**Global Rank**	G3	Rare
	Last Report	2003-08-21	**EO Rank**	A	
	County	Suffolk			
	Town	Brookhaven, Southampton			
	Location	Westhampton Island West			
	Directions	Group 1 is on the bay side of Dune Road at the beginning of "The Dunes" development, about 3.2 mi east of Moriches Inlet. In 2003 most of the plants were growing on the northern half of the spit that extends north from the island in this location. To rea			

Comments Over 2200 plants were seen in good habitat.

General Quality and Habitat Approximately 2 miles of barrier beach on the east side of Moriches Inlet with an extensive area of fairly well-developed dunes. The northeast end is salt marsh, while the extreme west end has the appearance of being frequently washed over. The dunes in the Pikes Beach area have been frequently washed away and rebuilt. Currently, most of the plants grow on a large sand spit that extends north from the main island into a large bay. Many plants were seen between slats of snow fences.

Polygonum glaucum — Office Use 124

Seabeach Knotweed	**NYS Legal Status**	Rare	**NYS Rank**	S3	Vulnerable
	Federal Listing		**Global Rank**	G3	Rare
	Last Report	2003-08-13	**EO Rank**	B	
	County	Suffolk			
	Town	Brookhaven			
	Location	Fire Island East			
	Directions	The plants are on the south shore of eastern Fire Island between 0.5 and 0.9 miles west of Moriches Inlet in sparse vegetation within tern and plover fencing. 2003: All plants were found inside piping plover string fencing.			

Comments There are 408 plants in good habitat.

General Quality and Habitat A maritime beach in diffuse wrack assemblage. The plants are in sparse vegetation within tern and plover string fencing.

Sabatia campanulata — Office Use 8254

Slender Marsh-pink	**NYS Legal Status**	Endangered	**NYS Rank**	S1	Critically imperiled
	Federal Listing		**Global Rank**	G5	Demonstrably secure
	Last Report	2006-08-31	**EO Rank**	C	
	County	Suffolk			

Town	Brookhaven
Location	Fire Island Wilderness
Directions	The plants are in the Fire Island Wilderness, about 0.5 mi south of Hospital Island. The site visited in 2006 is about 150 meters west of the hunting sign in a old jeep trail rut. Follow the trail to where it is very wet and filled with Cladium. The pla

Comments There are 40-50 plants in excellent habitat.

General Quality and Habitat A small shallow depression in dunes, some with open cranberry mats and some with shrub thickets. The community is a maritime interdunal swale.

Sporobolus clandestinus Office Use 307

Rough Rush-grass

NYS Legal Status	Endangered	**NYS Rank**	S1	Critically Imperiled
Federal Listing		**Global Rank**	G5	Demonstrably secure
Last Report	1985-06-10	**EO Rank**	E	
County	Suffolk			
Town	Islip			
Location	Fire Island Lighthouse			
Directions	Just east of Fire Island lighthouse.			

Comments

General Quality and Habitat Maritime dunes and swales.

Total of 18 VASCULAR PLANTS

More detailed information about many of the rare and listed animals in New York, including biology, identification, habitat, conservation, and management, are available online in Natural Heritage's Conservation Guides at www.acris.nyhp.org, from NatureServe Explorer at http://www.natureserve.org/explorer, and from NYSDEC at http://www.dec.ny.gov/animals/7494.html. (for animals), and from USDA's Plants Database at http://plants.usda.gov/index.html (for plants).

More detailed information about many of the natural community types in New York, including identification, dominant and characteristic vegetation, distribution, conservation, and management, is available online in Natural Heritage's Conservation Guides at www.acris.nyhp.org. For descriptions of all community types, go to http://www.dec.ny.gov/animals/29384.html and click on Draft Ecological Communities of New York State.

Natural Heritage Report on Rare Species and Ecological Communities

NYS Dept. of Environmental Conservation and
Natural Heritage Program

625 Broadway, 5th floor
Albany, NY 12233-4754
518-402-8964

Historical Records

The following plants and animals were documented in the vicinity of the project site at one time, but have not been documented there since 1979 or earlier, or there is uncertainty regarding their continued presence.

There is no recent information on these plants and animals in the vicinity of the project site and their current status there is unknown. In most cases the precise location of the plant or animal in this vicinity at the time it was last documented is also unknown and therefore location maps are generally not provided.

If appropriate habitat for these plants or animals is present in the vicinity of the project site, it is possible that they may still occur there.

Natural Heritage Report on Rare Species and Ecological Communities (Historical)

DRAGONFLIES AND DAMSELFLIES

Ischnura ramburii — Office Use 12587

Rambur's Forktail

NYS Legal Status	Unlisted	**NYS Rank**	S2	Imperiled
Federal Listing		**Global Rank**	G5	Demonstrably secure
Last Report	1913-pre	**EO Rank**	H	
County	Suffolk			
Town	Babylon, Brookhaven, Islip			
Location	Fire Island			
Directions	Fire Island is off the southern coast of Long Island. To access the western part of the island from Islip, take the Robert Moses Causeway south past Captree Island to Fire Island. To access the eastern part of the island, follow Suffolk Boulevard south f			

Comments

General Quality and Habitat

The damselfly was found on an island that is over 3 miles long

Total 1 DRAGONFLIES AND

VASCULAR PLANTS

Digitaria filiformis — Office Use 2516

Slender Crabgrass

NYS Legal Status	Threatened	**NYS Rank**	S1	Critically imperiled
Federal Listing		**Global Rank**	G5	Demonstrably secure

Natural Heritage Report on Rare Species and Ecological Communities (Historical)

Last Report	1955-09-19	**EO Rank**	F
County	Suffolk		
Town	Brookhaven		
Location	East Moriches		
Directions	Specimen label: East Moriches.		

Comments The natural areas north of Harts Road, east of Pine Street, and west of East Moriches-Riverhead Road were searched. No plants nor appropriate habitat were found.

General Quality and Habitat

Helianthus angustifolius Office Use 8662

Swamp Sunflower

NYS Legal Status	Threatened	**NYS Rank**	S2	Imperiled
Federal Listing		**Global Rank**	G5	Demonstrably secure
Last Report	1918-09-14	**EO Rank**	H	
County	Suffolk			
Town	Brookhaven			
Location	Smith Point Shirley			
Directions	Specimen label: Sandy swamp, near Smith's Point.			

Comments

General Quality and Habitat

Specimen label: Sandy swamp.

Rumex fueginus Office Use 7497

Golden Dock

NYS Legal Status	Endangered	**NYS Rank**	S1	Critically imperiled
Federal Listing		**Global Rank**	G4G5	Apparently secure
Last Report	1924-08-19	**EO Rank**	H	
County	Suffolk			
Town	Brookhaven			
Location	Fire Island Villages			
Directions	Specimen label: Beach of bay, northeast of inn on Point O'Woods, Fire Island.			

Comments

General Quality and Habitat

Beach of bay.

Page 2 of 3

Natural Heritage Report on Rare Species and Ecological Communities (Historical)

Suaeda linearis — Office Use 8747

Narrow-leaf Sea-blite

NYS Legal Status	Endangered	**NYS Rank**	S1	Critically imperiled
Federal Listing		**Global Rank**	G5	Demonstrably secure
Last Report	1968-10-03	**EO Rank**	H	
County	Suffolk			
Town	Brookhaven			
Location	Fire Island Wilderness Watch Hill			
Directions	Watch Hill salt marshes.			

Comments

General Quality and Habitat

Salt marsh.

Total 4 VASCULAR PLANTS

More detailed information about many of the rare and listed animals in New York, including biology, identification, habitat, conservation, and management, are available online in Natural Heritage's Conservation Guides at www.acris.nynhp.org, from NatureServe Explorer at http://www.natureserve.org/explorer, and from NYSDEC at http://www.dec.ny.gov/animals/7494.html. (for animals), and from USDA's Plants Database at http://plants.usda.gov/index.html (for plants).

Page 3 of 3

United States Department of the Interior

NATIONAL PARK SERVICE
FIRE ISLAND NATIONAL SEASHORE
120 Laurel Street
Patchogue, New York 11772
(631) 687-4750

IN REPLY REFER TO:

L-7615 (Deer Management Plan DEIS)

May 30, 2014

Ms. Ruth Pierpont
Deputy SHPO, Division for Historic Preservation
New York State Office of Parks, Recreation & Historic Preservation
Peebles Island State Park
P.O. Box 189
Waterford, New York 12188-0189

Dear Ms. Pierpont:

The National Park Service (NPS), in accordance with the National Environmental Policy Act (NEPA), is currently preparing a White-tailed Deer Management Plan and Environmental Impact Statement (plan/EIS) at Fire Island National Seashore (the Seashore). The purpose of the plan/EIS is to develop and analyze a range of strategies for managing deer to reduce their impacts on native vegetation, forest regeneration, cultural landscapes at the William Floyd Estate, and human-deer encounters at the Seashore.

When the Seashore initiated consultation under section 106 of the National Historic Preservation Act (NHPA) in a letter dated July 13, 2011 (enclosed), we intended to use the plan/EIS for compliance with both section 106 of the NHPA and NEPA. At this time, the extent of effects on cultural resources is uncertain; therefore, we are making an effect determination of no adverse effect for the issuance of the plan/EIS. In accord with our 2008 nationwide Programmatic Agreement we will undertake case-by-case consultation when locations and effects for each undertaking outlined in the plan/EIS can be more clearly identified. The Seashore will provide the New York State Historic Preservation Officer with a copy of the plan/EIS when it is ready for public release later this year. The NPS continues to welcome your input on any aspect of the project at any time during the preparation of the plan/EIS.

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If you have any questions or require any further information, please contact Christopher Olijnyk, Cultural Resource Manager, Fire Island National Seashore at 631-395-9693; or Michael Bilecki, Chief of Resource Management, at 631-687-4760. Thank you for your assistance.

