

Affected Environment

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INTRODUCTION

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

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

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



Interdunal swale in Sailors Haven (Photo Credit: VHB)

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

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

FIRE ISLAND COMMUNITIES

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

NATURAL AREAS

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

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



National Park Service
U.S. Department of the Interior

Fire Island National Seashore

White-tailed Deer Management Plan and
Environmental Impact Statement

FIGURE 6a
Vegetation



National Park Service
U.S. Department of the Interior

Fire Island National Seashore

White-tailed Deer Management Plan and
Environmental Impact Statement

FIGURE 6b
Vegetation



White-tailed Deer Management Plan and Environmental Impact Statement



National Park Service
U.S. Department of the Interior

Fire Island National Seashore

FIGURE 6c
Vegetation



National Park Service
U.S. Department of the Interior

Fire Island National Seashore

White-tailed Deer Management Plan and Environmental Impact Statement

FIGURE 6d
Vegetation



National Park Service
U.S. Department of the Interior

Fire Island National Seashore

White-tailed Deer Management Plan and Environmental Impact Statement

FIGURE 6e
Vegetation

TABLE 10. VEGETATION COMMUNITY TYPES

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

TABLE 10. VEGETATION COMMUNITY TYPES (CONT'D)

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

Source: Klopfer et al. 2002

Fire Island

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

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

William Floyd Estate

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

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

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



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

The Seashore has initiated the collection of vegetation data within the William Floyd Estate forests to establish baseline conditions for future monitoring similar to the studies being conducted at Talisman and Blue Point (NPS 2013f). Just as noted by Clark (1986), a clear forest canopy gradient exists from the southern end of the William Floyd Estate to the northern end (i.e., lower elevations to higher elevations). Black gum (*Nyssa sylvatica*) is dominant within the southern portion of the lower acreage with a strong component of shadblow (*Amelanchier canadensis*), while scarlet oak (*Quercus coccinea*) is the dominant tree species in the northern reaches of the property with a mixture of white oak (*Quercus alba*), black

oak (*Quercus velutina*), hickory (*Carya tomentosa*, *C. glabra*), and red maple (*Acer rubrum*). A look at the understory has revealed similar species gradient for shrubs. Among the four most common shrubs, black huckleberry (*Gaylussacia baccata*) is the most dominant shrub in the northern portion; spice bush (*Lindera benzoin*) and arrowwood (*Viburnum dentatum*) dominate central section, and highbush blueberry (*Vaccinium corymbosum*) dominates the shrub layer in the southern section. The most striking discovery is that black cherry (*Prunus serotina*), black gum (*Nyssa sylvatica*), and sassafras (*Sassafras albidum*) are the dominate seedlings/saplings throughout most of the property, even in areas where these species are not common in the overstory, suggesting a species composition shift is occurring to favor those tree species most avoided by deer (NPS 2013f). Furthermore, because of deer browse, there is not sufficient recruitment of tree seedlings to sustain natural reproduction of the overstory canopy (NPS 2013f).

UNIQUE VEGETATION COMMUNITIES

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

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

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

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

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

TABLE 11. UNIQUE ECOLOGICAL COMMUNITY TYPES

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

Source: Trocki 2008

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

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

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



The Sunken Forest (Photo credit:VHB)

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



Solomon's seal (Photo credit: NPS)

SPECIAL-STATUS PLANT SPECIES

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

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

TABLE 12. FEDERALLY AND STATE LISTED PLANT SPECIES

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

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

WETLANDS

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

All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters that are subject to the ebb and flow of the tide;

All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce including any such waters.

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

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

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

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

“Lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification, wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year.

“The term wetland includes a variety of areas that fall into one of five categories; (1) areas with hydrophytes and hydric soils, such as those commonly known as marshes, swamps, and bogs; (2) areas without hydrophytes but with hydric soils – for example flats where drastic fluctuation in water level, wave action, turbidity, or high concentration of salts may prevent the growth of hydrophytes; (3) areas with hydrophytes but nonhydric soils, such as margins of impoundments or excavations where hydrophytes have become established but hydric soils have not yet developed; (4) areas without soils but with hydrophytes such as the seaweed-covered portion of rocky shores; and (5) wetlands without soil and without hydrophytes, such as gravel beaches or rocky shores without vegetation.” (Cowardin et al. 1979)

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





Wetlands in the Sunken Forest (Photo credit: VHB)

present north of the Sunken Forest that are influenced by a high water table of freshwater and occasional tidal fluctuations creating a mixohaline (i.e., salt concentration less than 30 parts per thousand) hydrologic regime. The dominant plant within these marshes is a thick bed of reed grass (*Phragmites australis*) mixed with salt bush (*Baccharis halimifolia*) and wax myrtle (*Myrica cerifera*). The Highbush Blueberry Shrub Swamp wetland is classified as Palustrine Broad-leaved Deciduous Scrub-Shrub, Seasonally Flooded/Saturated. These freshwater wetlands occur slightly landward from the Reed Grass Marshes within saturated soils driven by a high groundwater table and are dominated by highbush blueberry (*Vaccinium corymbosum*), salt bush (*Baccharis halimifolia*), swamp azalea (*Rhododendron viscosum*), and reed grass (*Phragmites australis*).


