

United States Department of the Interior
National Park Service, Northeast Region

RECORD OF DECISION

WHITE-TAILED DEER MANAGEMENT PLAN FOR FIRE ISLAND NATIONAL SEASHORE

Fire Island National Seashore, New York

INTRODUCTION

The Department of the Interior, National Park Service (NPS), has prepared this Record of Decision (ROD) for the *Fire Island National Seashore White-tailed Deer Management Plan and Final Environmental Impact Statement*, December 2015 (final plan/EIS). This ROD identifies the decision/selected action, including mitigation measures; describes other alternatives analyzed; identifies the environmentally preferable alternative; and includes a brief discussion of the rationale for the decision reached. Complete references for in-text citations used in the ROD and non-impairment determination may be found in the final plan/EIS.

This ROD contains a summary description of the selected action; the complete description of the selected action is attached to this ROD (Attachment A). In accordance with NPS policy, a non-impairment determination for the selected action is attached to this ROD (Attachment B).

PURPOSE OF THE PLAN

The purpose of the final plan/EIS is to develop a deer management strategy for Fire Island National Seashore (Seashore) that supports protection, preservation, regeneration, and restoration of native vegetation and other natural and cultural resources at the Seashore; and minimizes undesirable human-deer interactions while maintaining a viable population of white-tailed deer within the Seashore. This plan also focuses on promoting public understanding of the complex relationship between deer and Seashore resources, tick-borne diseases, people, and infrastructure.

NEED FOR THE PLAN

Information collected as part of research conducted at the Seashore indicated 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; and
- 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; and

- habituation of deer to the unthreatening presence of humans and conditioning of deer, particularly to food sources.

Prior to the establishment of the Fire Island National Seashore (Seashore) in 1964, very few white-tailed deer (*Odocoileus virginianus*) 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). Since the late 1960s, the deer population at 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, a globally rare ecosystem. In some areas, current levels of browsing appeared to be creating conditions for an increase in undesirable species. There was concern that 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.

It was also determined that deer posed a threat to native vegetation in other natural zones of the Seashore and the cultural landscape of the William Floyd Estate. 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.

And finally, as a consequence of deer often being close to and interacting with humans, deer have become habituated to humans and conditioned to human food. This habituation has led to human-deer interactions such as deer approaching humans, people intentionally feeding deer, people unintentionally feeding deer via unsecured garbage or ornamental plants, and interactions between deer and pets. These interactions are viewed as undesirable by the Seashore because they raise the risk of injury to people and deer and increase the likelihood of property damage by deer.

PLAN OBJECTIVES

The objectives of the final plan/EIS are to:

- manage a viable white-tailed deer population in the Seashore that is supportive of the other objectives of this plan;
- promote natural regeneration of native vegetation;

- protect special-status species/vegetation communities and their habitat from high levels of deer browsing;
- 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 of herbs and shrubs that made up the Sunken Forest's vegetative composition when the Seashore was established;
- 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;
- continue to expand the knowledge base regarding the relationship between deer browsing and plant communities at Fire Island National Seashore to improve management decisions;
- 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 the impact of white-tailed deer on the cultural and natural resources of the Seashore, human-deer interactions, and tick-borne diseases throughout the Seashore, including the William Floyd Estate; and
- reduce the number of undesirable human-deer interactions within the Seashore.

DECISION (SELECTED ACTION)

The final plan/EIS identified Alternative D as the NPS preferred alternative. After release of the final plan/EIS and upon further review the NPS determined that:

- the final plan/EIS did not present the priorities for deer management actions in the order in which the Seashore expects to implement them;
- the final plan/EIS described deer management actions within the Fire Island communities that were either not feasible or not a priority for the Seashore.
- the final plan/EIS did not clearly describe the location of the exclusion fencing at the Sunken Forest as being partly inside the Sunken Forest Preserve and extending outside the Preserve to the east.

Therefore the NPS selected action described herein is a modification of Alternative D. The modifications clarify the NPS priority for the order and location of deer management actions. The selected action is summarized below. The complete description of the selected action is attached to this document (Attachment A; White-tailed Deer Management Plan for Fire Island National Seashore).

The selected action summary herein and in Attachment A present deer management actions in the order in which the Seashore expects to implement them. In addition, the summary and Attachment A clarify that the primary focus of the NPS in the communities will be enhanced education and deer monitoring. Direct reduction actions by the NPS will only occur in the

communities when explicitly requested by the land owner and in coordination with the New York State Department of Environmental Conservation. Finally, the summary and Attachment A more accurately describe the area encompassed by the exclusion fencing at the Sunken Forest. These changes are organizational and/or factual in nature and do not change the outcome of the impact analysis presented in the final plan/EIS.

It should be noted that while the deer management actions described below and in Attachment A are presented in the order in which the Seashore anticipates implementing them, the extent to which deer management actions will be implemented, and priorities for implementation, will be dependent on available funding and staff.

The selected action will become effective with the announcement of the availability of the signed Record of Decision.

SUMMARY OF THE SELECTED ACTION

The selected action includes the following management actions and techniques that will be used to manage white-tailed deer at Fire Island National Seashore.

CONTINUE EXISTING DEER MANAGEMENT EFFORTS - The Seashore will continue existing deer management and monitoring efforts, which include public education/interpretation efforts, vegetation monitoring, and deer population and behavior surveys.

ENHANCE PUBLIC EDUCATION EFFORTS - The Seashore will enhance public education/interpretation efforts to raise awareness of the role of humans in deer-related issues, and work collaboratively with the New York State Department of Environmental Conservation, New York State Parks, Suffolk County Parks, the Fire Island communities, and local environmental groups to develop, share, and use consistent and strategic messaging. This could include enhancing NPS enforcement of existing laws and policies related to deer management and feeding of wildlife on NPS lands in collaboration with the New York State Department of Environmental Conservation (NYSDEC) and local law enforcement agencies.

FENCING - The Seashore will use exclusion fencing to protect the Sunken Forest maritime holly forest and the historic core of the William Floyd Estate from the adverse impacts of deer browsing. The boundary fencing that outlines the William Floyd Estate property will be repaired and cattle guards could be installed at vehicle entrances to help prevent deer from entering the property. The Seashore will also continue its current practice of placing small-scale fencing around individual and small groups of special-status plants that occupy beaches and foredunes.

REDUCTION AND MAINTENANCE OF DEER DENSITY - The Seashore will utilize a combination of lethal and nonlethal actions to reduce and maintain deer density at a target level of approximately 20-25 deer per square mile.

Direct reduction actions will be implemented on NPS lands within the Seashore boundary. These actions include sharpshooting, limited capture and euthanasia, and a public hunt (in the Fire Island Wilderness only). They will be done initially to quickly reduce the deer population to the initial density goal. The Seashore will only take direct reduction actions on non-NPS lands within the Seashore boundary when explicitly requested by the land owner and in coordination with the NYSDEC.

As needed, the deer population will be maintained at the target density by either direct reduction (sharpshooting, capture and euthanasia, public hunt in the Fire Island Wilderness) or by nonsurgical reproductive control when an acceptable agent becomes available. Both lethal and nonlethal population maintenance methods are included in order to maintain maximum flexibility for future management.

Areas of the Seashore where direct reduction actions will occur will be closed to all except authorized personnel. Seashore personnel will patrol public areas to ensure compliance with the closures and any other public safety measures that may be needed. The public will be notified of Seashore closures by appropriate means such as media releases, web or social media alerts, printed notices placed at visitor contact stations or other appropriate venues.

Within the areas encompassed by exclusion fencing at the Sunken Forest and the historic core of the William Floyd Estate, a deer density of zero (0) will be established. During construction of exclusion fences, deer will be removed from the fenced area by driving them out. Once the fence is completed, any deer found inside the fence will be removed through direct reduction (sharpshooting or capture and euthanasia).

Management of deer density will be guided by established thresholds for taking action, target deer densities, and target vegetation densities outlined in Attachment A. An adaptive management approach will be used to adjust management actions over time according to whether or not the actions are achieving the desired outcome as determined by monitoring data (Attachment A).

REDUCE UNDESIRABLE HUMAN-DEER INTERACTIONS - The Seashore will take action to reduce the number of deer that approach people on NPS lands if more than 2% of the deer observed during deer density surveys approach the biologists. Appropriate action could range from increased education/enforcement efforts to removal of highly food conditioned deer on NPS lands. The Seashore may also take action if an individual deer creates a nuisance situation on park lands or at park facilities by repeatedly approaching visitors and causing safety concerns.

The selected action does not include any actions to remove deer that approach humans on non-NPS lands within the Seashore boundary. If a land owner within the Seashore boundary

requests assistance with an injured or nuisance deer, the Seashore will provide appropriate assistance in coordination with NYSDEC.

MONITORING - The selected action incorporates monitoring of vegetation; deer numbers and behavior; reproductive control, if and when implemented; and fencing.

The Seashore will utilize an enhanced vegetation monitoring program (Attachment A) to record baseline conditions of the vegetation within natural areas and to observe changes in vegetation over time. Data collection will occur annually, with each natural area being sampled at least once every three years.

The Seashore will continue to utilize a deer monitoring program (Attachment A) that includes both deer population (numbers) and deer behavior in order to measure deer densities relative to observed changes in vegetation. During deer density counts, staff will also record any observed deer behavior as a means of indexing the frequency of undesirable human-deer interactions. Deer monitoring efforts will occur annually in all areas of the Seashore.