Sincerely,

K. Christopher Soller
Superintendent

cc: Morgan Elmer, NPS-DSC
Tricia Wingard, VHB

Enclosure

United States Department of the Interior

NATIONAL PARK SERVICE
FIRE ISLAND NATIONAL SEASHORE
120 Laurel Street
Patchogue, New York 11772
(631) 687-4750

IN REPLY REFER TO:

L-7615 (Deer Management Plan DEIS)

May 30, 2014

Matthew Carroll, Chief
Unkechaug Indian Nation
P.O. Box 86
Mastic, New York 11950

Dear Mr. Carroll:

The National Park Service (NPS), in accordance with the National Environmental Policy Act (NEPA), is currently preparing a White-tailed Deer Management Plan and Environmental Impact Statement (plan/EIS) at Fire Island National Seashore (the Seashore). The purpose of the plan/EIS is to develop and analyze a range of strategies for managing deer to reduce their impacts on native vegetation, forest regeneration, cultural landscapes at the William Floyd Estate, and human-deer encounters at the Seashore.

When the Seashore initiated consultation under section 106 of the National Historic Preservation Act (NHPA) in a letter dated July 13, 2011 (enclosed), we intended to use the plan/EIS for compliance with both section 106 of the NHPA and NEPA. At this time, the extent of effects on cultural resources is uncertain; therefore, we are making an effect determination of no adverse effect for the issuance of the plan/EIS. In accord with our 2008 nationwide Programmatic Agreement we will undertake case-by-case consultation when locations and effects for each undertaking outlined in the plan/EIS can be more clearly identified. The Seashore will provide the Unkechaug Indian Nation with a copy of the plan/EIS when it is ready for public release later this year. The NPS continues to welcome your input on any aspect of the project at any time during the preparation of the plan/EIS.

If you have any questions or require any further information, please contact Christopher Olijnyk, Cultural Resource Manager, Fire Island National Seashore at 631-395-9693; or Michael Bilecki, Chief of Resource Management, at 631-687-4760. Thank you for your assistance.

Sincerely,

K. Christopher Soller
Superintendent

cc: Morgan Elmer, NPS-DSC
Tricia Wingard, VHB

Enclosure

United States Department of the Interior

NATIONAL PARK SERVICE
FIRE ISLAND NATIONAL SEASHORE
120 Laurel Street
Patchogue, New York 11772
(631) 687-4750

IN REPLY REFER TO:

L-7615 (Deer Management Plan DEIS)

May 30, 2014

Randy King
Trustee Chairman
Shinnecock Indian Nation
P.O. Box 5006
Southampton, New York 11969

Dear Mr. King:

The National Park Service (NPS), in accordance with the National Environmental Policy Act (NEPA), is currently preparing a White-tailed Deer Management Plan and Environmental Impact Statement (plan/EIS) at Fire Island National Seashore (the Seashore). The purpose of the plan/EIS is to develop and analyze a range of strategies for managing deer to reduce their impacts on native vegetation, forest regeneration, cultural landscapes at the William Floyd Estate, and human-deer encounters at the Seashore.

When the Seashore initiated consultation under section 106 of the National Historic Preservation Act (NHPA) in a letter dated July 13, 2011 (enclosed), we intended to use the plan/EIS for compliance with both section 106 of the NHPA and NEPA. At this time, the extent of effects on cultural resources is uncertain; therefore, we are making an effect determination of no adverse effect for the issuance of the plan/EIS. In accord with our 2008 nationwide Programmatic Agreement we will undertake case-by-case consultation when locations and effects for each undertaking outlined in the plan/EIS can be more clearly identified. The Seashore will provide the Shinnecock Indian Nation with a copy of the plan/EIS when it is ready for public release later this year. The NPS continues to welcome your input on any aspect of the project at any time during the preparation of the plan/EIS.

If you have any questions or require any further information, please contact Christopher Olijnyk, Cultural Resource Manager, Fire Island National Seashore at 631-395-9693; or Michael Bilecki, Chief of Resource Management, at 631-687-4760. Thank you for your assistance.

Sincerely,

K. Christopher Soller
Superintendent

cc: Morgan Elmer, NPS-DSC
Tricia Wingard, VHB

Enclosure

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APPENDIX B
VEGETATION MONITORING PLAN

INTRODUCTION

The vegetation monitoring plan enables the Seashore to analyze how vegetation within the boundaries of Fire Island National Seashore (Seashore) responds to management actions implemented as a result of the White-tailed Deer Management Plan and Environmental Impact Statement (plan/EIS). It also allows for the Seashore to monitor specific vegetation targets defined in the plan/EIS.

Specific targets have been established for forested areas of the park which include: The Sunken Forest, Talisman, Blue Point, and The William Floyd Estate. Due to the difficulty in establishing vegetation targets in habitat types other than forests, such as an early successional open swale habitat, the Lighthouse and Otis Pike High Dune Wilderness Area do not have specific vegetation targets. The desired condition in these areas would be to simply see a positive response in vegetation and an increase in native species diversity. Below is an overview of the plan. Please note, detailed protocols for monitoring are not included in this document but will be available in a separate document.

While not all areas throughout Fire Island can be monitored, data collected in surveyed areas can act as indicators for other non-surveyed areas. Only vegetation on federal tracts within the boundaries of the Seashore will be surveyed as part of this vegetation monitoring plan. Areas that fall within this plan are (from west to east) Lighthouse, Sunken Forest, Talisman, Blue Point, Otis Pike Fire Island High Dune Wilderness Area, and the William Floyd Estate. Monitoring of vegetation within established permanent plots will occur every 3 years (during the field season from May-September) after implementation of the plan/EIS. For logistical reasons, these surveys can be staggered within the 3 year period.

VEGETATION AREAS

LIGHTHOUSE

This area is primarily characterized by northern beach grass, dune, interdune beach grass, beach heather mosaic, northern dune shrub land, maritime deciduous shrub forest, brackish meadow, northern interdunal cranberry swale, and northern salt shrub (Klopfer et al. 2002). Permanent plots will be established in 2014 before the implementation of the plan/EIS.

SUNKEN FOREST

The Sunken Forest is an old-growth maritime holly forest and is ranked as a critically imperiled (G1 status) habitat. The desired future condition of the Sunken Forest is to maintain the character of the maritime holly forest in perpetuity by ensuring the regeneration of key canopy constituent tree species and a reasonable representation of herbs and shrubs reminiscent of its floristic composition when the Seashore was established.

Targets. The Sunken Forest vegetation monitoring utilizes 10m x 10m permanent vegetation plots established by Hank Art in 1967 (Art 1976). Targets for the Sunken Forest were created by utilizing data collected in 1967, a time in which deer were rarely seen on Fire Island. These targets fall into the range of what was observed in 1967.

TABLE B-1. TARGET FOR DENSITY OF SAPLINGS (>1 M IN HEIGHT AND <3.0 CM DBH) IN THE SUNKEN FOREST. ADAPTED FROM (ART 1976)

Common Name	Scientific Name	Stems/hectare
Canadian serviceberry	*Amelanchier canadensis*	380-580
Sassafras	*Sassafras albidum*	40-80
Black gum	*Nyssa sylvatica*	100-180
American holly	*Ilex opaca*	30-50
Black cherry	*Prunus serotina*	0-10

TABLE B-2. TARGET FOR DENSITY OF SHRUBS (>1 M IN HEIGHT AND < 3.0 CM DBH) IN THE SUNKEN FOREST. ADAPTED FROM (ART 1976)

Common Name	Scientific Name	Stems/hectare
Chokeberry	*Aronia arbutifolia*	400-750
Inkberry	*Ilex glabra*	300-550

TABLE B-3. TARGET FOR PERCENT COVER OF ALL VASCULAR PLANTS < 1 M TALL IN THE SUNKEN FOREST. ADAPTED FROM (ART 1976)

Common Name	Scientific Name	Form	Percent cover
Canada mayflower	*Maianthemum canadense*	Herb	1-2%
Starflower	*Trientalis borealis*	Herb	0.25%
Sarsaparilla	*Aralia nudicaulis*	Herb	6-10%
Solomon's seal	*Maianthemum stellatum*	Herb	1-2%
Bracken fern	*Pteridium aqualinum*	Herb	1%
Poison ivy	*Toxicodendron radicans*	Herb/ Liana/Woody	6-10%
Virginia creeper	*Parthenocissus quinquefolia*	Liana	3-4%
Grapes	*Vitis* spp.	Liana	1-2%
Canadian serviceberry	*Amelanchier canadensis*	Woody	1-2%
Black huckleberry	*Gaylussacia baccata*	Woody	6-8%
Northern bayberry	*Myrica pensylvanica*	Woody	1-2%
Black gum	*Nyssa sylvatica*	Woody	1-2%
Black cherry	*Prunus serotina*	Woody	<1%
Sassafras	*Sassafras albidum*	Woody	1-2%
Highbush blueberry	*Vaccinium corymbosum*	Woody	1-3%
Chokeberry	*Aronia arbutifolia*	Woody	1-2%
Ink berry	*Ilex glabra*	Woody	1-2%
Carolina rose	*Rosa carolina*	Woody	1-2%
Bog cranberry	*Vaccinium oxycoccus*	Woody	1-2%
Oaks	*Quercus* spp.	Woody	1%
Winged sumac	*Rhus copallinum*	Woody	1-2%
	TOTAL (native ground layer)	ALL	40-45%

TABLE B-4. A REVISED FORM OF DOMIN-KRAJINA COVER CLASS

Class	Domin-Krajina
1	<1%
2	1%
3	2-5%
4	6-10%
5	11-25%
6	26-33%
7	34-50%
8	51-75%
9	76-95%

TALISMAN AND BLUE POINT

Talisman and Blue Point are similar areas which mostly consist of maritime deciduous scrub forests and are also characterized by maritime holly forest (Klopfer et al. 2002). To monitor whether these two locations reach adequate recruitment or not, the Seashore modified the recruitment index and weighting factors established by McWilliams et al. 2005 (table C-5). While it was difficult to compare these forests to others in the Northeast, this modification seemed most appropriate after reviewing literature (see references below), considering vegetation survey methods practiced at this site, and reviewing the data available. These sections of maritime forests are also extremely stunted due to the conditions they grow in (barrier island). Permanent vegetation plots established in 2012 by Jordan Raphael (NPS Biologist) are used to monitor vegetation targets.

