

# Appendixes





**APPENDIX A**  
**RELEVANT AGENCY CORRESPONDENCE**



## **LIST OF RELEVANT AGENCY CORRESPONDENCE**

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



**United States Department of the Interior  
NATIONAL PARK SERVICE**

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

IN REPLY REFER TO:

L-7615 (Deer/Vegetation Management Plan DEIS)

July 7, 2011

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

Dear Mr. Scully:

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

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

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

Sincerely,

*K. Christopher Soller*  
K. Christopher Soller  
Superintendent

cc: Ann Van Huizen, DSC-PDS



IN REPLY REFER TO:

**United States Department of the Interior  
NATIONAL PARK SERVICE**

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

L-7615 (Deer/Vegetation Management Plan DEIS)

July 7, 2011

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

Dear Mr. Stillwell:

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

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

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

Sincerely,

*Jan Dupuy /acting superintendent*  
A. Christopher Soller  
Superintendent

cc: Ann Van Huizen, DSC-PDS



**United States Department of the Interior**  
**NATIONAL PARK SERVICE**

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

IN REPLY REFER TO:

L-7615 (Deer/Vegetation Management Plan DEIS)

July 13, 2011

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

Dear Ms. Pierpont:

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

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

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

Sincerely,

K. Christopher Soller  
Superintendent

cc: Ann Van Huizen, DSC-PDS



**United States Department of the Interior  
NATIONAL PARK SERVICE**

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

IN REPLY REFER TO:

L-7615 (Deer/Vegetation Management Plan DEIS)

July 13, 2011

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

Dear Mr. Carroll:

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

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

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

Sincerely,

K. Christopher Soller  
Superintendent

cc: Ann Van Huizen, DSC-PDS



**United States Department of the Interior  
NATIONAL PARK SERVICE**

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

IN REPLY REFER TO:

L-7615 (Deer/Vegetation Management Plan DEIS)

July 13, 2011

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

Dear Mr. King:

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

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

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

Sincerely,

A handwritten signature in dark ink, appearing to read "K. Christopher Soller".

K. Christopher Soller  
Superintendent

cc: Ann Van Huizen, DSC-PDS



IN REPLY REFER TO:

**United States Department of the Interior  
NATIONAL PARK SERVICE**

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

L-7615 (Deer/Vegetation Management Plan DEIS)

July 14, 2011

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

Dear Ms. Evans:

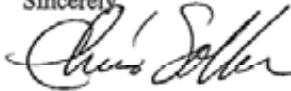
The National Park Service (NPS), in accordance with the National Environmental Policy Act, is currently preparing a White-tailed Deer and Vegetation Management Plan and Environmental Impact Statement (plan/EIS) at Fire Island National Seashore (FIIS). The purpose of the plan/EIS is to develop and analyze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