If and when a reproductive control agent becomes available and is implemented, the Seashore will implement additional monitoring to document reproductive control success (pregnancy rate, and reproductive rate). A detailed monitoring plan for reproductive control may be developed at that time.

The Seashore will monitor all fenced areas by visual inspection for fence integrity. Fence monitoring will be coordinated with vegetation monitoring activities.

COORDINATION WITH NEW YORK STATE - In implementing the selected action, the Seashore will coordinate with the New York State Department of Environmental Conservation (NYSDEC), the agency responsible for administration and enforcement of the state's Environmental Conservation Law and administration and oversight of deer population management in the state of New York. Coordination with the NYSDEC is to ensure that mutual management goals are achieved and all pertinent regulatory and permitting needs are met. In addition, once a fertility control agent is approved for use by the Environmental Protection Agency (EPA), the agent must also be registered for use in the state of New York and the National Park Service must comply with any labeled restrictions on use. Coordination will include routine meetings with NYSDEC staff, data sharing, public relations, and reporting.

COORDINATION WITH THE FIRE ISLAND COMMUNITIES - As summarized above and described in detail in Attachment A, in implementing this plan, the Seashore will coordinate with the Fire Island communities in the following ways:

Enhanced Public Education Efforts. Work collaboratively with New York State Parks, Suffolk County Parks, the Towns of Islip and Brookhaven, Fire Island communities, and local environmental groups to develop, share, and use consistent and strategic messaging with regard to the role of humans in deer-related issues on Fire Island.

Surveys and Monitoring. Deer population and behavior surveys will continue to be conducted island-wide, which will include the Fire Island communities and other non-NPS lands within the Seashore boundary.

Direct Reduction. Direct reduction actions (sharpshooting and capture and euthanasia) will be implemented on NPS-owned and managed lands within the Seashore boundary. The Seashore will only take direct reduction actions on non-NPS lands within the Seashore boundary when explicitly requested by the land owner and in coordination with the NYSDEC.

Seashore Area Closures for Management Actions. Areas of the Seashore where direct reduction actions will occur will be closed to all except authorized personnel. Seashore personnel will patrol public areas to ensure compliance with the closures and any other public safety measures that may be needed. The public will be notified of Seashore closures by appropriate means such as media releases, web or social media alerts, printed notices placed at visitor contact stations or other appropriate venues.

Assistance with injured or nuisance deer on request of the land owner. This plan does not include any actions to remove deer that approach humans on non-NPS lands within the Seashore boundary. If a land owner within the Seashore boundary requests assistance with an injured or nuisance deer, the Seashore will provide appropriate assistance in coordination with NYSDEC.

WILDERNESS MINIMUM REQUIREMENTS ANALYSIS - In accordance with NPS *Management Policies 2006*, section 6.3.5, the Seashore will complete a minimum requirement analysis for specific actions in this plan prior to implementation in the Otis Pike Fire Island High Dune Wilderness, such as a controlled public hunt. The NPS will strive to minimize the extent of adverse impact on wilderness character while accomplishing the Seashore's necessary wilderness objective.

MITIGATION MEASURES INCORPORATED INTO THE SELECTED ACTION

A number of mitigation measures will be implemented as part of the selected alternative to ensure protection of park resources and reduce the risk of injury to employees, park visitors, and adjacent landowners during implementation of population reduction and maintenance activities. These actions include the following:

- The exclusion fencing at the Sunken Forest will be located to minimize environmental impacts (particularly to wetlands), 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 will consider collecting desirable herbs and shrubs and replanting those plants within the area of disturbance.
- Mesh size on exclusion fencing will be sufficient to allow most small animals to move freely through the fence.

- Direct reduction and administering reproductive controls will be done only by NPS staff and authorized agents (such as qualified contractors and/or skilled volunteers).
- Sharpshooting with firearms will primarily occur at night (between dusk and dawn), during late fall and winter months when deer are more visible and fewer visitors are in the Seashore. Similarly, any capture and euthanasia actions or treatment of does will occur during the off-peak visitor hours (early morning and evening) and weekdays to the extent possible.
- During sharpshooting activities, noise-suppression devices and night vision equipment may be used to reduce disturbance to the public. Activities will be conducted in compliance with all federal firearm laws administered by the Bureau of Alcohol, Tobacco, Firearms, and Explosives.
- Public access will be limited as necessary during direct reductions, and NPS personnel will patrol public areas to ensure compliance with Seashore closures and public safety measures. The public will be notified of any park closures by appropriate means.
- Bait stations will be placed in park-approved locations away from public use areas to maximize the efficiency and safety of the reduction program.
- Non-lead ammunition will be used for any lethal removal of deer to preserve the opportunity to donate the meat or for the carcass to be left in the field for scavenging wildlife.
- Carcasses made available for consumption will be disposed of in accordance with NPS Public Health Program guidelines for donation of meat for the purpose of human consumption. For carcasses left in the field, efforts will be made to reduce their visibility on the landscape.
- Captured deer will be euthanized as humanely as possible, in accordance with current veterinary practice.
- Animals euthanized with chemicals will be appropriately disposed of, and will not be available for consumption.
- Does treated with a reproductive control agent will be appropriately marked or tagged to facilitate identification of treated individuals and to prevent human consumption if necessary.

ALTERNATIVES CONSIDERED BUT NOT SELECTED

Alternative A (No Action).

Under alternative A, No Action (described on pages 34-35 of the final plan/EIS), the Seashore would continue to manage deer through existing deer management and monitoring efforts. These actions include continued public education/interpretation efforts, vegetation monitoring, and deer population and behavior surveys. No additional deer management actions, including reduction of deer density or undesirable human-deer interactions, would take place under this alternative.

Alternative B.

Under alternative B (described on pages 43-48 of the final plan/EIS), the Seashore would manage deer through a combination of nonlethal actions including the existing deer monitoring and educational efforts described under alternative A (with some modifications to monitoring schedules) with enhanced public education and monitoring as described for the selected action; the construction of large-scale deer exclosures (fencing) for the purposes of forest regeneration and restoration of the cultural landscape at the William Floyd Estate; the use of nonsurgical reproductive control of does (if an appropriate reproductive control agent meets the criteria listed under this alternative) to reduce deer density to the initial goal of 20-25 deer per square mile and maintain the deer population at an appropriate density, as determined through adaptive management; and translocation of deer observed approaching humans to reduce undesirable human-deer interactions. Alternative B would only use non-surgical reproductive control to achieve the initial deer density goal and maintain the deer population at an appropriate density over time, if and when an agent becomes available that meets the NPS criteria described. Alternative B does not include an option for use of direction reduction.

Alternative C.

Under alternative C (described on pages 48-52 of the final plan/EIS), the Seashore would manage deer through a combination of lethal and nonlethal actions that are similar to the selected action; i.e., Alternative C includes the same enhanced education and monitoring efforts as the selected action; the same use of exclusion fencing at the Sunken Forest and the William Floyd Estate plus small-scale fencing of individual and small groups of plants along dunes; and the same direct reduction methods to reduce deer density to the initial goal of 20-25 deer per square mile and maintain the deer population at an appropriate density over time, utilizing an adaptive management strategy. However, alternative C would only use direct reduction (sharpshooting and limited capture and euthanasia) to reduce and maintain the deer population and reduce undesirable human-deer interactions. Alternative C does not include non-surgical reproductive control as an option for long-term maintenance of deer density.

RATIONALE FOR THE DECISION REACHED

In reaching the decision to select modified alternative D for implementation, the NPS evaluated each alternative based on its ability to meet the plan objectives (see table 8 of the final plan/EIS), the potential impacts on the environment (see "Chapter 4: Environmental Consequences" of the final plan/EIS), anticipated effort with implementation, and degree of management flexibility.

The NPS selected modified alternative D because it reduces deer density quickly, providing immediate relief from the adverse impacts of deer browsing, and because it incorporates a wider range of management options than the other alternatives evaluated. In addition to direct reduction, the selected action incorporates the use of non-surgical reproductive control as a management option for future maintenance of the deer population at an appropriate density, if and when an acceptable agent becomes available. Thus, the selected action provides for both an efficient initial removal of deer and flexibility in management methods to address future control of deer density in different ways.

Alternative A (no action) fails to meet or fully meet the objectives of the plan, since no action would be taken to reduce deer numbers or effect a change in conditions that are the basis for the purpose of and need for action.

Alternative B was not selected because of the length of time required before deer numbers would be reduced. Even assuming that a reproductive control agent that meets NPS criteria became available in the near future, it would still take many years to reduce the deer population to the initial density goal. Although the majority of the Sunken Forest and the historic core and forests of the William Floyd Estate would be protected by exclusion fencing, the continued loss of vegetation to deer browsing outside fenced areas would severely degrade vegetation communities throughout the Seashore. The composition and structure of the vegetation would change, and the potential for invasion by non-native plants would greatly increase. This, in turn, would cause the loss and degradation of wildlife habitat, potentially reducing wildlife numbers and diversity in the Seashore. Further, there is uncertainty that the deer density goal could be achieved with reproductive control alone, even over an extended period of time, which raises the concern that the continuing adverse impacts to vegetation could reach a “tipping point” from which recovery may not be possible.