Targets. Densities of living "seedlings" are recorded within each 100 m2 (10 m x 10 m) permanent vegetation plot. There are 2 size class categories that need to be surveyed, and weighting factors are applied to each seedling according to its size class (table C-5). For example, one seedling that is greater than 150 cm in height and less than 1 cm DBH is equivalent to 50 "seedlings." Forest regeneration targets (adequate recruitment) will be reached when an average of 2 seedlings per square meter (20,000 seedlings per ha) is observed. Table 6 is a list of species (genus for *Quercus*) that are used to monitor targets; these 7 added together must reach the threshold of 2 seedlings per m2 (20,000 seedlings per ha). *Prunus serotina* (black cherry) is left out of the targets due to its dominance within the understory. Evidence suggests that deer avoid this species, and it has increased in dominance as a result (Horsley, Stout, and DeCalesta 2003; Forrester 2004).

TABLE B-5. SIZE CLASS WEIGHING. MODIFIED FROM MCWILLIAMS ET AL. 2005

Height Class	Weighting Factor
100-150 cm in height	20
>150 cm in height and <1 cm DBH	50

TABLE B-6. LIST OF TARGET "SEEDLING" SPECIES FOR EACH AREA

Blue Point and Talisman	
Common Name	**Scientific Name**
American holly	*Ilex opaca*
Canadian serviceberry	*Amelanchier canadensis*
Sassafras	*Sassafras albidum*
Black gum	*Nyssa sylvatica*
Oak	*Quercus* spp.
Winged sumac	*Rhus copallinum*
Pitch pine	*Pinus rigida*

Table C-7 provides a list of species that will be monitored in the maritime forest on Fire Island (Sunken Forest, Talisman, and Blue Point). This is subject to change if an increase of a new species is detected.

TABLE B-7. LIST OF SPECIES THAT WILL BE MONITORED IN THE MARITIME FOREST ON FIRE ISLAND

Common Name	Scientific Name	Form
Canada mayflower	*Maianthemum canadense*	Herb
Starflower	*Trientalis borealis*	Herb
Sarsaparilla	*Aralia nudicaulis*	Herb
Solomon's seal	*Maianthemum stellatum*	Herb
Seaside goldenrod	*Solidago sempervirens*	Herb
Bracken fern	*Pteridium aqualinum*	Herb
Cinnamon fern	*Osmunda cinnamomea*	Herb
Spinulose woodfern	*Dryopteris carthusiana*	Herb
Virginia marsh St. John's wort	*Triadenum virginicum*	Herb
Germander	*Teucrium canadense*	Herb
Swamp smartweed	*Polygonum hydropiperoides*	Herb
Sedges	*Carex spp.*	Herb
Jewelweed	*Impatiens capensis*	Herb
Eastern marsh fern	*Thelypteris palustris*	Herb
Salt meadow cordgrass	*Spartina patens*	Herb
Canada lettuce	*Lactuca canadensis*	Herb
Rush	n/a	Herb
Other grasses	n/a	Herb
Poison ivy	*Toxicodendron radicans*	Herb/ Liana/Woody
Blackberries	*Rubus* spp.	Liana
Virginia creeper	*Parthenocissus quinquefolia*	Liana
Grapes	*Vitis* spp	Liana
Greenbriar	*Smilax rotundifolia*	Liana
Cat greenbriar	*Smilax glauca*	Liana
Canadian serviceberry	*Amelanchier canadensis*	Woody
Salt bush	*Baccharis halimifolia*	Woody
Black huckleberry	*Gaylussacia baccata*	Woody
Northern bayberry	*Myrica pensylvanica*	Woody
Black gum	*Nyssa sylvatica*	Woody
Black cherry	*Prunus serotina*	Woody
Swamp azalea	*Rhododendron viscosum*	Woody

TABLE B-7. LIST OF SPECIES THAT WILL BE MONITORED IN THE MARITIME FOREST ON FIRE ISLAND (CONT'D)

Common Name	Scientific Name	Form
Sassafras	*Sassafras albidum*	Woody
Highbush blueberry	*Vaccinium corymbosum*	Woody
American holly	*Ilex opaca*	Woody
Chokeberry	*Aronia arbutifolia*	Woody
Ink berry	*Ilex glabra*	Woody
Carolina rose	*Rosa carolina*	Woody
Bog cranberry	*Vaccinium oxycoccus*	Woody
Cranberry	*Vaccinium macrocarpon*	Woody
Oaks	*Quercus* spp.	Woody
Winged sumac	*Rhus copallinum*	Woody
Eastern red cedar	*Juniperus virginiana*	Woody

OTIS PIKE FIRE ISLAND HIGH DUNE WILDERNESS AREA

Much of the wilderness area is characterized by an extensive saltmarsh and reedgrass marsh network. This site is also vegetated by northern dune shrubland, northern beach grass dune, pitch pine dune woodland, highbush blueberry shrub forest, and beach heath dune (Klopfer et al. 2002). Permanent plots will be established in 2014, before the implementation of the plan/EIS.

WILLIAM FLOYD ESTATE

The wooded lots of the William Floyd Estate is dominated by coastal oak-heath forest and also characterized by pitch pine-oak forest, maritime deciduous scrub forest, acidic red maple basin swamp forest (red maple-tupelo dominant) (Klopfer et al. 2002).

The Seashore has adopted recruitment index and weighting factors established and defined by McWilliams et al. 2005 (table C-8). This seemed most appropriate after reviewing literature (see references below), considering vegetation survey methods practiced at this site, and reviewing the data available. Permanent vegetation plots established by Jordan Raphael (NPS Biologist) in 2013 are used to monitor vegetation targets.

Targets. Forest regeneration targets (adequate recruitment) will be reached when an average of 2 seedlings (native and deer preferred species) per square meter is observed (McWilliams et al. 2005). To monitor for vegetation targets, the densities of living seedlings greater than 5 cm in height but less than 1 cm DBH are recorded within the four 1 m^2 subplots located at the corners of each 100 m^2 (10 x 10 m) plot. There are four height class categories that are surveyed, and weighting factors are applied to each seedling according to its height class (table C-2). For example, one seedling that is greater than 150 cm in height and less than 1 cm DBH is equivalent to 50 seedlings that are 5 cm–30 cm in height.

TABLE B-8. HEIGHT CLASS AND WEIGHTING FACTORS MODIFIED FROM MCWILLIAMS ET AL. 2005

Height Class	Weighting Factor
5-30 cm	1
30-100 cm	2
100-150 cm	20
>150 cm and < 1 cm DBH	50

Common nonnative invasive species found on Fire Island and the William Floyd Estate. This is subject to change if an increase of a new species is detected.

TABLE B-9. LIST OF NONNATIVE INVASIVE SPECIES FOUND ON FIRE ISLAND AND THE WILLIAM FLOYD ESTATE

Common Name	Scientific Name
Autumn olive	*Elaeagnus umbellata*
Black locust	*Robinia pseudoacacia*
Canada thistle	*Cirsium arvense*
Chinese lespedeza	*Lespedeza cuneata*
Chinese/Japanese wisteria	*Wisteria* spp.
Common mullein	*Verbascum thapsus*
Common reed	*Phragmites* spp.
Garlic mustard	*Alliaria petiolata*
Japanese barberry	*Berberis thunbergii*
Japanese black pine	*Pinus thunbergii*
Japanese honeysuckle	*Lonicera japonicus*
Japanese knotweed	*Polygonum cuspidatum*
Lesser celandine	*Ranunculus ficaria*
Mugwort	*Artemesia vulgaris*
Multiflora rose	*Rosa multiflora*
Norway maple	*Acer platanoides*
Oriental bittersweet	*Celastrus orbiculatus*
Spotted knapweed	*Centaurea maculosa*
Tree of heaven	*Ailanthus altissima*

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APPENDIX C
DEER MONITORING PLAN

INTRODUCTION

Deer population and deer behaviors will be monitored to gauge success of actions taken to meet Seashore objectives for the White-tailed Deer Management Plan and Environmental Impact Statement (plan/EIS) for Fire Island National Seashore. Objectives are written for the entire Seashore (Seashore-wide), as well as for specific areas such as the Sunken Forest, Fire Island communities, and the William Floyd Estate.

As outlined in chapter 2 of the plan/EIS, targets have been defined for deer population and deer behavior. This monitoring plan serves as a strategic operating plan for monitoring deer population and deer behavior throughout the life of the plan/EIS. Data collected will be used to inform Seashore managers on the success of management actions in the preferred alternative.

DEER POPULATION MONITORING

BACKGROUND

Distance sampling surveys have been conducted at Fire Island National Seashore to estimate white-tailed deer densities within certain areas of Fire Island since 1995 (Underwood, Verret, and Fischer 1998). This annual effort was done in tandem with the long-term fertility control research project through 2009 and has been continued since. The Seashore has been separated into several locales/sites for surveying: Robert Moses State Park, Lighthouse Tract, Kismet to Lonelyville, Ocean Beach to Ocean Bay Park, Sailors Haven, Fire Island Pines, Davis Park, Fire Island Wilderness and the William Floyd Estate. The goal each year is to survey all sites; however, not all locales are surveyed every year due to staffing, budgetary and time constraints. Protocols are outlined in Underwood, Verret, and Fischer (1998) and were updated in NPS (2009).

Distance sampling theory accounts for partial detection, assuming that only animals directly on the survey route or transect will be detected, and that the probability of detection will decrease away from the transect line (Buckland et al 1993). This alleviates the need to correct for missed animals. The detection function describes the decrease in ability of the surveyor to detect objects with increasing distance from the transect. The area around the transect where objects are counted can be computed from this function. This model is then used to calculate the effective strip width (ESW), where the number of animals detected inside the ESW equals the number of animals detected outside the ESW.