One proposed action would affect jurisdictional wetlands: the installation of the exclusion fence around the Sunken Forest. The fence would be expected to bisect sections of wetlands between the Sunken Forest and shoreline of Great South Bay. Wetland types in this area include the Reed Grass Marsh and Highbush Blueberry Shrub Swamp Associations (figure 7). Using the U.S. Fish and Wildlife Service wetland classification system (Cowardin et al. 1979), the Reed Grass Marsh wetland is classified as Estuarine Intertidal Persistent Emergent, Irregularly Flooded. Several Reed Grass Marsh wetlands are


LEGEND



 Sunken Forest Preserve

 Sunken Forest Trail/Boardwalk

Wetlands

 Highbush Blueberry Shrub Swamp

 Reedgrass Marsh

  0 400 Feet

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



FIGURE 7
Existing Wetlands - Sunken Forest

WHITE-TAILED DEER POPULATION

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



Adult female deer and fawn (Photo credit: NPS)

The Seashore has undertaken several studies to understand the population dynamics of deer on Fire Island and the William Floyd Estate. The Seashore's first examination of the number of deer on Fire Island occurred from 1983 through 1988 by O'Connell and Sayre (1988) using aerial helicopter surveys. This methodology was continued until 1998. Results from aerial surveys found that by 1991, the deer population increased annually between 11% and 43% for areas on the western side of Fire Island near the Fire Island communities, while the population in

the Fire Island Wilderness on the eastern side of Fire Island remained relatively unchanged (table 13). During this same study, 20 deer (11 males, 9 females) were fitted with radio-telemetry collars to track and analyze their movements across the Seashore. In general, deer maintained high fidelity to home ranges with an average of 1.5 miles (2.4 km) movement distance across the Seashore, with longer movements attributed to young males. During a study on vector hosts of Lyme disease, one marked deer was found to travel 3.1 miles (5 km) from the lighthouse to Point O'Woods (Underwood 2005).

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

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

Source: Underwood 2005

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

Deer management began a new phase in the 1990s as private citizens residing in the Fire Island communities began funding an exploratory study looking at immunological contraception to control deer numbers. The first five years of the study were designed to examine the biological effectiveness of the newly developed contraceptive PZP in blocking fertilization of individuals. The data showed positive results (Naugle et al. 2002), and in 1998 the study turned toward determining whether the overall deer population could be lowered using the PZP vaccine primarily within the Fire Island communities on the western side of the Seashore. The Seashore assumed partial funding and carried out the

program during the last several years of the study. This study continued until 2009, with approximately 100 female deer treated each year. Underwood (2005) concluded, "In areas with the longest treatment history, the longest record of monitoring and the best access to breeding-aged females, the deer population has declined by almost 50% since 1998 (Naugle et al. 2002). In other treatment areas, population responses have been much less dramatic."



Deer in pedestrian corridor (Photo credit: NPS)

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

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

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



Deer browsing on vegetation (Photo credit: NPS)

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

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

Source: NPS 2013b

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

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

O'Connell and Sayre (1988) performed deer counts and examined the movements of 20 deer on the Seashore. From these data, they suggested that a dichotomy existed in the dynamics of the deer herd between the eastern and western halves of the Seashore. Underwood (2005), based on population trend data from the immunocontraceptive studies and deer density surveys, made similar conclusions. Underwood (2005) observed a relatively stable deer population at the Fire Island Wilderness and a rapidly increasing population in western areas of Fire Island, confirming O'Connell and Sayre's observations. Scientists have found that deer residing in the Fire Island



Deer within Fire Island communities (Photo credit: NPS)

Wilderness rely on natural food sources with few coming in contact with humans, and these deer generally exhibit a flight response to humans. In contrast, many of the deer on the western side of the Seashore use the Fire Island communities as part of their home range; exploit artificial food sources from human refuse, handouts, and 4-Poster devices; and are thus more habituated to human presence and conditioned to human food (Underwood 2005).