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

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

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

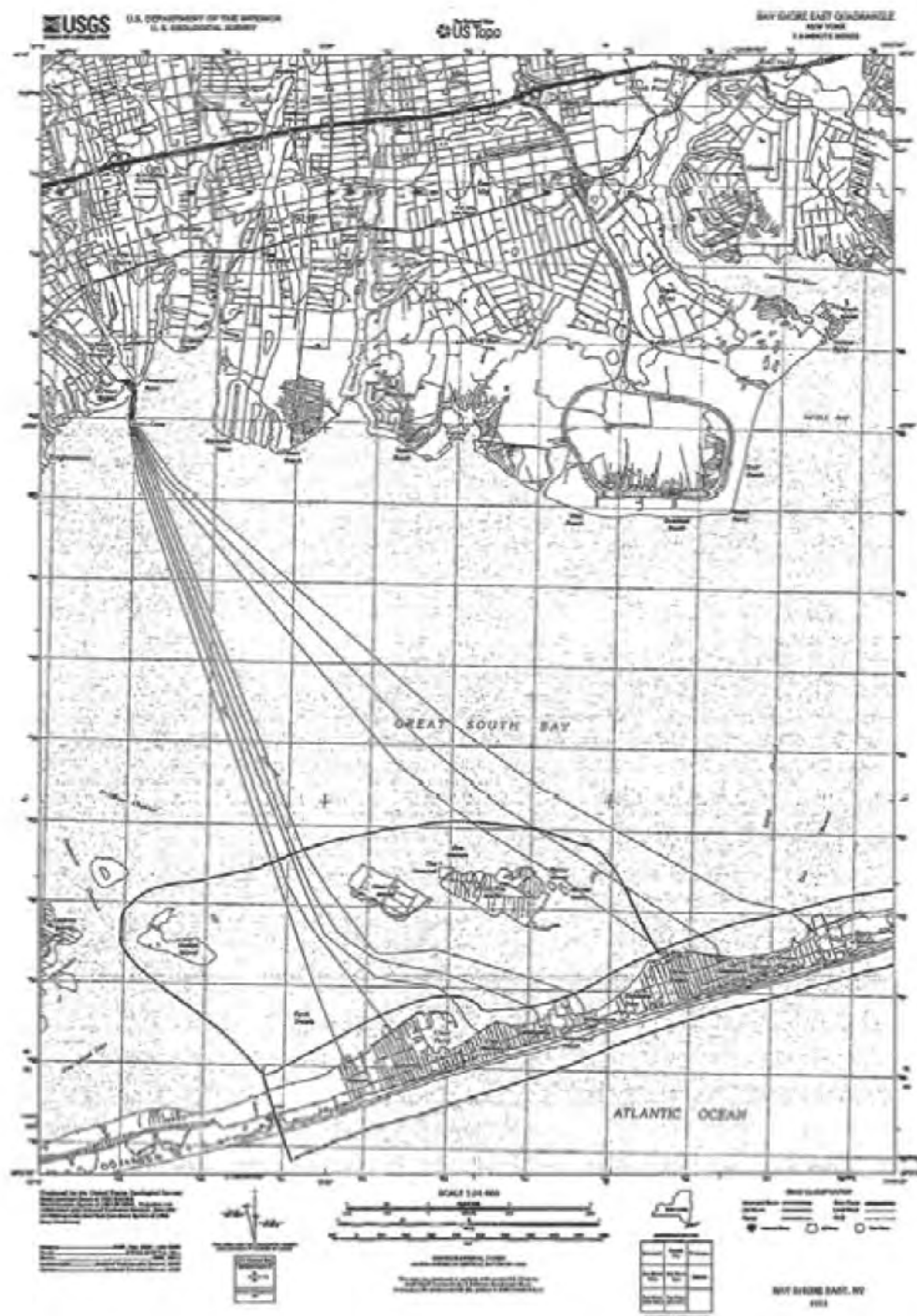
Sincerely,

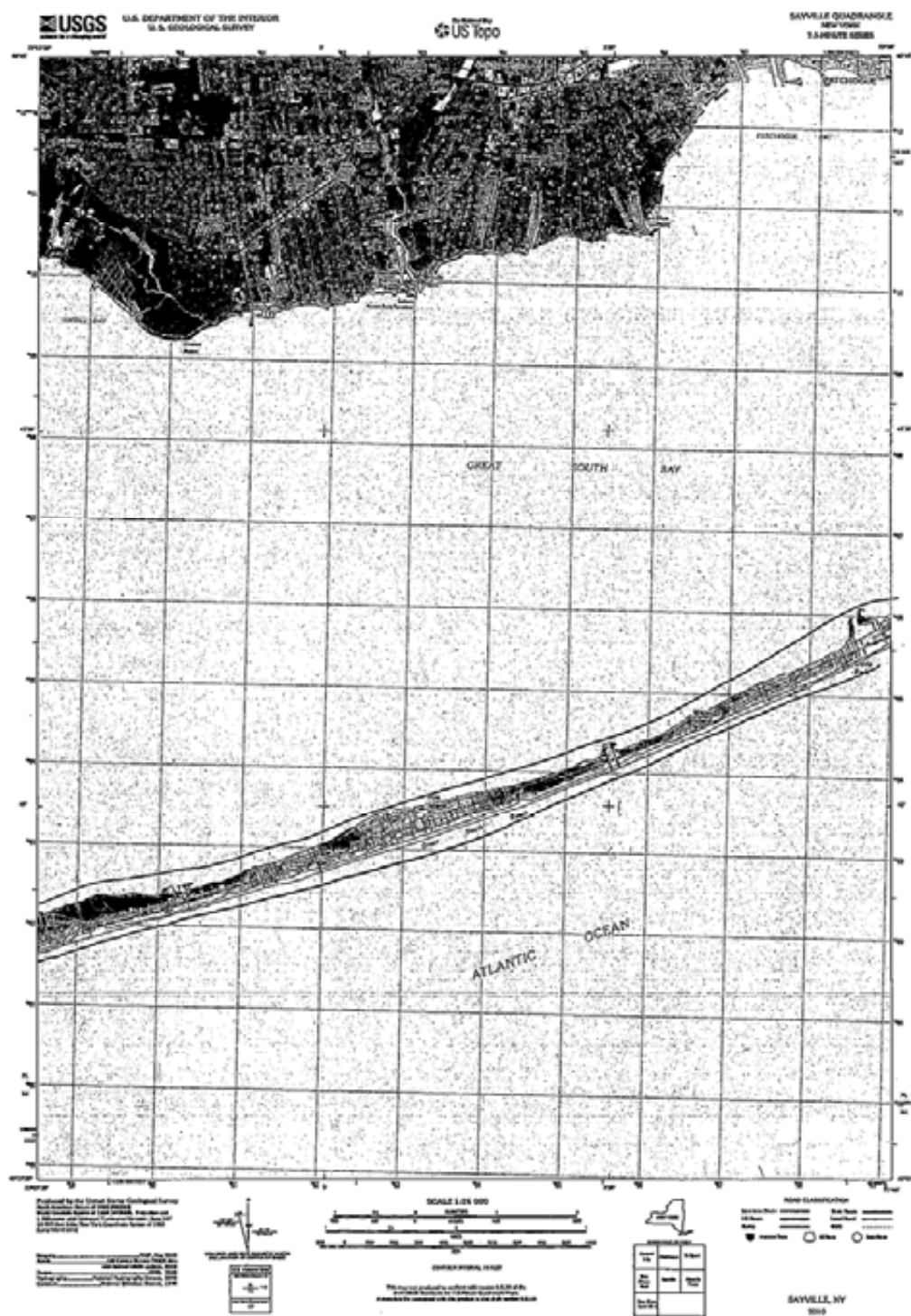
A handwritten signature in cursive script, appearing to read "Chris Soller".