The Seashore uses DISTANCE 6. 0 (Thomas et al 2010), a free software program, to fit the detection function, calculate the ESW and fit a density function to the distance sampling data collected. This process is used to generate deer densities for white-tailed deer within each of the study units at Fire Island National Seashore. The Seashore has partnered with Dr. H. B Underwood (USGS and SUNY-ESF) in generating deer densities from DISTANCE 6. 0 from field data collected by NPS staff and interns.

SURVEY PROCEDURES/DATA COLLECTION

Sites, along with routes, for monitoring deer populations across Fire Island and at the William Floyd Estate are detailed in Underwood, Verret, and Fischer (1998) and NPS (2009). The name and length of each boardwalk or road is stored in a digital database for community sites (except Davis Park) and the William Floyd Estate. Samples of boardwalk segments or roads are drawn randomly

for a given survey. The total number of boardwalks or roads selected is based upon a minimum length of transect required to achieve a desired level of precision (Underwood, Verret, and Fischer 1998). For all other sites with smaller areas and accessibility there are predetermined routes that meet the length requirement for a desired level of precision (Underwood, Verret, and Fischer 1998; NPS 2009). Community sites and most natural areas on Fire Island are surveyed every year, whereas the William Floyd Estate and Fire Island Wilderness are surveyed every 2-3 years. Once the plan/EIS is implemented, these areas would also be surveyed annually.

Surveys are initiated either 20 minutes before official sunrise or timed so the survey is finished just before sunset. This is to ensure sampling is conducted when deer are most active. In addition, the surveyor must proceed slowly in order to scan both sides of the transect thoroughly and with equal efficiency. If conducting the survey from within a vehicle, speeds are constrained to no more than 10 mph.

When a deer group (≥ 1 deer) is encountered, data should be collected as rapidly and quietly as possible. Ideally, deer should be detected and observed before they become aware of the researcher's presence. Binoculars are utilized to observe details of appearance and behavior when necessary (e.g., determining sex or age at a distance).

In the communities (with random survey routes), observations of deer are recorded on the first passage through a segment of the selected boardwalk. Any observations made while backtracking through a boardwalk are not counted. The surveyor should take the shortest route from one selected boardwalk to the next to minimize the time lapse between observations. This also allows deer less time to travel, thereby reducing the chances of viewing the same animal more than once. A map and pre-determined route should be chosen and studied before starting the survey.

The following is a list of data to be collected in the field:

1) Herd Composition

Individuals within each deer group encountered are classified according to sex and age at the time of sampling. Group size is also included. If group membership is questionable, distances and angles to each deer are recorded as if it were alone. These observations are marked uniquely, then discussed and resolved later.

Sex is classified as (1) male, (2) female or (3) unknown. Age is classified as (1) fawn (less than 1 year-old), (2) yearling (between 1-2 years old), (3) adult (greater than 2 years old) and (4) unknown. In addition, it should be noted whether fawns have spots visible on their coats. Physical morphological criteria developed from numerous observations of deer are used to determine the sex and age of individuals.

2) Perpendicular Distance

After initial observations are made, the perpendicular distance from the observer is recorded using a hand-held laser rangefinder. If the deer has moved from its original location, the distance from another object close by can be used. The distance is estimated for deer less than 15 m away by the observer.

If the perpendicular distance cannot be measured directly, the following measurements are taken: (1) radial distance (i.e., distance from where you located deer), (2) transect direction (compass bearing), and (3) object direction (compass bearing). These measurements are used to

calculate the angle to the object and perpendicular distance is computed later in DISTANCE. In addition, a GPS point should be recorded for each detection.

3) Ancillary Data

Ancillary data includes: information on the initial, habituation/reactive and undesirable food conditioning behavior of deer in each detection (Table B-1); forage type, if applicable (table B-1); start/end times of each survey; and GPS points for each detection.

NOTE: There are three properties of distance data that are fundamental for reliable density estimation:

1) The person/s surveying a particular unit must remain the same within sampling of that unit due to individual differences in detection.
2) There must be enough objects observed by the surveyor/s to adequately describe the probability of detection as a function of the perpendicular distance from the transect. In sum, the more objects (i.e., deer) observed, the smoother the representation of the detection function. For distance data of deer at Fire Island National Seashore we aim for 60-80 detections per site each year. This number may need to be adjusted in the future, as the preferred alternative is implemented and the white-tailed deer population declines.
3) The transect length needs to be sufficient to achieve a desired level of precision. Based on estimates generated in DISTANCE, the total length needed to travel has been estimated for each study site.

DEER BEHAVIOR MONITORING

Behavioral data of deer is collected in conjunction with distance sampling data. Initial behaviors of deer when first sighted were collected from 1995 through 2007. Undesired behaviors were also noted, such as a deer feeding from a trash can. However, it's uncertain how standardized and consistent these notes have been through time.

Since 2008, we have followed a standard protocol for monitoring deer behavior. First, we use the same sites used for distance sampling and categorize them as Community or Non-community. Community sites include: Kismet to Lonelyville, Ocean Beach to Ocean Bay Park, Fire Island Pines and Davis Park. Non-community sites include: Robert Moses State Park, Lighthouse Tract, Sailors Haven, Wilderness-West (Watch Hill to Bellport Beach) and Wilderness-East (Bellport Beach to Wilderness Visitor Center). A specific objective in the White-tailed Deer and Vegetation Management plan/EIS is to reduce human-deer interactions within Fire Island communities (i.e., community sites). Non-community sites provide the Seashore with acceptable targets (rather than just zero) for deer behaviors related to human-deer interactions.

Two different kinds of deer behavior are recorded: (1) initial behaviors, including food conditioning behaviors and forage type (if applicable); and (2) habituation/reactive behaviors (table B-1). Initial behavior refers to the behavior that the majority of the group are engaged in at the time of detection. Habituation/reactive behaviors describe response to the observer's presence; an individual or group of deer within a detection is considered unaffected if they do not react to the observer's presence. The behaviors during the surveys could be affected by the distance of the deer from the transect, and whether an individual or deer group is aware of the observer's presence. Behaviors are coded (table B-1) and proportions calculated.

TABLE C-1: BEHAVIOR AND FORAGE TYPE CATEGORIES AND CODES DURING WHITE-TAILED DEER DISTANCE SAMPLING SURVEYS, POST-2008

Initial Behaviors		**Food Conditioning Behaviors**	
Code	**Activity**	**Code**	**Activity**
ST	Standing	F4	Foraging from a 4-Poster device
FO	Foraging	FT	Foraging from an overturned trash can
BE	Bedding	FD	Being directly fed by a person
WA	Walking		
RU	Running		
Habituation/Reactive Behaviors		**Forage Type**	
Code	**Activity**	**Code**	**Type**
AP	Approached	N	Native plant
UN	Unaffected	NNP	Non-native plant or food
WA	Walked away		
RA	Ran away		

Three additional food conditioning behaviors are also noted: (1) foraging from a 4-Poster device, (2) foraging from an overturned trash can/s, or (3) being fed by a person. These are noted in addition to the initial and habituation/reactive behaviors already being recorded for each detection, if they occurred. Since 2008 these three additional behaviors have only been observed in community areas.

Forage type is a subcategory of foraging and is noted when applicable as (1) native plants or (2) nonnative plants or food. Nonnative plants or food includes ornamental plantings, identifiable nonnative plants, corn from 4-Poster devices, garbage or any other food items.

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APPENDIX D
REVIEW OF WHITE-TAILED DEER FERTILITY CONTROL

INTRODUCTION

Managing the high density of certain wildlife species has become a topic of public concern (Rutberg et al. 2004). Species such as Canada geese (*Branta canadensis*), coyotes (*Canis latrans*), and white-tailed deer (*Odocoileus virginianus*) have become either locally or regionally highly dense in many areas in the United States (Fagerstone et al. 2002). Traditional wildlife management techniques such as hunting and trapping are often unfeasible, publicly unacceptable, or illegal in many parks, urban, and suburban areas, forcing wildlife managers to seek alternative management methods (Kilpatrick and Walter 1997; Muller, Warren, and Evans 1997). The use of reproductive control as a wildlife management tool has been studied for several decades.

For reproductive control agents to effectively reduce population size, treatment with an agent must decrease the reproductive rate to less than the mortality rate in a closed population with no immigration or emigration. In an open population, where there is much animal movement into and out of an area being considered for treatment, the use of fertility control agents is not likely to be successful in decreasing a population (Rudolph, Porter, and Underwood 2000). Good estimates of population emigration, immigration, birth and survival rates are needed before predictive models can be used to approximate the effort required to successfully use contraception as a population management technique.

The purpose of this document is to provide NPS managers at Fire Island National Seashore with: (1) a brief overview of contemporary reproductive control options as they pertain to white-tailed deer; (2) an outline of the primary advantages, disadvantages and challenges related to the application of wildlife fertility control agents including population management challenges, regulatory issues, potential logistical issues, and consumption issues; (3) an evaluation of current fertility control agents against criteria established by the Seashore for use of a reproductive control agent. This document is not intended to be exhaustive but to provide a scientifically sound basis for understanding and evaluating deer management alternatives that include reproductive control of female deer.

It is important to note that some of the most critical elements of a successful population level fertility control program focus on ecological and logistical questions rather than the efficacy of fertility control agents in individual animals. It should also be noted that technology and regulation is changing rapidly in this field and updated information should be reviewed prior to implementation of a deer management program that involves fertility control.