Alternative C is very similar to the selected action in meeting all of the plan objectives and in their relative impacts. However, alternative C was not selected because it utilizes a narrower range of management tools and does not provide the same management flexibility as the selected action.

ENVIRONMENTALLY PREFERABLE ALTERNATIVE

Based on the analysis of environmental consequences of each alternative presented in chapter 4 and summarized in table 9 of the final plan/EIS, 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. Alternative C 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 because it would not impose an artificial method of fertility control.

CONCLUSION

The selected action as described herein and in Attachment A best meets the purpose, need, and objectives of the Fire Island National Seashore White-tailed Deer Management Plan and is expected to support the long-term protection, preservation, and restoration of native vegetation and other natural and cultural resources at Fire Island National Seashore.

As described in ‘Mitigation Measures Incorporated into the Selected Action’ section above and in Attachment A, all practical means to avoid or minimize environmental harm from the selected action have been adopted.

The selected alternative will not result in the impairment of park resources and values (Attachment B).

The required "no-action period" before approval of this Record of Decision began on January 8, 2016, with publication by the U.S. Environmental Protection Agency of a Notice of Availability of the final plan/EIS in the *Federal Register* (81 FR 936). The no-action period ended on February 8, 2016.

The official responsible for approving this Record of Decision is the Regional Director, Northeast Region, National Park Service.

The official responsible for implementing the selected alternative is the Superintendent of Fire Island National Seashore, New York.

RECOMMENDED:


Chris Soller, Superintendent
Fire Island National Seashore

April 14, 2016
Date

APPROVED:


Michael A. Caldwell, Regional Director
Northeast Region, National Park Service

April 28, 2016
Date

Attachment A Approved White-Tailed Deer Management Plan for Fire Island National Seashore
Attachment B Non-Impairment Determination

ATTACHMENT A

U.S. DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE, NORTHEAST REGION

**WHITE-TAILED DEER MANAGEMENT PLAN
FOR FIRE ISLAND NATIONAL SEASHORE**

Fire Island National Seashore, New York

APPROVED

APRIL 2016

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WHITE-TAILED DEER MANAGEMENT PLAN FOR FIRE ISLAND NATIONAL SEASHORE

The *White-Tailed Deer Management Plan for Fire Island National Seashore* (this plan) provides a deer management strategy that supports protection, preservation, regeneration, and restoration of native vegetation and other natural and cultural resources at the Seashore and minimizes undesirable human-deer interactions while maintaining a viable population of white-tailed deer within the Seashore. This plan also focuses on promoting public understanding of the complex relationship between deer and Seashore resources, tick-borne diseases, people, and infrastructure.

NEED FOR THIS PLAN

Information collected as part of research conducted at the Seashore indicated 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; and
- 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; and
 - habituation of deer to the unthreatening presence of humans and conditioning of deer, particularly to food sources.

Prior to the establishment of the Fire Island National Seashore (the Seashore) in 1964, very few white-tailed deer (*Odocoileus virginianus*) 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). Since the late 1960s, the deer population at 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. In some areas, current levels of browsing appeared to be creating conditions for an increase in undesirable species.

There was concern that 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.

It was also determined that deer posed a threat to native vegetation in other natural zones of the Seashore and the cultural landscape of the William Floyd Estate. 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.

And finally, as a consequence of deer often being close to and interacting with humans, deer have become habituated to humans and conditioned to human food. This habituation has led to human-deer interactions such as deer approaching humans, people intentionally feeding deer, people unintentionally feeding deer via unsecured garbage or ornamental plants, and interactions between deer and pets. These interactions are viewed as undesirable by the Seashore because they raise the risk of injury to people and deer and increase the likelihood of property damage by deer.

PLAN OBJECTIVES

The objectives of this plan are to:

- manage a viable white-tailed deer population in the Seashore that is supportive of the other objectives of this plan;
- promote natural regeneration of native vegetation;
- protect special-status species/vegetation communities and their habitat from high levels of deer browsing;
- 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 of herbs and shrubs that made up the Sunken Forest's vegetative composition when the Seashore was established;
- 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;
- continue to expand the knowledge base regarding the relationship between deer browsing and plant communities at Fire Island National Seashore to improve management decisions;
- 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 the impact of white-tailed deer on the cultural and natural resources of the Seashore, human-deer interactions, and tick-borne diseases throughout the Seashore, including the William Floyd Estate; and
- reduce the number of undesirable human-deer interactions within the Seashore.

OVERVIEW OF THIS PLAN

In summary, the actions included in this plan are as follows:

- Continue existing deer management and monitoring efforts, which include public education/interpretation efforts, vegetation monitoring, and deer population and behavior surveys.
- Enhance education efforts and work collaboratively with the New York State Department of Environmental Conservation, New York State Parks, Suffolk County Parks, the Fire Island communities, and local environmental groups on deer-related issues within the Seashore.
- Utilize exclusion fencing to protect the Sunken Forest, the historic core of the William Floyd Estate, and small areas of special status plants.
- Utilize a combination of lethal and nonlethal deer management actions to address high deer density.
 - Lethal actions (sharpshooting, limited capture and euthanasia, public hunt in the Fire Island wilderness) will be taken initially to reduce the deer herd numbers quickly.
 - Population maintenance may then be conducted either by nonsurgical reproductive control when an acceptable agent becomes available or by lethal actions as needed. Both lethal and nonlethal population maintenance methods are included in order to maintain maximum flexibility for future management.
 - Adaptive management of deer density will be guided by the monitoring of established thresholds for taking action, target deer densities, and target vegetation densities outlined in this plan.
- Utilize actions ranging from increased education/enforcement efforts to removal of highly food conditioned deer to reduce the number of deer that approach people on NPS lands.

It should be noted that while the deer management actions described under “Management Actions” below are presented in the order in which the Seashore anticipates implementing them, the extent to which deer management actions are implemented, and priorities for implementation, will be dependent on available funding and staff.

MANAGEMENT ACTIONS

ENHANCED PUBLIC EDUCATION EFFORTS

Seashore staff will enhance public education/interpretation efforts to raise awareness of the role of humans in deer-related issues. Actions could include the following:

Work collaboratively with New York State Parks, Suffolk County Parks, the Towns of Islip and Brookhaven, Fire Island communities, and local environmental groups to develop, share, and use consistent and strategic messaging.

Dedicate interpretive effort where feasible to conduct outreach and provide interpretive media on the topic of co-existing with deer. This could 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 on deer-related issues and deer management.

Enhance National Park Service (NPS) enforcement of existing laws and policies related to deer management and feeding of wildlife on NPS lands. Collaborate with the New York State Department of Environmental Conservation (NYSDEC) and local law enforcement agencies on enhanced enforcement efforts related to feeding of wildlife within the boundaries of Fire Island National Seashore.

FENCING

Fencing of the Sunken Forest

An exclusion fence will be installed around approximately 44 acres of the Sunken Forest to protect the majority of the rare maritime holly forest from deer browse. Approximately 29 acres of exclusion fence will be within the Sunken Forest Preserve and approximately 15 acres will be outside the Preserve, extending to the east (Figure 1).

Typically the fence will be a minimum of 8-10 feet high and mesh size will be sufficient to allow most small animals to move freely through the fence; however, as newer technologies emerge the Seashore may explore different kinds of exclusion fencing. It is expected that technical details (e.g., exact length, type of footer, post type, and spacing, etc.) will vary based on factors such as topography, geologic substrate, access, potential visibility, and presence of archeological resources. This information will be evaluated on a site-by-site basis.

The location of the fence will 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 will consider collecting desirable herbs and shrubs and replanting those plants within the area of disturbance.

During construction of the fence, deer will be removed from the fenced area by driving them out. Once the fence is completed, any deer found inside the fence will be removed through direct reduction (sharpshooting or capture and euthanasia).

Visitors will be allowed within the fenced areas at the Sunken Forest.

Electric fencing will not be used based on concerns for visitor safety, potential impacts on other native wildlife, and long-term maintenance requirements.

Fencing Of The Historic Core At The William Floyd Estate

At the William Floyd Estate, the historic core will be fenced to protect all plantings important to the cultural landscape from deer browse. The layout of fencing at the William Floyd Estate is illustrated in Figure 2. The fenced area encompassing the historic core is expected to be approximately 80 acres.

Typically this fence will be a minimum of 8–10 feet high and mesh size will be sufficient to allow most small animals to move freely through the fence; however, as newer technologies emerge the Seashore may explore different kinds of exclusion fencing. It is expected that technical details (e.g., exact length, type of footer, post type, and spacing, etc.) will vary based on factors such as topography, geologic substrate, access, potential visibility, and presence of archeological resources. This information will be evaluated on a site-by-site basis.

During construction of the fence, deer will be removed from the fenced area by driving them out. Once the fence is completed, any deer found inside the fence will be removed through direct reduction (sharpshooting or capture and euthanasia).

Visitors will be allowed within the fenced areas at the William Floyd Estate historic core.

Electric fencing will not be used based on concerns for visitor safety, potential impacts on other native wildlife, and long-term maintenance requirements.

Securing The Perimeter Fence At The William Floyd Estate

In addition to fencing the historic core, the William Floyd Estate perimeter fence will be enhanced and damaged sections will be replaced to secure the fence.