OTHER WILDLIFE AND WILDLIFE HABITAT

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

MAMMALS

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

REPTILES

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

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

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

BIRDS

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

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

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

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

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

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

TICKS AND OTHER INVERTEBRATES

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

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

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

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

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

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

WILDERNESS

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

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



Fire Island Wilderness visitor center (Photo credit: VHB)

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

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

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

The Interagency Wilderness Character Monitoring Team, which represents the Bureau of Land Management, U.S. Fish and Wildlife Service, National Park Service, U.S. Geological Survey, and U.S. Forest Service, offers an interagency strategy to monitor trends in wilderness character across



the National Wilderness Preservation System in the handbook *Keeping It Wild: An Interagency Strategy to Monitor Trends in Wilderness Character across the National Wilderness Preservation System* (Landres et al. 2008). Based on the statutory language of the Wilderness Act, the interagency team identified four qualities of wilderness character that should be used in wilderness planning, stewardship, and monitoring. The National Park Service also has developed an agency-specific guide to managing wilderness called *Keeping it Wild in the National Parks* (NPS 2013b), which includes a fifth quality. All five qualities are used to describe the condition of the wilderness character and are as follows:

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

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

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

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

CULTURAL LANDSCAPES

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

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

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

WILLIAM FLOYD ESTATE

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

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



Old Mastic House (Photo credit: NPS)

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

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



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

VISITOR USE AND EXPERIENCE/RECREATION

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

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

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

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

Along with the driving restrictions, fishing and waterfowl hunting regulations are in place to protect the natural, scenic, and recreational resources in the Seashore. Hunting, fin fishing, and shellfishing are important recreational pastimes in the local area, and the Seashore is one of the few units of the National Park System in which public hunting is allowed through its enabling legislation. Waterfowl hunting is permitted at Fire Island with a permit issued by Seashore staff, a valid NYS hunting license, a signed federal duck stamp, a driving license, and a confirmation number from the Migratory Bird Harvest Information Program. No hunting is allowed at the William Floyd Estate.

Hunting/fishing seasons and limits are established and regulated by the New York State Department of Environmental Conservation. The Seashore's park rangers have the policing authority to enforce state hunting and fishing laws in the Seashore.



Visitors feeding a deer (Photo credit: NPS)

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

According to a 2008 survey of Seashore visitors, approximately 50% of the respondents felt that close contact with deer or other wildlife added to their Seashore experience, 20% felt the presence of deer or other wildlife had no effect on their experience, and 2% felt the deer detracted from their experience. An additional 29% of visitors reported no contact with deer or other wildlife (NPS 2009b).



Deer feeding on garbage (Photo credit: NPS)

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

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

FIRE ISLAND COMMUNITIES AND ADJACENT LANDOWNERS

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

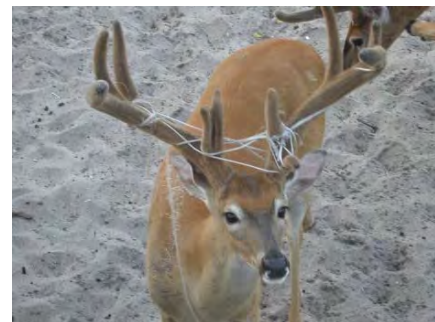


Boardwalks and landowner fencing of ornamentals within the Fire Island communities (Photo credit: VHB)

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

loose landscaped or natural edges, well-designed entrances and fencing associated with private residences, and naturalized, beach tolerant landscape treatments all elicited positive responses (Nelessen 2012).

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



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

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

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

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

PUBLIC HEALTH AND SAFETY

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

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

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

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



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

SEASHORE OPERATIONS

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

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

VISITOR AND RESOURCE PROTECTION

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



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

Park rangers and ocean lifeguards protect Seashore visitors, resources, and property through professional services in law enforcement, emergency medical services, search and rescue, beach safety, and community assistance. Park rangers patrol the Seashore by all-terrain vehicle, boat, and automobile. Due to the unique Fire Island communities and resources within the Seashore's boundary, park rangers at the Seashore are among the National

Park Service's most diverse in terms of necessary skills. Seashore staff manage reports of negative human-deer interactions and spend an estimated 185 hours annually completing Case Incident Reports related specifically to these incidents. Time spent on these reports is almost 0.4% of the budget for visitor and resource protection.

EDUCATION/INTERPRETATION

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

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

RESOURCE MANAGEMENT

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

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

Deer monitoring takes place annually Seashore-wide, requiring approximately 200 hours for three staff. Additionally, monitoring takes place every three years within the Fire Island Wilderness and at the William Floyd Estate. Monitoring in the Fire Island Wilderness requires approximately 25 hours of time from two staff every three-year cycle. Monitoring at the William Floyd Estate requires 25 hours from three staff every three-year cycle.



Seashore staff monitoring vegetation (Photo credit: NPS)

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

MAINTENANCE

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

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

MANAGEMENT AND ADMINISTRATION

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

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