There is general agreement that controlling large, open, free-ranging populations of wild ungulates solely with a contraceptive vaccine is impractical and unlikely to succeed because of the logistical difficulties of treating significant numbers of deer (Rutberg et al. 2004; Garrott et al. 1992; Garrott 1995; Warren 2000; Rudolph, Porter, and Underwood 2000; Cowan, Pech, and Curtis 2002; Merrill, Cooch, and Curtis 2003, 2006). There is also agreement that fertility control as an exclusive means of managing populations cannot reduce wildlife population size rapidly (Rutberg and Naugle 2008a; Kirkpatrick and Turner 2008). The few long-term (greater than 10 years) research projects evaluating population level effects of porcine zona pellucida vaccine (PZP) on long-lived species (horses and deer) support this statement. At Assateague Island National Seashore, PZP treatments were successful in reducing the wild horse population 16% (from 160 to 135 individuals) between 1994 and 2009 (15 years). The park expects to reach the target population size of 80–100 horses in another 5-8 years (Zimmerman, pers. comm., 2009). At Fire Island National Seashore, the Fire Island communities funded a research study through The Humane Society of the United States to evaluate the viability of immunocontraception as a newly emerging form of deer population control. The program began in 1993 and ended in 2009, lasting 16 years. Seashore staff report a 33% reduction in

overall deer population size (from approximately 600 to 400 individuals) between 1994 and 2009 (Bilecki, pers. comm., 2009). In the most intensively treated areas of Fire Island, deer population size decreased up to 55% over 15 years (Rutberg and Naugle 2008a). All population level studies have been conducted in relatively closed populations. The appropriateness of fertility control as a deer management tool is heavily dependent on specific park objectives, local deer population dynamics, and the purpose and need for management.

CURRENT TECHNOLOGY

The area of wildlife contraception is constantly evolving as new technologies are developed and tested. For the sake of brevity, this appendix will only discuss reproductive control as it applies to female deer. There is a general understanding in white-tailed deer biology that managing the female component of the population is more important than managing the male component. Based on the polygamous breeding behavior of white-tailed deer, treating males with reproductive control would be ineffective when the goal is population management (Warren 2000; Garrott and Siniff 1992).

Regulation of wildlife fertility control agents can be confusing. If a product is intended for use in a food-producing animal, it must be deemed safe for human consumers. Regardless of its use in food animals, a fertility control agent must be considered safe for use in the target species and not present environmental health hazards to non-target species. Until 2006, the Food and Drug Administration (FDA) was the agency responsible for regulation of wildlife contraceptives and their potential for drug residues. In 2006, the Environmental Protection Agency assumed responsibility for regulating contraceptives for use in free-ranging wildlife and feral animals (Fagerstone et al. 2010). After a product is federally registered with the EPA it must also be registered for use in each individual state where a wildlife management agency or organization would like to apply a product.

The EPA in consultation with the contraceptive manufacturer/sponsor will determine the safety of the product and marking requirements for free-ranging animals treated with contraceptives. Prior to EPA registration products can be studied in free-ranging populations to gather safety and efficacy data under an experimental use permit (EUP) which is obtained from the EPA by the product's sponsor. Until products are registered by the EPA, and marking requirements made explicit, animals treated with any fertility control product should be permanently marked.

Marking is also needed for long-term monitoring of contraceptive efficacy in individual animals, determining which deer have been treated during implementation and for efficient re-treatment, and to monitor population vital rates. Finally, while NPS units have jurisdiction for wildlife management within their borders, parks are strongly encouraged to cooperate and coordinate with state agencies to manage cross boundary wildlife resources whenever possible (43 CFR § 24). Therefore, parks should also communicate with appropriate state agencies regarding marking of treated animals in areas where deer may cross park boundaries. The disadvantages of permanent marking are primarily related to the substantial additional labor and costs of the first year's capture and marking of treated animals, sustainability of this effort over the long-term, capture associated stress to individual deer (compared to remote delivery), and potential social acceptance concerns. Despite these drawbacks, marking is nearly always warranted when considering a fertility control program.

There are three basic categories of reproductive control technology: (1) immunocontraceptives (vaccines), (2) non-immunological methods (pharmaceuticals), and (3) physical sterilization.

Immunocontraceptives

It has been suggested that immunocontraceptive vaccines offer significant promise for future wildlife management (Rutberg et al. 2004). Immunocontraception involves injecting an animal with a vaccine that stimulates its immune system to produce antibodies against a protein (antigen) involved in reproduction (Warren 2000). In order to induce sufficient antibody production, an adjuvant is combined with the antigen. An adjuvant is a product that increases the intensity and duration of the immune system's reaction to the vaccine. There are two primary types of antigens used in reproductive control vaccines in deer: porcine zona pellucida (PZP) and gonadotropin releasing hormone (GnRH).

Neither PZP nor GnRH vaccines are 100% effective in preventing pregnancy. Using a 2 dose vaccination protocol Curtis et al. (2002) demonstrated approximately 85-90% decrease in the number of fawns born per female after vaccination with either GnRH or PZP immunocontraceptive vaccines in white-tailed deer. Likewise, Rutberg and Naugle (2008a) showed a 75% decrease in annual fawn production using traditional PZP vaccination in two relatively closed white-tailed deer populations and most recently demonstrated 95-100% decrease in fawning the first year and 65-70% the second year after a single vaccination using several long-term and delayed release PZP vaccines (Rutberg et al. 2013). In a more contemporary version of the GnRH vaccine, Gionfriddo et al. (2009, 2011) found approximately 70-90% infertility the first year and 40-50% infertility the second year in white-tailed deer after a single vaccination. The GnRH vaccine has not been evaluated at the population level. Efficacy generally decreases as antibody production wanes when using any immunocontraceptive. Reduced pregnancy rates can usually be expected for 1-2 years post-treatment with immunocontraceptive vaccines although there is the potential for longer-term or even permanent sterility (Fraker et al. 2002; Miller et al. 2008, 2009; Gionfriddo et al. 2011; Rutberg et al. 2013). Duration of infertility is strongly related to the conjugate-antigen design, the adjuvant used, how the vaccine is delivered, and the host's immune system (Miller et al. 2008, Kirkpatrick et al. 2009).

Porcine Zona Pellucida (PZP). The majority of immunocontraceptive research in wildlife has been conducted using PZP vaccines. PZP vaccines stimulate production of antibodies directed towards specific outer surface proteins of domestic pig ova (eggs). Pig ova are sufficiently similar to many other mammals' ova and antibodies produced will cross-react with the vaccinated animal's own ovum. PZP antibodies prevent fertilization, presumably by blocking the sperm attachment sites on the zona which surrounds the ovum. There are currently several PZP vaccine products being developed, one is called SpayVac®, another is simply called PZP, and finally there is heat extruded and cold evaporated pelleted PZP. Each can be mixed with different adjuvants which may change their efficacy.

SpayVac® (ImmunoVaccine Technologies, Halifax) uses a liposome preparation of PZP mixed with an adjuvant to induce antibody production. This vaccine has been evaluated in a variety of species, including captive and to a lesser extent free-ranging white-tailed deer (Brown et al. 1997; Fraker et al. 2002; Locke et al. 2007; Rutberg and Naugle 2009; Rutberg et al. 2013). Potential advantages of SpayVac® compared to the native PZP vaccine are: 1) a more rapid immune response, 2) higher antibody titers, 3) a higher proportion of antibodies that bind to target sites, and 4) longer duration of efficacy (Fraker and Bechert 2007; Miller et al. 2009). Although little long-term data on population level effects exists for SpayVac®, it is assumed effects are similar to those for the native PZP formulation. The second PZP vaccine, often called "native" PZP, has been used extensively in captive wildlife species in the course of investigating its effectiveness (Kirkpatrick et al. 1997; Turner, Kirkpatrick, and Liu 1996; Walter et al. 2002a, 2002b). This vaccine requires multiple vaccinations (e.g., 2 the first year and yearly thereafter) to maintain high antibody titers. The native PZP vaccine

has also been tested at length in free-ranging white-tailed deer (Rutberg and Naugle 2008a; Naugle et al. 2002; Rudolph, Porter, and Underwood 2000; Rutberg et al. 2004; Walter et al. 2002a, 2002b; Walter, Kilpatrick, and Gregonis 2003). Potential benefits of the native vaccine include the ability to deliver the vaccine remotely via darts, its safety in pregnant deer and non-target species (Barber and Fayrer-Hosken 2000), and the availability of at least some long-term data on population level effects (Rutberg and Naugle 2008a).

Finally, the delayed release heat extruded or cold evaporated pelleted vaccine has recently been tested in free-ranging deer. Advantages are increased efficacy and single application which lasts up to two years but requires hand-injection and has strict vaccine storage requirements (Rutberg et al. 2013). There are no long-term or population level data on this new technology.

Challenges to the use of all PZP vaccines include lack of regulatory approval for use in free-ranging deer populations, behavioral impacts (e.g., continued estrous cycling), out of season fawning, and possibly changes in body condition. None of the PZP vaccines are currently registered for use in free-ranging deer but may be in the future (see above for regulatory issues).

PZP based vaccines often cause out of season breeding behavior in treated deer because 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 male/female rutting behaviors. Additionally, extended estrous seasons may result in late pregnancies if the vaccine fails (Fraker et al. 2002; McShea et al. 1997). Fawning later in the summer/fall may lead to higher fawn mortality as winter ensues. Any effect that extends the rut also has the potential for secondary effects to both male and female deer. Increased attempts to breed may result in increased deer movements. It has been suggested that this may encourage deer-vehicle collisions. However, the only known research evaluating this specific issue reported that deer treated with PZP were at no greater risk of being involved in a deer-vehicle collision than untreated deer (Rutberg and Naugle 2008b).

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). Alternatively, PZP-treated females may experience increased body condition and a longer life span compared to untreated individuals as a result of reduced energetic costs of pregnancy and lactation (Warren 2000; Hone 1992). For example, at Assateague Island National Seashore, the life span of horses treated with PZP has been extended from an average age at death of 20 years to 26-30 years (Kirkpatrick and Turner 2008; Zimmerman, pers. comm., 2009). Longer life span may extend the time needed to observe a decline in population size (Kirkpatrick and Turner 2008). Studies in white-tailed deer investigating effects on body condition are equivocal (Walter, Kilpatrick, and Gregonis 2003; McShea et al. 1997). There are no long-term studies investigating potential extended survival in free-ranging wild deer.