Cattle guards will also be installed at each vehicular gate to prevent deer from passing through the vehicular gate when it is opened for a vehicle.

Small-Scale Fencing Of Special-Status Plants

The Seashore will continue its current practice of placing small-scale fencing around special-status plants that occupy beaches and foredunes.

This small-scale fencing is typically done as part of the annual surveys conducted by the Seashore for special-status plants that occupy these habitats across the entire length of Fire Island. When such plants are discovered, small-scale screens may be placed around individual plants or small groups of plants to protect them from deer browse.

DIRECT REDUCTION

This plan utilizes direct reduction methods to quickly reduce the deer population to the initial density goal of 20-25 deer per square mile (see “Reducing and Managing Deer Density to Achieve Vegetation Objectives” below). Direct reduction may also 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.

Direct reduction actions will be implemented on NPS lands within the Seashore boundary. The Seashore will only take direct reduction actions on non-NPS lands within the Seashore boundary when explicitly requested by the land owner and in coordination with the NYSDEC.

Sharpshooting

Methods. Qualified federal employees, contractors, or skilled volunteers 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 - will be used to implement this action. They typically will 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) will be coordinated with Seashore staff (e.g., transportation to the meat processing facility and coordination with the meat recipient).

In most locations, high-power, small-caliber rifles will be used at close range. Nonlead ammunition will be used in compliance with NPS policy (NPS 2009). Use of nonlead ammunition also will 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 will be made to ensure humane treatment of individual deer.

Sharpshooting will 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 both cases, sharpshooters will be located in elevated positions (e.g., tree stands) or in clearly marked, high-clearance government vehicles traveling on trails and/or roads on Fire Island and within the William Floyd Estate. Spotlights will be used during night operations.

Areas where sharpshooting will occur will be closed to all except authorized personnel. Seashore personnel will patrol public areas to ensure compliance with the closures and any other public safety measures that may be needed. The public will be notified of Seashore closures by appropriate means such as media releases, web or social media alerts, printed notices placed at visitor contact stations or other appropriate venues.

Compliant with New York State law, sharpshooting will not occur within 500 feet of an occupied dwelling or structure without the owner's consent. During sharpshooting activities, noise-suppression devices and night vision equipment may be used to reduce disturbance to the public. Activities will 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 will 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. All sharpshooters will be held to rigorous skill and safety standards as described below. Specific qualifications, based on state regulations, will be developed prior to implementation. These individuals also will need to demonstrate firearms proficiency, based on NPS firearms qualifications, on an annual basis throughout the project. On-site training will include Seashore orientation and required safety measures to protect visitors, NPS employees, and volunteers. Volunteers may also assist in other activities such as the transport and processing of carcasses, maintenance of bait stations, and implementation of Seashore closures. Volunteer training will be provided by NPS staff to support volunteer involvement.

Disposal. Deer carcasses will 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 will 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 will 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 will be made to reduce the visibility of the carcass to Seashore visitors.

Capture and Euthanasia

Capture and euthanasia may be used in circumstances where sharpshooting would not be appropriate due to safety or security concerns, such as close to occupied buildings. For this reason, this method is expected to be used minimally (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.

Methods. Captured deer will 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 will be selected based on the specific circumstances (location, number of deer, accessibility, and reasons that sharpshooting was not advised). Data will 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.

Training. 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) will perform these actions. Training will include safety measures to protect visitors, NPS employees, and contractors. Federal employees or contractors will also be qualified to handle live deer in order to minimize any harm to an animal or an employee.

Activities will occur when few people are visiting the Seashore. Appropriate safety measures will be followed when setting up the capture area. If area closures are needed, they will be done as described above for "Sharpshooting."

Disposal. Animals euthanized with chemicals will be appropriately disposed of, and will not be available for consumption.

Public Hunt in the Fire Island Wilderness

The NPS may carry out a controlled public hunt in the Fire Island Wilderness, in accordance with NYSDEC hunting season and regulations. The Seashore will be responsible for managing the public hunt. The Seashore may limit the number of hunters and the hours available for hunting, or may not carry out a public hunt every year if a hunt is not needed to meet deer density goals. The use of both bowhunting and firearms could be allowed, as dictated by the state deer hunting seasons. At least one check station could 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.

REPRODUCTIVE CONTROL

Reproductive control of female deer through the use of a chemical reproductive control agent could be implemented, when an acceptable chemical agent becomes available, to maintain the deer population after it has been reduced. 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 current research related to chemical reproductive control technologies offers highly variable results in terms of key elements such as contraceptive efficacy and duration. 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 will reproductive control be implemented as a management tool. The rationale for each criterion is noted below.

The fertility control agent is federally approved and state-registered for application to free-ranging white-tailed deer populations.

- Rationale: It is critical that all aspects of a fertility control program be consistent with federal and state laws and regulations, and NPS policies.

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.

- Rationale: Modeling efforts have clearly demonstrated that (1) “the efficacy of fertility control as a management technique depends strongly on the [multi-year] persistence of...the fertility control agent;” and (2) the only scenarios in which fertility control is more efficient than culling at maintaining population size is when a multi-year efficacy is achieved (Hobbs et al. 2000).

The agent can be administered through remote injection to avoid capturing the animal on a regular basis and to increase the efficiency of distribution.

- Rationale: Same as criterion 2.

The agent will leave no harmful residual in the meat (meat will be safe for human and non-target animal consumption).

- Rationale: Any fertility control agent applied must be safe for human consumption, either immediately after delivery or after an established withdrawal period.

The agent will have minimal impact on deer behavior (e.g., reproductive behaviors, social behaviors, out of season estrous cycling).

- Rationale: NPS *Management Policies 2006*, section 4.4.2, states that native species will be maintained by 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 (NPS 2006). Reproduction is a fundamental ecological process for deer and affects their social structure. Any fertility control agent that significantly changes the timing or duration of the breeding season or the social structure of the population does not meet this requirement.

The criteria included in this plan were chosen by the National Park Service to meet objectives of NPS policy, and there are currently no fertility control agents that fulfill all of the criteria. Regardless, because the NPS anticipates an agent that meets all NPS criteria will 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 management tools in this plan.

The Seashore will 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 demonstrates a benefit to deer management and that NPS criteria may be met, the Seashore will make a determination on incorporating an appropriate chemical reproductive control agent into this plan. The determination will be based on how well the criteria for an acceptable control agent are met and on availability, cost, and safety at the time that reproductive control could be implemented.

The success of implementing reproductive control on a deer population that has undergone reduction efforts for several years will 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 will become increasingly difficult after reduction efforts due to deer behavioral changes in response to previous human interaction (Underwood 2005).

Administration Of The Reproductive Control Agent

Methods. Regardless of the reproductive control agent used, treated females will 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 will 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 will perform these activities. NPS employees and contractors performing the darting will 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 will 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 will be adequately separated for safety reasons.

THRESHOLDS FOR TAKING ACTION

Actions to be taken have specific goals for success. 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 in this plan are associated with vegetation and human-deer interactions and are organized by the different areas of the Seashore.

VEGETATION

Fire Island

Sunken Forest. The vegetation monitoring data indicate little change in the tree canopy in terms of density and species composition since the establishment of the Seashore (NPS 2011, Raphael 2014). However the primary concern is that regeneration of understory 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, 2013 and 2015 (Table 1).

TABLE 1. 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 | 2013 | 2015 |
| Shadblow (<i>Amelanchier canadensis</i>) | 194±86 | 129±47 | 65±65 | 57±36 | 0 | 0 |
| Sassafras (<i>Sassafras albidum</i>) | 24±18 | 32±25 | 8±8 | 73±34 | 146±63 | 81±41 |
| Blackgum (<i>Nyssa sylvatica</i>) | 57±43 | 8±8 | 8±8 | 0 | 0 | 0 |
| American holly (<i>Ilex opaca</i>) | 16±11 | 8±8 | 0 | 0 | 0 | 0 |
| Total | 291±41 | 178±29 | 81±15 | 129±19 | 146±63 | 81±41 |

Notes: Data available from permanent plots in the Sunken Forest (Art 1976, 1987; Forrester 2004; NPS 2011, Raphael 2014, 2015 unpublished data). Values are means ± standard errors.

Stem densities in the sapling and shrub layers of those key constituents will be used 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 because it represents a time when deer were relatively uncommon on Fire Island.

Four woody species (dominant canopy constituents) and two species of understory shrubs that were relatively common in 1967 (Art 1976) were chosen as the target species: American shadblow (*Amelanchier canadensis*), sassafras (*Sassafras albidum*), blackgum (*Nyssa sylvatica*), American holly (*Ilex opaca*), chokeberry (*Aronia arbutifolia*), and inkberry (*Ilex glabra*) (Table 2). 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 2. ACTION THRESHOLDS FOR SAPLINGS AND SHRUBS

| Species | Action Threshold (stems per acre) |
|--|---|
| American shadblow (<i>Amelanchier canadensis</i>) | Less than 101 stems per acre (250 stems per hectare) |
| Sassafras (<i>Sassafras albidum</i>) | Less than 16 stems per acre (40 stems per hectare) |
| Blackgum (<i>Nyssa sylvatica</i>) | Less than 40 stems per acre (100 stems per hectare) |
| American holly (<i>Ilex opaca</i>) | Less than 8 stems per acre (20 stems per hectare) |
| Chokeberry (<i>Aronia arbutifolia</i>) | Less than 101 stems per acre (250 stems per hectare) |
| Inkberry (<i>Ilex glabra</i>) | 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, 2011 and 2013. This data showed that a number of species were present in 1967 but absent from the 2002, 2011 and 2013 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 return of these species as part of the regeneration effort would be desirable; however, formulating target thresholds for each of these ground cover plants is 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, achieving a quantifiable target may 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 target used for this plan is 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 chosen 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. Vegetation will be measured within the permanent plots to record the presence or absence and percent cover of these two species.