Successful field application of a fertility control program requires both an effective agent and a practical delivery system (Cowan, Pech, and Curtis 2002). Although PZP vaccines may be successfully delivered remotely through darting, the native PZP vaccine that has been tested most extensively requires a series of two initial doses followed by periodic boosters in order to maintain infertility. The need for multiple doses leads to significant logistical issues when working with free-ranging white-tailed deer, particularly when the number of deer to be treated is high. SpayVac® does not require a first year booster and may prove to be easier to implement because follow-up doses would only be required every 3-7 years (Fraker, pers. comm., 2009), however, to our knowledge SpayVac® has not been delivered remotely. The new long-term pellets cannot be delivered via dart.

Many studies have modeled and a few field studies have tested population-level effects of PZP vaccination (Rutberg et al. 2004; Nielsen, Porter, and Underwood 1997; Rudolph, Porter, and Underwood 2000; Rutberg and Naugle 2008a; Rutberg et al. 2013). Research evaluating the effectiveness of PZP in reducing the size of deer populations has focused on moderate to high density deer populations of relatively small size (less than 300-500 individuals). Within these populations, long-term (greater than 10 years) data indicates that population size may gradually decline using PZP treatments (Kirkpatrick and Turner 2008; Rutberg and Naugle 2008a). Rutberg and Naugle (2008a) reported a 27% decline in the size of a small, relatively closed, suburban deer population (approximately 250 deer) between 1997 and 2002, as a result of PZP treatments and potentially other stochastic events. However, level of success in reducing population size varies widely. For example, deer density on Fire Island National Seashore was significantly reduced in some areas but reduced very little in other areas likely due to inability to treat significant numbers of does in certain areas (Rutberg and Naugle 2008a; Underwood 2005). Site specific modeling using accurate population demographic and vital rate data as well as knowledge of local deer behavior, land access availability and likelihood of achieving treatment application goals is needed to determine how fast a population can be reduced and how deep a reduction can be achieved.

Additional information on PZP may be obtained at:
http://www.aphis.usda.gov/wildlife_damage/nwrc/research/reproductive_control/index.shtml or http://www.pzpinfo.org.

Gonadotropin Releasing Hormone (GnRH) Vaccines. GnRH is a small neuropeptide (a protein-like molecule made in the brain) that plays a necessary role in reproduction. It is naturally secreted by the hypothalamus (a region of the brain that regulates hormone production), which directs the pituitary gland to release hormones (luteinizing hormone and follicle stimulating hormone) that control the function of reproductive organs (Hazum and Conn 1988). In an attempt to interrupt this process, research has focused on eliminating the ability of GnRH to trigger the release of reproductive hormones. One option is vaccination against GnRH. Antibodies produced in response to vaccination likely attach to GnRH in the hypothalamic region and prevent the hormone from binding to receptors in the pituitary gland, thus suppressing the secretion of reproductive hormones and preventing ovulation.

GnRH vaccines have been investigated in a variety of wild and domestic ungulates (hoofed mammals) (Adams and Adams 1990; Curtis et al. 2002; Miller, Johns, and Killian 2000c; Miller, Rhyan, and Drew 2004). One GnRH vaccine that has been developed specifically for wildlife contraception is GonaCon™. GonaCon™ is registered with the EPA as a restricted use pesticide to control white-tailed deer fertility. The label requires marking the treated animal to prevent accidental re-injection and giving the vaccine by hand-injection which limits the potential for non-target animal and environmental exposure to the vaccine.

Potential benefits of this vaccine include a relatively long-lasting contraceptive effect (1-2 years and potentially longer) and possibly the lack of repeated estrous cycles (Curtis et al. 2002). In free-ranging white-tailed deer, GonaCon™ is estimated to be 70–90% effective in preventing pregnancy during the first year post-treatment, and approximately 40–50% effective in the second year (Gionfriddo et al. 2009, 2011), however long-term field efficacy data currently does not exist. Although the label indicates a minimum of 1 year efficacy, the contraceptive effect typically lasts two years and possibly longer in some individuals (Fagerstone et al. 2008). Repeated estrous cycling and other behavioral changes in white-tailed deer have not been consistently documented in association with GnRH vaccines (Curtis et al. 2008). However, Killian et al. (2008) reported that behavioral expressions of estrus were only decreased for 1–2 years post-treatment and increased in subsequent

years despite does remaining infertile and Curtis et al. (2002) reported sporadic and delayed estrous cycling with prolonged fawning season in GnRH vaccinated deer as contraceptive effects waned.

GnRH vaccines have many of the same challenges associated with PZP including the need for repeated treatment to maintain long-term infertility, and the need to mark treated animals. Additionally, as with any vaccine which uses the adjuvant AdjuVac™, immune response to the adjuvant may interfere with determination of the animal's Johne's disease status (a gastrointestinal disease of potential regulatory importance for domestic livestock) (Miller et al. 2008). Managers should be aware of this prior to vaccination if neighboring lands have domestic livestock grazing.

Other challenges to use of GonaCon™ include potential health effects on treated deer (Kirkpatrick, Lyda, and Frank 2011), lack of information related to effectiveness at the population level in free-ranging deer, and requirement for hand-injection. Killian et al. 2006a concluded that GonaCon™ was safe for deer and that there were no adverse health impacts associated with unintentional repeated vaccination. Granulomas (a localized inflammatory response to the vaccine that occurs at the site of injection and can persist for many years post-treatment) and injection site abscesses are consistently associated with vaccination; however, they do not appear to cause negative health impacts (Curtis et al. 2008; Gionfriddo et al. 2009). Overall, no debilitating, long-term impacts on health or changes in behavior have been consistently associated with GnRH vaccination in female deer.

Similar site specific modeling and population data are required for evaluating the potential for success in managing a free-ranging deer population with GonaCon™ as was described for PZP immunocontraception.

Additional information may be obtained at:
http://www.aphis.usda.gov/wildlife_damage/nwrc/research/reproductive_control/index.shtml

Non-immunological Reproductive Control Methods

This group of reproductive control agents includes GnRH agonists, GnRH toxins, steroid hormones, and contragestives.

GnRH Agonists. GnRH agonists are highly active analogs of GnRH which are similar in structure and action to the endogenous hormone. The exact mechanism of action of GnRH agonists is not completely understood; regardless they suppress the biological activity of endogenous GnRH. As a result of this suppression, reproductive hormones are not released (Aspden et al. 1996; D'Occhio, Aspden, and Whyte 1996). Continuous administration of the agonist is necessary to maintain infertility. This can be accomplished with controlled-release formulations or surgically implanted pumps or by daily administration.

Not all agonists have the same effects in all species. In fact, some can have an effect that is the opposite of what is intended. The wide variation in response is likely due to a combination of type of agonist, dose, treatment regime, reproductive status, sex, and species (Becker and Katz 1997). Therefore, it is important to fully understand the effects of a product on a given species. Although many GnRH agonists are used in human as well as veterinary medicine only a few have been investigated in wildlife species (Becker and Katz 1997; Vickery 1986). GnRH agonists have been tested primarily in mule deer and elk and been shown to both suppress reproductive hormones and prevent pregnancy (Baker et al. 2002, 2004, 2005; Conner et al. 2007).

- Leuprolide acetate: Leuprolide is a GnRH agonist that when administered as a controlled-release formulation, results in 100% pregnancy prevention in treated female elk and mule deer (Baker et al. 2002, 2004; Conner et al. 2007). In addition, the treatment is reversible, and the effects last only for a single breeding season (Baker et al. 2004; Trigg et al. 2001). Advantages of leuprolide acetate are that it is 100% effective in preventing pregnancy, is safe for human consumption (Baker et al. 2004), can be delivered remotely (Baker et al. 2005), does not result in physiological side effects, and there are few behavioral effects (Baker et al. 2004). Treatment did not suppress reproductive behavior during the breeding season but also did not prolong behaviors into the non-breeding season.

  Leuprolide is FDA-approved for use in humans and has been used experimentally in cervids. It is not currently approved for use in free-ranging wildlife as a fertility control drug. It is not known if this application will be pursued in the future. The need to deliver leuprolide subcutaneously via hand injection has traditionally been considered a significant barrier to the long-term application of this drug as a wildlife management tool. However, Baker et al. (2005) successfully applied the treatment through dart delivery which may extend the practical application of this contraceptive.

  Treatment using leuprolide differs from GnRH vaccines in that it does not require an adjuvant and does not induce an antibody reaction. Therefore, inflammatory responses to adjuvant components and other physiological effects, often observed with immunocontraceptives, have not been observed in association with leuprolide. It does, however, require a slow release implant that remains under the skin or in the muscle. Additionally, leuprolide does not likely pose a threat to the environment or nontarget species because the drug is not absorbed through the oral route of administration (Baker et al. 2004). Marking requirements for animals treated with leuprolide implants are currently unknown because it is not a registered wildlife contraceptive.

  One drawback to the use of leuprolide is the need to treat animals within a short timeframe prior to the breeding season (Conner et al. 2007). If a female is not retreated each year then she has the same chances of becoming pregnant as an animal that was never treated. The need to treat a potentially large number of individuals within a short period of time on an annual basis reduces the feasibility of leuprolide as a wildlife management tool, particularly for large, free-ranging, open deer populations.

- Histrelin acetate: Histrelin acetate is effective in suppressing a key reproductive hormone in white-tailed deer (Becker and Katz 1995). However, testing was conducted using a mini-pump that was surgically implanted under the animal's skin. This is an infeasible route of administration in free-ranging animals. In the future, a delivery system with slow release characteristics may help to make this a more feasible option for free-ranging wildlife. It is likely that histrelin acetate will also suppress ovulation and pregnancy in white-tailed deer, although this remains to be tested.

GnRH Toxins. GnRH toxins consist of a cellular toxin that is combined with a GnRH analog (either agonist or antagoinst). A GnRH analog is a synthetic peptide similar to the body's own gonadotropin-releasing hormone. Using the analog as a carrier, a cellular toxin can be delivered to specific cells in the pituitary which produce reproductive hormones. Internalization of the toxin leads to cell death. When this occurs, the production of reproductive hormones (leuteinizing hormone and follicle stimulating hormone) is affected. This process has been studied in male dogs (Sabeur et al. 2003), domestic sheep (Nett et al. 1999), rats (Kovacs et al. 1997), and female mule deer

(Baker et al. 1999) but the technology is still in the developmental stages and not ready for use in free-ranging wildlife.

Steroid Hormones. The field of wildlife contraception began with research examining the manipulation of reproductive steroid hormones (Matschke 1977a, 1977b, 1980). Treatment usually entails the application of synthetic hormones, such as norgestomet, and melangestrol acetate (Jacobsen, Jessup, and Kesler 1995; DeNicola, Kesler, and Swihart 1997a; Fagerstone et al. 2010). Available products are administered via slow release implants or repeated feeding and have demonstrated variable efficacy and duration of infertility. Most products that are available are used in domestic animal or zoological veterinary medicine and have not been tested widely in free-ranging wildlife. Issues related to using steroids include difficulties in treating large numbers of animals for extended periods of time, potential reproductive tract pathological side effects experienced by the treated animals, and concerns over the consumption of treated animals by nontarget species and humans. Although many of these hormones are used as growth promotants in domestic food animal production, they are not labeled for use in free-ranging wildlife. Currently, this method of contraception is not being pursued by the wildlife management community.

Contragestives. Contragestives are products that prevent or terminate pregnancy. Progesterone is the primary gestational hormone for maintaining pregnancy in mammals. Many contragestives act by preventing progesterone production or blocking its effect, thereby affecting pregnancy. The primary contragestive that has been researched for use in domestic animals and white-tailed deer is an analog of Prostaglandin F2α (PGF2α) (Becker and Katz 1994; DeNicola, Kesler, and Swihart 1997b; Waddell et al. 2001). Lutalyse® is a commercially available form of PGF2α. Unlike many of the other alternatives, there are no issues related to consumption of the meat when the animal has been treated with this product. Challenges with contragestives include timing of administration, efficacy, potential to rebreed if breeding season is not finished, and the potential for aborted fetuses on the landscape. These limitations make their use in free-ranging populations for fertility control purposes unlikely.

Sterilization. Surgical sterilization of females is an effective method of controlling reproduction and has been used extensively in domestic animal medicine. However, implementation requires capture, general anesthesia, and surgery conducted by a veterinarian which is generally considered labor intensive and costly (Boulanger et al. 2012) and calls into question the long-term sustainability of sterilization as a wildlife management tool, except under very limited circumstances. Boulanger et al. (2012) notes that surgical sterilization is a costly but effective technique for reducing suburban deer herds if 80% or more of the female deer in a population are sterilized and that proportion is maintained over time. Overall success was greatest for closed populations. Only in rare circumstances is physical sterilization reversible.

Depending on the method of sterilization, this procedure may have behavior effects on both male and female deer. If gonads are removed, then the source of important reproductive hormones will be removed. This is likely to change deer social interactions. If gonads are not removed, females will continue to ovulate and show behavioral signs of estrus and consequently may extend the breeding season.

EVALUATION OF FERTILITY CONTROL AGENTS BASED ON SELECTION CRITERIA ESTABLISHED BY FIRE ISLAND NATIONAL SEASHORE

Five criteria were established for Fire Island National Seashore that reflect minimum desired conditions for using a reproductive control agent. Only when these criteria are met would reproductive control be implemented. These criteria assume that the agent poses no significant health risk to the deer.

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)

TABLE D-1. EVALUATION OF FERTILITY CONTROL AGENTS BASED ON SELECTION CRITERIA FOR FIRE ISLAND NATIONAL SEASHORE

Agent	Criterion 1 Federally Approved and State Registered	Criterion 2 Multi-year efficacy (3+)	Criterion 3 Capable of remote administration	Criterion 4 Meat Safe for Humans	Criterion 5 Minimal Impact on Deer Behavior
Immunocontraceptives					
"Native" PZP	No	No	Yes	Likely, but need EPA approval	No – repeated estrous cycles
SpayVac®	No	Possibly[c]	Unknown		No – repeated estrous cycling
Long-term pelleted PZP	No	Possibly[d]	No		Unknown – likely repeated estrous cycles
GnRH	No[a]	Possibly[e]	Possibly[f]	Yes	Yes
GnRH Agonists					
Leuprolide Acetate	No	No	Yes	Likely but need EPA approval	Yes
Histrelin Acetate	No	No	No	Likely but need EPA approval	Unknown
Other					
GnRH Toxins	No	Unknown	Unknown	Likely but unknown	Unknown
Steroid Hormones	No	No	Unknown	Unlikely, but need regulatory guidance	Unknown
Contragestives	No	No	Yes	Yes	Yes
Physical sterilization - ovariectomy	Not applicable[g]	Yes - permanent	No	Yes – after anesthesia withdrawal date	No – lack of reproductive hormones will change reproductive behaviors and likely social behaviors
Physical sterilization – tubal ligation	Not applicable[g]	Yes - permanent	No	Yes – after anesthesia withdrawal date	No – repeated estrous cycles

a Federally approved but not registered in the state of New York for use in free ranging white-tailed deer populations.

b Recent research demonstrates excellent efficacy using a single dose of native PZP primer combined with heat extruded pellets in year 1 (96%), moderate in year two (74%), and little efficacy by year three (Rutberg et al. 2013). The data regarding cold evaporated pellets is inconclusive (Rutberg et al. 2013).

c SpayVac® has demonstrated 80%-100% efficacy for up to 5-7 years in horses and deer (Fraker, pers. comm., 2009; Miller et al. 2009; Killian et al. 2008). The term "possibly is used because long-term studies (greater than 5 years) have been conducted only in captive deer and had a small sample size in each treatment group (N=5) (Miller et al. 2009). The only longer term study in free-ranging white-tailed deer did not evaluate past the third year (Rutberg et al. 2013).

d Long-term pelleted PZP has not been adequately evaluated past year two in free-ranging deer to determine extended efficacy (Rutberg et al. 2013)

e Research on one-shot, multiyear GnRH vaccine in penned/captive deer indicates GonaCon is 88-100% effective in year 1, 47-100% effective in year 2, and 25-80% effective up to 5 years post-treatment (Miller et al. 2008). The term "possibly" is used because the multi-year formulation has been used only in captive deer, had a small sample size, and lacks confidence intervals on the data. Work in free-ranging deer suggests lower efficacy rates and shorter duration of efficacy (Gionfriddo et al. 2009, 2011).

f Work published in elk used dart delivery to administer the GnRH vaccine (Killian et al. 2009).

g Not applicable because this is a veterinary procedure rather than a product. The procedure requires general anesthesia, a veterinarian to perform surgery, post-operative antibiotics, and is likely associated with a higher mortality rate (approximately 6%; MacLean et al. 2006) than anesthesia alone (approximately 1.5%; Rutberg et al. 2013). Results in permanent sterilization.

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References

GLOSSARY

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A

Abundance. Relative representation of a species in a given area or ecosystem.

Action alternative. An alternative that proposes a different management action or actions to address the purpose, need, and objectives of the plan; one that proposes changes to the current management. Alternatives B, C, and D are the action alternatives in this planning process. See also: "no-action alternative."

Adaptive management. The rigorous application of management, research, and monitoring to gain information and experience necessary to assess and modify management activities. A process that uses feedback from research and the period evaluation of management actions and the conditions they produce to either reinforce the viability of objectives, strategies, and actions prescribed in a plan or to modify strategies and actions in order to more effectively accomplish management objectives.

Affected environment. A description of the existing environment that may be affected by the proposed action.

Archeological resources. Any material remains or physical evidence of past human life or activities which are of archeological interest, including the record of the effects of human activities on the environment. Archeological resources are capable of revealing scientific or humanistic information through archeological research.

B

Biobullet. A single dose, biodegradable projectile comprised of an outer methylcellulose casing containing a solid, semi-solid, or liquid product (usually a vaccine or chemical contraceptive), propelled by a compressed-air gun.

Biodiversity. The number and variety of organisms found within a specified geographic region.

Birth rate. Demographic measure of the rate at which offspring are born.

Browse line. A visible delineation at approximately 6 feet below which most or all vegetation has been uniformly browsed.

C

Carrying capacity. The maximum number of organisms that can be supported in a given area or habitat.

Cervids. All members of the Cervidae family and hybrids, including deer, elk, and moose.

Chronic wasting disease (CWD). A slowly progressive, infectious, self-propagating neurological disease of captive and free-ranging deer, elk, and moose. CWD belongs to the transmissible spongiform encephalopathy (TSE) group of diseases and is characterized by accumulations of abnormal prion proteins in neural and lymphoid tissue.

Contractor. For the purposes of this plan, a contractor is a fully-insured business entity, nonprofit group, or other governmental agency engaged in wildlife management activities that include trapping, immobilization, and lethal removal through sharpshooting and chemical euthanasia. The contractor must possess all necessary permits and be able to pass any needed security clearances.

Contragestive. A product that prevents or terminates pregnancy.

Cultural landscape. A geographic area (including both cultural and natural resources and the wildlife therein) associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values.

Cumulative impacts. Those impacts on the environment that result from the incremental effect of the action when added to the past, present, and reasonable foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

D

Deer population. The group of deer living within Fire Island National Seashore that have common characteristics and interbreed among themselves.

Demographic. Referring to the intrinsic factors that contribute to a population's growth or decline: birth, death, immigration, and emigration. The sex ratio of the breeding population and the age structure (the proportion of the population found in each age class) are also considered demographic factors because they contribute to birth and death rates.

Depredation. Deer browsing that leads to vegetation damage or loss.

Direct lethal reduction. For the purposes of this plan, direct lethal reduction is the removal of deer through a combination of sharpshooting, and capture and euthanasia, and public hunting.