Other Fire Island Natural Areas. The action threshold for other forested areas on Fire Island (other than the Sunken Forest) and the William Floyd Estate is 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 the Vegetation Monitoring Plan (Appendix A). This threshold is based on a combination of actual data collected at each site (NPS 2015, NPS 2013), long-term data collected in the Sunken Forest, the scientific literature, and professional experience and opinions of scientists involved in the planning process. Data collection will be extended to other maritime forests in the future.

William Floyd Estate

Historic House and Surrounding Landscape. Restoring the cultural landscape within the historic core area of the William Floyd Estate will require successful establishment of key ornamental plantings. The condition of ornamental plantings will be monitored annually to determine relative condition. Deer browsing heavy enough to result in poor vegetation growth and vegetation mortality will serve as a threshold for taking action to control deer browse. Seashore staff will 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 will identify more detailed thresholds for taking action, once completed.

William Floyd Estate Forests. The forested areas of the William Floyd Estate will be managed as natural areas separate from the historic core area. The number of tree seedlings will be the action threshold indicator. This action threshold was selected based on available research on forest regeneration and the regeneration standard adopted by the Pennsylvania Regeneration Study, a component of the Forest Inventory and Analysis (FIA) Program being implemented nationwide by the US Forest Service (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).

Based on this study, forest regeneration targets (adequate recruitment) for the William Floyd Estate will 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). Details are provided in the Vegetation Monitoring Plan (Appendix A).

HUMAN-DEER INTERACTIONS

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.

Seashore biologists record the behavior of each deer during deer density surveys to accurately identify and measure the number of deer actively approaching people. Data collected from 2008 through 2015 showed approximately 2% of the deer on NPS lands surveyed (Light House Annex, Sailors Haven, and Fire Island Wilderness) approached the biologists (NPS 2016).

When a deer intentionally approaches a person, it can lead to human-deer interactions that are considered undesirable because they increase the risk of injury to people and to deer. Therefore, the focus of this threshold is to reduce undesirable human-deer interactions on NPS lands by minimizing the percentage of deer that approach people, using the behaviors noted in these surveys as a measure.

On NPS Lands. The Seashore believes a realistic target will be recording less than 2% of deer on NPS lands approaching biologists during deer density surveys. If more than 2% of the deer observed during surveys approach biologists, the Seashore will take appropriate action to reduce the number of deer that approach people. Appropriate action could range from increased education/enforcement efforts to removal of highly food conditioned deer on NPS lands. The Seashore may also take action if an individual deer creates a nuisance situation on park lands or at park facilities by repeatedly approaching visitors and causing safety concerns.

On Non-NPS Lands Within the Seashore Boundary. This plan does not include any actions to remove deer that approach humans on non-NPS lands within the Seashore boundary. If a land owner within the Seashore boundary requests assistance with an injured or nuisance deer, the Seashore will provide appropriate assistance in coordination with NYSDEC.

REDUCING AND MANAGING DEER DENSITY TO ACHIEVE VEGETATION OBJECTIVES

DEER DENSITY

This plan incorporates a density of approximately 20-25 deer per square mile as the initial deer density goal across Fire Island and at the William Floyd Estate lower acreage. The initial density target of 20–25 deer per square mile will 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 monitoring of vegetation impacts and whether vegetation goals are reached.

Table 3 shows deer density and population estimates at the time that this plan was prepared; however, the most current estimates will be used before implementation.

TABLE 3. DEER POPULATION ESTIMATES FOR PORTIONS OF FIRE ISLAND NATIONAL SEASHORE

| Location | Year Surveyed | Deer Density (deer per square mile)* | Habitat Area (in square mile) | Number of Deer** |
|------------------------------|---------------|--------------------------------------|-------------------------------|---------------------|
| Robert Moses State Park | 2014 | 55 32–92 | 0.853 | 47 27–78 |
| Lighthouse Tract | 2014 | 33 20–55 | 0.238 | 8 5–13 |
| Kismet-Lonelyville | 2014 | 264 212–330 | 0.352 | 93 75–116 |
| Ocean Beach – Ocean Bay Park | 2014 | 94 70–127 | 0.289 | 27 20–37 |
| Sailors Haven-Sunken Forest | 2014 | 112 85–147 | 0.242 | 27 21–36 |
| Fire Island Pines | 2014 | 165 114–239 | 0.176 | 29 20–42 |
| Davis Park | 2014 | 265 210–334 | 0.071 | 19 15–24 |
| Fire Island Wilderness | 2013 | 36 27–48 | 1.705 | 62 46–82 |
| William Floyd Estate | 2013 | 93 73–118 | 0.904 | 84 66–107 |

Source: NPS 2015

*The range in parentheses indicates the lower and upper confidence intervals, as calculated during the statistical analysis of the data gathered during deer monitoring. For simplicity, this document refers to the bold number, rather than the range.

**The range in parentheses reflects the possible number of individual deer based on the confidence intervals included in the deer density column. For simplicity, this document refers to the bold number, rather than the range.

At the Sunken Forest reserve, it is believed that even a small number of deer could potentially do a great deal of harm, especially to the herbaceous layer; therefore, the target density for the Sunken Forest reserve is zero (0) deer in order to completely protect this area from deer browse.

NUMBER OF DEER REMOVED

Seashore staff will 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 current 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.

Table 4 provides an estimated scenario for the removal actions at each location, beginning with the current deer population numbers. The scenario assumes that direct reduction methods will be used to remove the deer.

TABLE 4. ESTIMATED DEER REMOVALS BY YEAR AND LOCATION

| Year | Total Number of Deer | Percent Removed | Number Removed | Post-Removal Number | Post-Removal Density (deer per square mile) | Recruitment | Immigration | Pre-removal Number for the Following Year |
|--|----------------------|-----------------|----------------|---------------------|---|-------------|-------------|---|
| Fire Island (low end of population) | | | | | | | | |
| 1 | 229 | 65 | 149 | 80 | 20.4 | 12 | 0 | 92 |
| 2 | 92 | 15 | 14 | 78 | 19.9 | 12 | 0 | 90 |
| Fire Island (high end of population) | | | | | | | | |
| 1 | 428 | 65 | 278 | 150 | 38.2 | 37 | 7 | 195 |
| 2 | 195 | 60 | 117 | 78 | 19.9 | 20 | 4 | 101 |
| 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 |

Removal will be targeted for the six-month period from October through March. The extent to which the three methods of direct reduction will be used is dependent on variable factors (e.g., number of hunting permits issued) which will be established upon implementation of the plan and could vary by year.

The numbers presented in Table 4 are estimates based on deer density data available at the time this plan was approved and estimates of annual growth, as well as what experienced staff believe is reasonable. It is expected that these numbers will change over time as the plan is implemented.

Several factors could influence the number of years required to reach the initial deer density goal. 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. Immigration of deer into the Seashore property could also vary, and this will have an effect on the number of deer to be removed (Porter, Underwood, and Woodward 2004). Thus, monitoring will be an essential part of determining the number of deer to be removed in a given year, and actions may be adjusted as described in “Adaptive Management Approach” below.

The number of deer removed in years following attainment of the desired density goal will be adjusted as described in “Adaptive Management Approach” below. 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 for annual density maintenance will range from 15-30, while at William Floyd Estate, it will range from 3–12.

SEX PREFERENCE

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

MAINTAINING DENSITY WITH REPRODUCTIVE CONTROL

If an acceptable agent becomes available, reproductive control could be initiated when the Seashore’s deer population density reached the range of 20–25 deer per square mile, at which point, the Seashore’s total deer population is expected to be approximately 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 will be approximately 110 females on Fire Islands and 12 females at the William Floyd Estate.

For the initial fertility control treatment, the estimated number of adult females that may need to be treated and marked for identification will be 90% of the females (Rudolph, Porter, and Underwood 2000; Hobbs, Bowden, and Baker 2000), or 99 of the females on Fire Island and 11 of the females at the William Floyd Estate.

The deer population will be monitored (Appendix B) as fertility control continues in subsequent years, and uncertainties could be tested via modeling approaches as part of adaptive management. If the deer population increases during the reproductive control application, periodic direct reduction methods could be initiated to maintain the deer population density at the designated goal.

ADAPTIVE MANAGEMENT APPROACH

Under this plan, the following five steps will constitute the iterative phase of the adaptive management approach:

1) Monitor the conditions.

- a) These conditions will be recorded and compared against baseline data to determine whether management actions are necessary.
- b) 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.

- a) Deer will be managed using one of the management actions described in this plan. For example, the Seashore will 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.
- b) Initial thresholds for taking action for the various areas of the Seashore have been established, as described under the "Thresholds for Taking Action" section, and these thresholds will be adjusted as necessary in the future, based on information collected through subsequent monitoring.