Dispersal. One-way and permanent movement of animals from an area of birth to another.

E

Ecosystem. An ecological system; the interaction of living organisms and the nonliving environment, producing an exchange of materials and energy between the living and nonliving.

Endemic. Native to or confined to a particular region.

Environment. The sum total of all biological, chemical, and physical factors to which organisms are exposed; the surroundings of a plant or animal.

Environmental assessment (EA). A concise public document, prepared in compliance with NEPA, that briefly discusses the purposes and need for an action, and provides sufficient evidence and analysis of impacts to determine whether to prepare an environmental impact statement or finding of no significant impact.

Environmental consequences. Environmental effects of project alternatives, including the proposed action, any adverse environmental effects which cannot be avoided, the relationship

between short term uses of the human environment, and any irreversible or irretrievable commitments of resources which would be involved if the proposal should be implemented.

Environmental impact statement (EIS). A detailed written statement required by Section 102(2)(C) of the National Environmental Policy Act, analyzing the environmental impacts of a proposed action, adverse effects of the project that cannot be avoided, alternative courses of action, short term uses of the environment versus the maintenance and enhancement of long term productivity, and any irreversible and irretrievable commitment of resources.

Environmental Justice. Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

Ethnographic resource. Any site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it.

Euthanasia. Ending the life of an animal by humane means.

Exclosure. An area enclosed by a barrier, such as a fence, to protect vegetation and prevent browsing by animals.

Exotic species (or nonnative invasive species). Any introduced plant, animal, or protist species that is not native to the area and may be considered a nuisance; also called nonnative, invasive, or alien species.

F

Fertility control. In this plan/EIS, the use of immunocontraceptive agent to manage population growth.

Forest regeneration. For the purposes of this plan, the regrowth of forest species and renewal of forest tree cover such that the natural forest sustains itself without human intervention.

H

Habitat. The environment in which a plant or animal lives (includes vegetation, soil, water, and other factors).

Herbaceous plants. Non-woody plants; includes grasses, wildflowers, and sedges and rushes (grass-like plants).

Herbivore. An animal that eats a diet consisting primarily of plant material.

Historic Structures. A constructed work, usually immovable by nature or design, consciously created to serve some human act. To be listed on or eligible for listing on the National Register, a site, structure, object, or district must possess historic integrity of those features necessary to convey its significance, particularly with respect to location, setting, design, feeling, association, workmanship, and materials.

Home range. The geographic area in which an animal normally lives.

I

Immunocontraception. The induction of contraception by injecting an animal with a compound that produces an immune response that precludes pregnancy.

Immunocontraceptive. A contraceptive agent that causes an animal to produce antibodies against some protein or peptide involved in reproduction. The antibodies hinder or prevent some aspect of the reproductive process.

Indian Trust resources. The federal Indian Trust responsibility is a legally enforceable obligation on the part of the United States to protect tribal lands, assets, resources, and treaty rights, and it represents a duty to carry out the mandates of federal laws with respect to Native American tribes.

Infrared. The range of invisible radiation wavelength just longer than the red in the visible spectrum.

Irretrievable. A term that applies to the loss of production, harvest, and consumptive or nonconsumptive use of natural resources. For example, recreation experiences are lost irretrievably when an area is closed to human use. The loss is irretrievable, but the action is not irreversible. Reopening the area would allow a resumption of the experience.

Irreversible. A term that describes the loss of future options. Applies primarily to the effects of use of nonrenewable resources, such as minerals or cultural resources, or to those factors, such as soil productivity that are renewable only over long periods of time.

L

Lethal reduction. The purposeful authorized killing of (an) animal(s) to achieve park management objectives.

M

Managed hunt. A special/managed hunt is one in which the government entity allows a certain number of citizen hunters to take a certain number of deer pursuant to specific requirements. Sometimes these hunts include firearm proficiency tests, hunting in specific areas or stands, and taking specific cohorts. Typically, these hunts take place during the state's sport hunting season and last for several days.

Monitoring. A process of collecting information to evaluate if an objective and/or anticipated or assumed results of a management plan are being realized (effectiveness monitoring) or if implementation is proceeding as planned (implementation monitoring).

Myopathy. A non-infectious disease of wild and domestic animals in which muscle damage results from extreme exertion, struggle, or stress.

N

National Environmental Policy Act of 1969 (NEPA), as amended. A law that requires all federal agencies to examine the environmental impacts of their actions, incorporate environmental information, and utilize public participation in the planning and implementation of all actions. Federal agencies must integrate NEPA with other planning requirements and prepare appropriate NEPA documents to facilitate better environmental decision making. NEPA requires federal agencies to review and comment on federal agency environmental plans/documents when the

agency has jurisdiction by law or special expertise with respect to any environmental impacts involved.

Naturally regenerating and sustainable forest. A forest community that has the ability to maintain plant and animal diversity and density by natural (non-human facilitated) tree replacement.

No-action alternative. The alternative in which baseline conditions and trends are projected into the future without any substantive changes in management. Alternative A is the no-action alternative in this planning process.

P

Palatable. The property of being acceptable to the taste or sufficiently agreeable in flavor to be eaten.

Parasitism. A symbiotic relationship in which one species, the parasite, benefits at the expense of the other, the host.

Penetrating captive bolt gun. A gun with a steel bolt that is powered by either compressed air or a blank cartridge. When fired, the bolt is driven into the animal's brain and renders it instantly unconscious without causing pain.

Pericardial. Around or surrounding the heart.

Population (or species population). A group of individual plants or animals that have common characteristics and interbreed among themselves and not with other similar groups.

Population dynamics. All the elements of change by which a particular population exists such as mortality, reproduction, and movement.

Predator restoration. The method of reintroducing natural predators as a means of controlling a highly dense population.

Productivity. Number of fawns born minus those killed through all sources of mortality at a given population size.

R

Radial distance. A straight-line distance measured along a radius.

Record of decision (ROD). A concise public record of decision prepared by a federal agency, pursuant to NEPA, that contains a statement of the decision, identification of all alternatives, a statement as to whether all practical means to avoid or minimize environmental harm from the alternative selected have been adopted (and if not, why they were not), and a summary of monitoring and enforcement where applicable for any mitigation.

Regulated (traditional) hunting. Killing, trapping, or capture of animals as allowed by law.

Reproductive control. See fertility control.

Reproductive intervention. A method or methods used to limit the numbers of animals in a population by decreasing the reproductive success of the animals, such as contraception or sterilization.

Reproductive rate. Number of fetuses per doe.

Rut. An annually recurring condition or period of sexual excitement and reproductive activity in deer; the breeding season.

S

Sacred Sites. Places containing certain natural and cultural resources which have established religious meaning and are used as locales of private ceremonial activities.

Sapling. A young tree, generally not over 4 inches in diameter at breast height.

Scoping. An early and open process for determining the extent and variety of issues to be addressed and for identifying the significant issues related to a proposed action.

Seedling. A young plant grown from seed; a young tree before it becomes a sapling.

Sex ratio. The proportion of males to females (or vice versa) in a population. A sex ratio of 50:50 would mean an equal number of does and bucks in a deer population.

Sharpshooting. The authorized shooting of animals by specially trained professionals using appropriate weapons for means of effective and efficient lethal control.

Special-status Species. Special-status species include plant and animal species that have regulatory protection under current federal and state laws. Federal protection is afforded through the Endangered Species Act of 1973 (ESA), which is administered by the U.S. Fish and Wildlife Service and the National Marine Fisheries Service.

The U.S. Fish and Wildlife Service defines an "endangered" species as one that is in danger of extinction throughout all or a significant portion of its range. A "threatened" species is one that is likely to become endangered in the foreseeable future. The agency maintains a list of plants and animals native to the U.S. that are ESA candidates or are proposed for possible addition to the federal list.

Species diversity. The variety of different species present in a given area; species diversity takes into account both species richness and the relative abundance of a species.

Species richness. The number of species present in a community.

Spotlight counts. A method used to estimate deer numbers in an area by shining spotlights at night and counting the number of deer observed. This technique provides an estimate of deer numbers but not density.

Subcutaneous. Under the skin.

T

Translocation. The method of sedating, capturing, and moving deer from one location to another. Under alternative B in this plan/EIS, deer would be translocated from the Fire Island communities west of Sailors Haven to the Fire Island Wilderness.

U

Ungulate. A hoofed, typically herbivorous, animal; includes horses, cows, deer, elk, and bison.

V

Vaccine. A suspension of killed or attenuated microorganisms that, when introduced into the body, stimulates an immune response against that microorganism.

Vascular plant. A plant that contains a specialized conducting system consisting of phloem (food-conducting tissue) and xylem (water-conducting tissue). Ferns, trees, and flowering plants are all vascular plants.

Viable white-tailed deer population. A population of deer that allows the forest to naturally regenerate, while maintaining a healthy deer population in the park.

W

Woody plants. Plants containing wood fibers, such as trees and shrubs.

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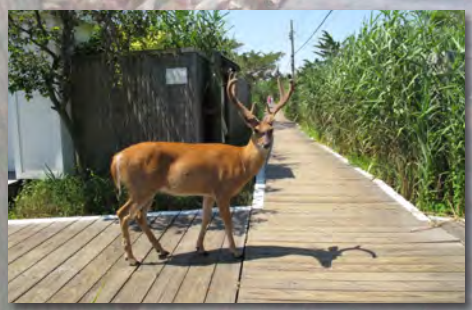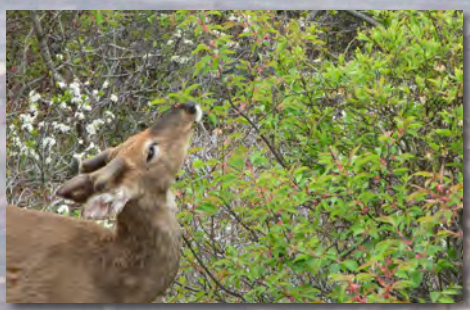
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