3) Monitor for the effectiveness of each management action.

- a) Monitoring will determine whether the management actions were achieving the desired outcome. For example: 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? Are less than 2% of deer observed approaching surveyors?
- b) It is expected that it will take at least 8–10 years after the initial deer density goal was achieved until vegetation results will be seen in the monitored plots within the maritime forests and the William Floyd Estate.

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.

- a) For example, if vegetation 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, additional vegetation management actions will be considered, and additional compliance may be necessary.

- b) This also 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.**
- a) 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 will be used in the following areas:

- vegetation management
- deer density goal
- reproductive control
- undesirable human-deer interactions.

As this plan is implemented, it is assumed that knowledge and experience with vegetation monitoring, the current deer density at the Seashore, existing technology, and knowledge of deer population dynamics will 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 this plan.

Changes in timing will be made in cooperation with the state and only when there was scientific evidence to support such an action.

Vegetation monitoring results will be the key parameter for determining success, and not deer density. If monitoring indicates that vegetation was not regenerating, management actions will be adjusted.

MONITORING

ENHANCED VEGETATION MONITORING WITHIN NATURAL AREAS

Seashore 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. Vegetation monitoring will utilize existing permanent vegetation plots so that comparisons can be made. Any additional permanent plots that are needed will be established before monitoring will occur. Data collection will occur annually, with each natural area being sampled at least once every three years.

The detailed Vegetation Monitoring Plan is provided as Appendix A.

ENHANCED DEER MONITORING

Deer monitoring includes both deer population (numbers) and deer behavior. Monitoring deer numbers is a critical element of this plan to measure deer densities relative to observed changes in vegetation. Enhancement of deer monitoring efforts will occur by increasing the monitoring events across all regions of the Seashore to an annual basis. This data will be a key component in determining whether Seashore goals are met and any adaptive management actions throughout the implementation of the plan.

Records will 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 will be compared with data used in deer population models to improve model accuracy.

During deer density counts, staff will also record any observed deer behavior as a means of indexing the frequency of undesirable human-deer interactions.

The detailed Deer Population Monitoring Plan is provided as Appendix B.

MONITORING OF REPRODUCTIVE CONTROL

If and when a reproductive control agent becomes available and is implemented, additional monitoring to document reproductive control success (pregnancy rate, and reproductive rate) will be implemented.

It is expected that, as the number of females treated with a reproductive control agent increases over time, the percent of pregnant females will decrease. Data on reproductive rates also will be used to describe the existing deer population.

General deer population monitoring (age composition, etc.) is described in Appendix B. A detailed monitoring plan for reproductive control may be developed in the future if and when reproductive control is implemented.

MONITORING OF FENCING

All fencing will be monitored by Seashore staff and maintained by contract with a local fence company.

Monitoring of all fenced areas will consist of visual inspection for fence integrity and will be coordinated with vegetation monitoring activities.

COORDINATION WITH NEW YORK STATE

The New York State Department of Environmental Conservation (NYSDEC) 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 NYSDEC is the agency entrusted with administration and oversight of deer population management in the state of New York according to the specific policies, authorities, and responsibilities outlined in the New York State Environmental Conservation Law Article 11.

The Seashore 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 will be conducted in accordance with federal and state laws as appropriate. In addition, once a fertility control agent is approved for use by the Environmental Protection Agency (EPA), the agent must also be registered for use in the state of New York. Registration of any agent will include labeled restrictions. By law, any landowner using the agent, including the National Park Service, will need to comply with these labeled restrictions. Coordination will include routine meetings with NYSDEC staff, data sharing, public relations, and reporting.

COORDINATION WITH THE FIRE ISLAND COMMUNITIES

As previously described, in implementing this plan, the Seashore will coordinate with the Fire Island communities in the following ways:

Enhanced Public Education Efforts. Work collaboratively with New York State Parks, Suffolk County Parks, the Towns of Islip and Brookhaven, Fire Island communities, and local environmental groups to develop, share, and use consistent and strategic messaging with regard to the role of humans in deer-related issues on Fire Island.

Surveys and Monitoring. Deer population and behavior surveys will continue to be conducted island-wide, which will include the Fire Island communities and other non-NPS lands within the Seashore boundary.

Direct Reduction. Direct reduction actions (sharpshooting and capture and euthanasia) will be implemented on NPS-owned and managed lands within the Seashore boundary. The Seashore will only take direct reduction actions on non-NPS lands within the Seashore boundary when explicitly requested by the land owner and in coordination with the NYSDEC.

Seashore Area Closures for Management Actions. Areas of the Seashore where direct reduction actions will occur will be closed to all except authorized personnel. Seashore personnel will patrol public areas to ensure compliance with the closures and any other public safety measures that may be needed. The public will be notified of Seashore closures by appropriate means such as media releases, web or social media alerts, printed notices placed at visitor contact stations or other appropriate venues.

Assistance with injured or nuisance deer on request of the land owner. This plan does not include any actions to remove deer that approach humans on non-NPS lands within the Seashore boundary. If a land owner within the Seashore boundary requests assistance with an injured or nuisance deer, the Seashore will provide appropriate assistance in coordination with NYSDEC.

WILDERNESS 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. 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. . .” 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 Seashore will complete a minimum requirement analysis for specific actions in this plan prior to implementation in the Otis Pike Fire Island High Dune Wilderness, such as a controlled public hunt. The NPS will strive to minimize the extent of adverse impact while accomplishing the Seashore’s necessary wilderness objective.

FIGURES



White-tailed Deer Management Plan for Fire Island National Seashore

FIGURE 2
William Floyd Estate Fencing



National Park Service
U.S. Department of the Interior
Fire Island National Seashore

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APPENDIX A

VEGETATION MONITORING PLAN

INTRODUCTION

The vegetation monitoring plan enables the Seashore to analyze how vegetation within the boundaries responds to management actions implemented through the White-tailed Deer Management Plan for Fire Island National Seashore (this plan). It also allows for the Seashore to monitor specific vegetation targets defined in this plan.

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 will 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 are 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 this plan. 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 before the implementation of this plan.

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 A-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 |
|-------------------|-------------------------------|---------------|
| American shadblow | <i>Amelanchier canadensis</i> | 380-580 |
| Sassafras | <i>Sassafras albidum</i> | 40-80 |
| Black gum | <i>Nyssa sylvatica</i> | 100-180 |
| American holly | <i>Ilex opaca</i> | 30-50 |
| Black cherry | <i>Prunus serotina</i> | 0-10 |

TABLE A-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 | <i>Aronia arbutifolia</i> | 400-750 |
| Inkberry | <i>Ilex glabra</i> | 300-550 |

TABLE A-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 | <i>Maianthemum canadense</i> | Herb | 1-2% |
| Starflower | <i>Trientalis borealis</i> | Herb | 0.25% |
| Sarsaparilla | <i>Aralia nudicaulis</i> | Herb | 6-10% |
| Solomon's seal | <i>Maianthemum stellatum</i> | Herb | 1-2% |
| Bracken fern | <i>Pteridium aquilinum</i> | Herb | 1% |
| Poison ivy | <i>Toxicodendron radicans</i> | Herb/ Liana/Woody | 6-10% |
| Virginia creeper | <i>Parthenocissus quinquefolia</i> | Liana | 3-4% |
| Grapes | <i>Vitis</i> spp. | Liana | 1-2% |
| American shadblow | <i>Amelanchier canadensis</i> | Woody | 1-2% |
| Black huckleberry | <i>Gaylussacia baccata</i> | Woody | 6-8% |
| Northern bayberry | <i>Myrica pensylvanica</i> | Woody | 1-2% |
| Black gum | <i>Nyssa sylvatica</i> | Woody | 1-2% |
| Black cherry | <i>Prunus serotina</i> | Woody | <1% |
| Sassafras | <i>Sassafras albidum</i> | Woody | 1-2% |
| Highbush blueberry | <i>Vaccinium corymbosum</i> | Woody | 1-3% |
| Chokeberry | <i>Aronia arbutifolia</i> | Woody | 1-2% |
| Ink berry | <i>Ilex glabra</i> | Woody | 1-2% |
| Carolina rose | <i>Rosa carolina</i> | Woody | 1-2% |
| Bog cranberry | <i>Vaccinium oxycoccus</i> | Woody | 1-2% |
| Oaks | <i>Quercus</i> spp. | Woody | 1% |
| Winged sumac | <i>Rhus copallinum</i> | Woody | 1-2% |
| | TOTAL (native ground layer) | ALL | 40-45% |

**TABLE A-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 A-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 Seashore biologists 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 A-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 A-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 A-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 A-6. LIST OF TARGET "SEEDLING" SPECIES FOR EACH AREA

| Blue Point and Talisman | |
|-------------------------|-------------------------------|
| Common Name | Scientific Name |
| American holly | <i>Ilex opaca</i> |
| American shadblow | <i>Amelanchier canadensis</i> |
| Sassafras | <i>Sassafras albidum</i> |
| Black gum | <i>Nyssa sylvatica</i> |
| Oak | <i>Quercus</i> spp. |
| Winged sumac | <i>Rhus copallinum</i> |
| Pitch pine | <i>Pinus rigida</i> |

Table A-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 A-7. LIST OF SPECIES THAT WILL BE MONITORED IN THE MARITIME FOREST ON FIRE ISLAND

| Common Name | Scientific Name | Form |
|--------------------------------|------------------------------------|-------------------|
| Canada mayflower | <i>Maianthemum canadense</i> | Herb |
| Starflower | <i>Trientalis borealis</i> | Herb |
| Sarsaparilla | <i>Aralia nudicaulis</i> | Herb |
| Solomon's seal | <i>Maianthemum stellatum</i> | Herb |
| Seaside goldenrod | <i>Solidago sempervirens</i> | Herb |
| Bracken fern | <i>Pteridium aquilinum</i> | Herb |
| Cinnamon fern | <i>Osmunda cinnamomea</i> | Herb |
| Spinulose woodfern | <i>Dryopteris carthusiana</i> | Herb |
| Virginia marsh St. John's wort | <i>Triadenum virginicum</i> | Herb |
| Germander | <i>Teucrium canadense</i> | Herb |
| Swamp smartweed | <i>Polygonum hydropiperoides</i> | Herb |
| Sedges | <i>Carex</i> spp. | Herb |
| Jewelweed | <i>Impatiens capensis</i> | Herb |
| Eastern marsh fern | <i>Thelypteris palustris</i> | Herb |
| Salt meadow cordgrass | <i>Spartina patens</i> | Herb |
| Canada lettuce | <i>Lactuca canadensis</i> | Herb |
| Rush | n/a | Herb |
| Other grasses | n/a | Herb |
| Poison ivy | <i>Toxicodendron radicans</i> | Herb/ Liana/Woody |
| Blackberries | <i>Rubus</i> spp. | Liana |
| Virginia creeper | <i>Parthenocissus quinquefolia</i> | Liana |
| Grapes | <i>Vitis</i> spp | Liana |
| Greenbriar | <i>Smilax rotundifolia</i> | Liana |
| Cat greenbriar | <i>Smilax glauca</i> | Liana |
| American shadblow | <i>Amelanchier canadensis</i> | Woody |
| Salt bush | <i>Baccharis halimifolia</i> | Woody |
| Black huckleberry | <i>Gaylussacia baccata</i> | Woody |
| Northern bayberry | <i>Myrica pensylvanica</i> | Woody |
| Black gum | <i>Nyssa sylvatica</i> | Woody |
| Black cherry | <i>Prunus serotina</i> | Woody |
| Swamp azalea | <i>Rhododendron viscosum</i> | Woody |

TABLE A-7. LIST OF SPECIES THAT WILL BE MONITORED IN THE MARITIME FOREST ON FIRE ISLAND (CONT'D)

| Common Name | Scientific Name | Form |
|--------------------|------------------------------|-------------|
| Sassafras | <i>Sassafras albidum</i> | Woody |
| Highbush blueberry | <i>Vaccinium corymbosum</i> | Woody |
| American holly | <i>Ilex opaca</i> | Woody |
| Chokeberry | <i>Aronia arbutifolia</i> | Woody |
| Ink berry | <i>Ilex glabra</i> | Woody |
| Carolina rose | <i>Rosa carolina</i> | Woody |
| Bog cranberry | <i>Vaccinium oxycoccus</i> | Woody |
| Cranberry | <i>Vaccinium macrocarpon</i> | Woody |
| Oaks | <i>Quercus</i> spp. | Woody |
| Winged sumac | <i>Rhus copallinum</i> | Woody |
| Eastern red cedar | <i>Juniperus virginiana</i> | 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 before the implementation of this plan.

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 A-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 Seashore biologists 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 m² subplots located at the corners of each 100 m² (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 A-8). 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 A-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 A-9. LIST OF NONNATIVE INVASIVE SPECIES FOUND
 ON FIRE ISLAND AND THE WILLIAM FLOYD ESTATE**

| Common Name | Scientific Name |
|---------------------------|------------------------------|
| Autumn olive | <i>Elaeagnus umbellata</i> |
| Black locust | <i>Robinia pseudoacacia</i> |
| Canada thistle | <i>Cirsium arvense</i> |
| Chinese lespedeza | <i>Lespedeza cuneata</i> |
| Chinese/Japanese wisteria | <i>Wisteria</i> spp. |
| Common mullein | <i>Verbascum thapsus</i> |
| Common reed | <i>Phragmites</i> spp. |
| Garlic mustard | <i>Alliaria petiolata</i> |
| Japanese barberry | <i>Berberis thunbergii</i> |
| Japanese black pine | <i>Pinus thunbergii</i> |
| Japanese honeysuckle | <i>Lonicera japonicus</i> |
| Japanese knotweed | <i>Polygonum cuspidatum</i> |
| Lesser celandine | <i>Ranunculus ficaria</i> |
| Mugwort | <i>Artemisia vulgaris</i> |
| Multiflora rose | <i>Rosa multiflora</i> |
| Norway maple | <i>Acer platanoides</i> |
| Oriental bittersweet | <i>Celastrus orbiculatus</i> |
| Spotted knapweed | <i>Centaurea maculosa</i> |
| Tree of heaven | <i>Ailanthus altissima</i> |

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APPENDIX B
DEER MONITORING

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 for Fire Island National Seashore (this plan). 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.

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 this plan. Data collected will be used to inform Seashore managers on the success of management actions included in this plan.

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 this plan is implemented, these areas will 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:

- 3) The person/s surveying a particular unit must remain the same within sampling of that unit due to individual differences in detection.
- 4) 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 this plan is implemented and the white-tailed deer population declines.
- 5) 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, the Seashore has followed a standard protocol for monitoring deer behavior. First, data on deer behavior is collected at 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).

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 B-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.

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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Attachment B

Non-Impairment Determination

By enacting the NPS Organic Act of 1916 (Organic Act), Congress directed the U.S. Department of Interior and the NPS to manage “to conserve the scenery, natural and historic objects, and wild life in the [National Park] System units and to provide for the enjoyment of the scenery, natural and historic objects, and wild life in such manner and by such means as will leave them unimpaired for the enjoyment of future generations” (54 USC 100101(a)). Congress reaffirmed this mandate in 1978 by stating that NPS must conduct its actions in a manner that will ensure no “derogation of the values and purposes for which the System units have been established, except as directly and specifically provided by Congress.” (54 USC 100101(b)(2)).

NPS Management Policies 2006, Section 1.4.4, explains the prohibition on impairment of park resources and values:

While Congress has given the Service the management discretion to allow impacts within parks, that discretion is limited by the statutory requirement (generally enforceable by the federal courts) that the Park Service must leave park resources and values unimpaired unless a particular law directly and specifically provides otherwise. This, the cornerstone of the Organic Act, establishes the primary responsibility of the Nation Park Service. It ensures that park resources and values will continue to exist in a condition that will allow the American people to have present and future opportunities for enjoyment of them.

The NPS has discretion to allow impacts on Park resources and values when necessary and appropriate to fulfill the purposes of a Park (NPS 2006 sec. 1.4.3). However, the NPS cannot allow an adverse impact that would constitute impairment of the affected resources and values (NPS 2006 sec 1.4.3). An action constitutes an impairment when its impacts “harm the integrity of Park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values” (NPS 2006 sec 1.4.5). To determine impairment, the NPS must evaluate “the particular resources and values that would be affected; the severity, duration, and timing of the impact; the direct and indirect effects of the impact; and the cumulative effects of the impact in question and other impacts” (NPS 2006 sec 1.4.5).

This determination on impairment has been prepared for the selected action described in this Record of Decision. An impairment determination is made for all resource impact topics analyzed for the selected action; i.e., vegetation, unique vegetation communities, and special-status plant species; wetlands; white-tailed deer population; other wildlife and wildlife habitat; and cultural landscapes. An impairment determination is not made for visitor use and experience, Fire Island communities and adjacent landowners, public health and safety, and Seashore operations because impairment findings relate to park resources and values, and these impact areas are not generally considered to be park resources or values according to the Organic Act; thus, these cannot be impaired in the same way that an action can impair park resources and values and are not subject to the impairment standard of the Organic Act. Similarly, while wilderness is subject to its own requirements under the Wilderness Act, it is not itself a park resource or value subject to the impairment standard of the Organic Act, and is not included here.

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

Native vegetation is necessary to fulfill the purposes for which the Seashore was established and is key to the natural and cultural integrity and enjoyment of the Seashore. Vegetation contributes to the cultural landscapes of the Seashore, including the William Floyd Estate, that are to be preserved or restored. Seashore planning documents recognize natural resources of the Seashore, including vegetation, as being important to the regional ecology and historic context of the Seashore and promote protection of natural resources.

A description of the vegetation within the boundary of 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). Vegetation in the Seashore is the product of those natural forces as well as human influences, such as development and sand renourishment projects, which affect species composition, abundance, and spatial patterns (Klopfer et al. 2002).

Sections of the federally owned land also contain rare maritime vegetative communities. The majority of the eastern half of the Seashore comprises natural lands associated with the Fire Island Wilderness and Smith Point County Park. The Seashore contains 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. 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 William Floyd Estate, situated on the south shore of Long Island, contains vegetative community types that, though typical of those on Long Island, are dramatically different from those found on Fire Island. 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. Clark (1986) 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 (Clark 1986 and Klopfer et al. 2002). Clark (1986) 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.

Seven species of rare plants have been identified at the Seashore, including the seabeach amaranth (*Amaranthus pumilus*), which is the only plant species within the Seashore that is federally listed as threatened under the Endangered Species Act. During annual surveys, 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 2012). Seashore staff has protected seabeach amaranth plants since 2012 with small-scale fencing.

The selected action will result in some adverse impacts on vegetation in the Sunken Forest and the William Floyd Estate historic core area due to the installation of exclusion fencing which will require trimming and removal of some vegetation. The extent of linear vegetation removal needed for fence installation totals approximately 1.31 acres in the Sunken Forest and 5.6 acres at the William Floyd Estate. To minimize impacts on surrounding vegetation, clearing will be accomplished by hand using hand tools. Seashore staff will select alignments for the fence that will minimize removal of overstory trees in the Sunken Forest and will avoid wooded trails and lopped trees at the William Floyd Estate. If feasible, at the Sunken Forest, desirable shrub and herbaceous plants may be collected by Seashore staff and replanted immediately in other areas of the Sunken Forest. Vegetation will be allowed to recover along the edge of the fence where construction impacts occurred. Vegetative recovery is expected within one to two growing seasons after fence installation.

This amount of vegetation removal for fence installation from either the Sunken Forest or the William Floyd Estate is considered small-scale, especially in the context of the much larger acreage of these important resources that will ultimately be protected. Vegetation recovery is expected in the Sunken Forest, including 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 will be increased to promote canopy replacement in the event of tree mortality from disease or storm damage. At the William Floyd Estate, vegetation recovery is expected through the protection of culturally significant plants. Protecting the historic core from deer browse will allow the Seashore to successfully restore degraded elements of the cultural landscape through plantings. Where existing plantings remain but are severely degraded, these will be able to recover and regenerate naturally, maintaining and restoring the integrity of the cultural landscape.

In addition to the protections provided at the Sunken Forest and William Floyd Estate, the selected alternative will result in a substantial improvement in the overall condition of special-status plants throughout the Seashore. The relatively rapid deer herd reduction will quickly reduce browsing pressure, creating conditions that allow vegetation throughout the Seashore to begin to recover. Seashore staff will continue to install screens and fencing around special-status plants to provide immediate protection of individual and small groups of special-status plants while reduction of high deer density and maintaining a smaller deer population will allow the time needed to sustain the recovery of native herb, seedlings, saplings, and shrubs for the 8 to 10 years that will likely be required for the recovery to occur.

The selected action will 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. Adverse impacts due to the fence installation will be relatively small-scale in nature. Because there will only be slight adverse impacts and primarily long-term beneficial impacts that support the natural integrity of the Seashore and the resources it strives to conserve, the selected alternative will not result in impairment of vegetation resources.

Wetlands

Wetlands have unique, intrinsic functions and values that cannot be easily duplicated or replaced; for example, groundwater recharge, stormwater storage and discharge, and support of unique habitats. The selected action has potential to result in adverse impacts to wetlands as a result of installing exclusion fencing in the Sunken Forest. The fence is expected to bisect jurisdictional wetland marsh and scrub-shrub areas and will require clearing approximately 0.05 acre of wetland vegetation (273 linear feet at a width of 8 feet) to create a corridor for installing the fence; ground disturbance to excavate the fence post holes, and sidecasting soil extracted from the post holes into the adjacent wetlands. These adverse impacts will not have any noticeable effect on wetland functions. Removing vegetation along the fence construction corridor will temporarily disturb the wetlands within the 8-foot corridor but will not affect the adjacent wetlands. The loss of wetland vegetation will be mitigated by locating the fence so as to minimize impacts to wetlands. Wetland vegetation will be allowed to re-grow along the fence corridor once installation is complete, and is expected to return in the cleared areas within the first growing season. It is possible that the presence of the fence may also exacerbate erosion on the bayside shoreline, anticipated to occur as sea-level rise causes the shoreline to move toward the Sunken Forest. The fence at the Sunken Forest will be monitored by Seashore staff in coordination with vegetation monitoring. If any areas of erosion are observed along the fence, appropriate action to minimize or correct the situation will be taken. For these reasons, the selected action will not impair wetlands in the Seashore.

White-tailed Deer Population

Viable wildlife populations are important components of the natural landscape of the Seashore. One of the management objectives in the Seashore's *General Management Plan* is to protect and preserve natural plant and animal communities (NPS 1977). That plan recognizes natural resources of the Seashore, which include deer, as being important to the regional ecology, but also promote managing deer to protect resources from being harmed by overbrowsing. In developing a deer management strategy, an important goal has been to maintain a viable population of white-tailed deer in the Seashore.

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. 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). Current deer densities, from the most recent surveys in 2013 and 2014, vary between approximately 36 and 264 deer per square mile, depending on location.

The selected action will result in adverse impacts on the deer population in the initial two to three years of implementation due to the higher than normal mortality from the rapid population control. Reproductive control actions, if implemented, will adversely impact individual deer, due to handling stress and the possible physiological or behavioral changes due to the use of non-surgical reproductive controls. 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 outside the fences until the deer density is lowered. However, although changes to numbers, structure, or other demographic factors will occur, the Seashore's white-tailed deer population is expected to remain viable because the target density of 20-25 deer per square mile is believed to be adequate to maintain population viability while reducing deer browsing pressure sufficiently to allow vegetation to recover. Further, the reduction in deer numbers and density under the selected action will ultimately improve the condition of the deer population in the Seashore because the recovery of vegetation from reduction of browsing pressure will improve overall habitat quality. Deer will have access to higher quality forage and less competition for resources.

Because adverse effects will be mainly limited to individual deer and because there will be long-term benefits to deer at the population level, the selected alternative will not result in impairment of the white-tailed deer population at the Seashore.

Other Wildlife and Wildlife Habitat

As noted for white-tailed deer, viable populations of other wildlife are also important components of the natural landscape of the Seashore, recognized in the Seashore's *General Management Plan* (NPS 1977). The Seashore contains a mosaic of natural habitats situated close 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 a variety of habitats for a diverse population of wildlife species, including mammals, reptiles, birds, and ticks and other invertebrates.

The selected action will result in minimal adverse impacts to other wildlife and their habitats from vegetation removal to install exclusion fencing and some general disturbance from deer management actions. The removal of approximately 7 acres of vegetation due to the installation of fencing in the Sunken Forest and at the William Floyd Estate will be distributed linearly within areas that provide plentiful habitat. Noise disturbance from humans during the fence installation will generally be limited to construction. Some natural wildlife movement patterns may be altered but many other wildlife species' movement will likely be minimally affected by the fence. Disturbance impacts on other wildlife from bait stations, sharpshooting, and hunting will be occur only a few weeks each year.

The selected action will primarily result in substantial long-term benefits to other wildlife and wildlife habitats as a result of reducing and controlling the effects of deer browse. The Sunken Forest and William Floyd Estate will be fenced, and those habitats are expected to begin improving due to the absence of deer browse. Once the target deer density is reached and maintained, the reduction in deer numbers and deer browse is expected to promote the recovery of native understory vegetation resulting in long-term benefits to other wildlife, such as songbirds, reptiles, insects, and small mammals, and their habitats. The reduction in deer numbers will also promote the regeneration of native species and decrease the potential for the spread of invasive species, which will provide long-term beneficial impacts on other wildlife and wildlife habitats.

Because of the small magnitude of adverse effects from management actions and the primarily beneficial effects that will result from reduced deer browsing pressure, the selected alternative will not result in impairment of wildlife and wildlife habitat.

Cultural Landscapes

A cultural landscape, as defined by The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes, consists of "a geographic area (including both cultural and natural resources and *the wildlife or domestic animals therein*) [emphasis added] associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values" (NPS 1996). Cultural landscapes are an issue in deer management because an overabundance of deer and resultant deer browse can adversely affect the cultural landscapes within the Seashore, as could the erection of fences and large exclosures.

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, the landscape associated with the William Floyd Estate is the only cultural landscape affected by the selected action.

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 is a 613-acre tract that includes a 34.5-acre historic core, which encompasses the Old Mastic House, the Floyd Family Cemetery, and 10 agricultural buildings.

Under the selected alternative, the existing William Floyd Estate perimeter fence will be improved to exclude deer as much as possible by the use of cattle guards at the gates, and an additional fence will exclude deer from the historic core. This will 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 will 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 will be unaffected. However, there will be an adverse impact associated with the installation of the fence in the cultural landscape of the William Floyd Estate. This will 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 will 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 will be preserved, the circulation between the core and the lower acreage will be interrupted. The adverse impacts of the introduction of extensive fencing at the south end of the historic core can be largely mitigated by careful placement of the fence within existing tree lines. Overall, the reduction of deer browse of vegetation will 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. Therefore, the selected alternative will not result in an impairment of cultural landscapes.

Conclusion

In the professional judgement of the NPS decision-maker, the adverse impacts that may result from implementing the selected action will not rise to levels that would constitute impairment. This determination is based on consideration of the Seashore's purpose and significance, a thorough analysis of the environmental impacts described in the final plan/EIS, relevant scientific studies, the comments provided by the public and others, and the professional judgment of the decision maker guided by the direction of the NPS *Management Policies 2006* (NPS 2006).