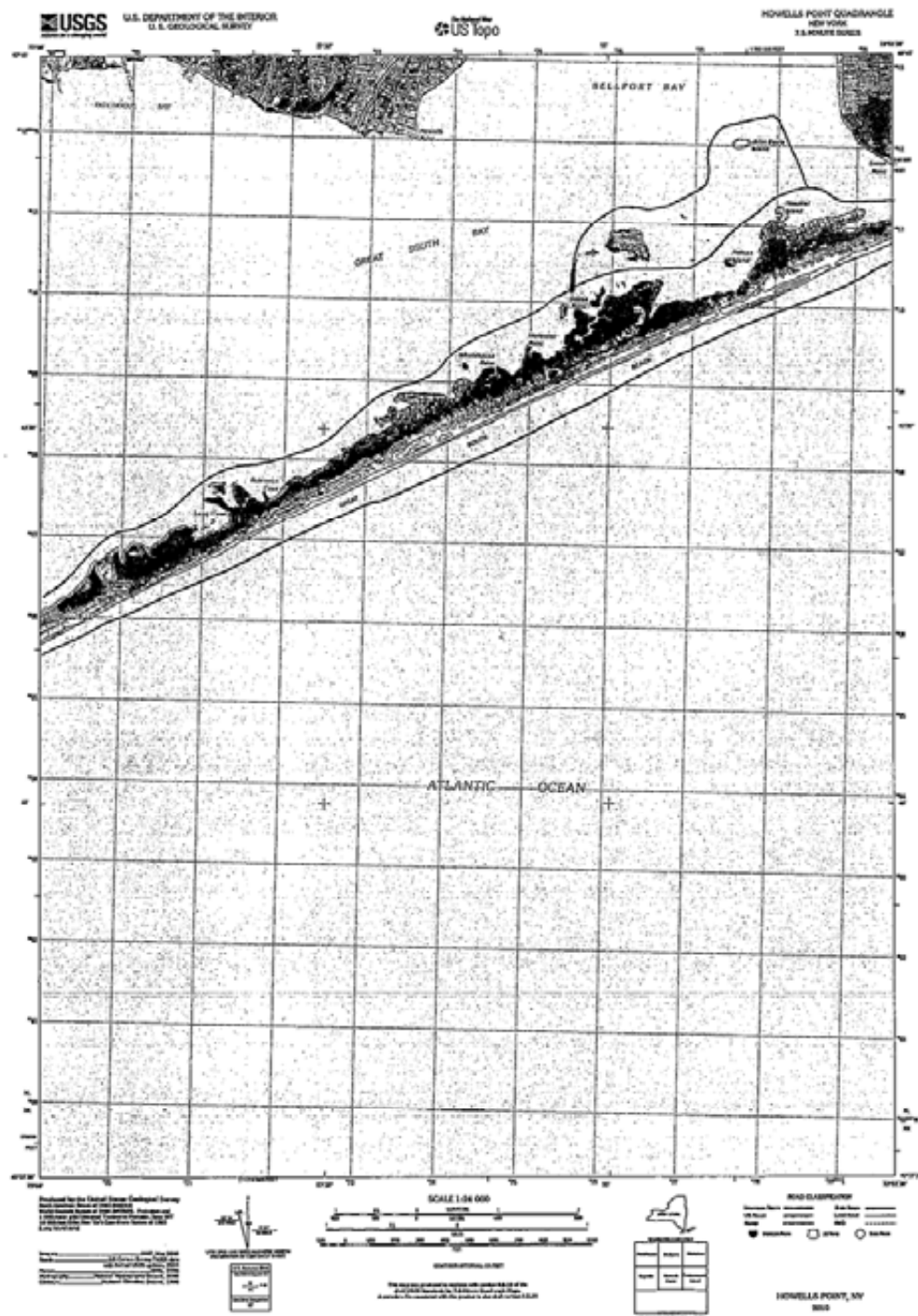
K. Christopher Soller  
Superintendent

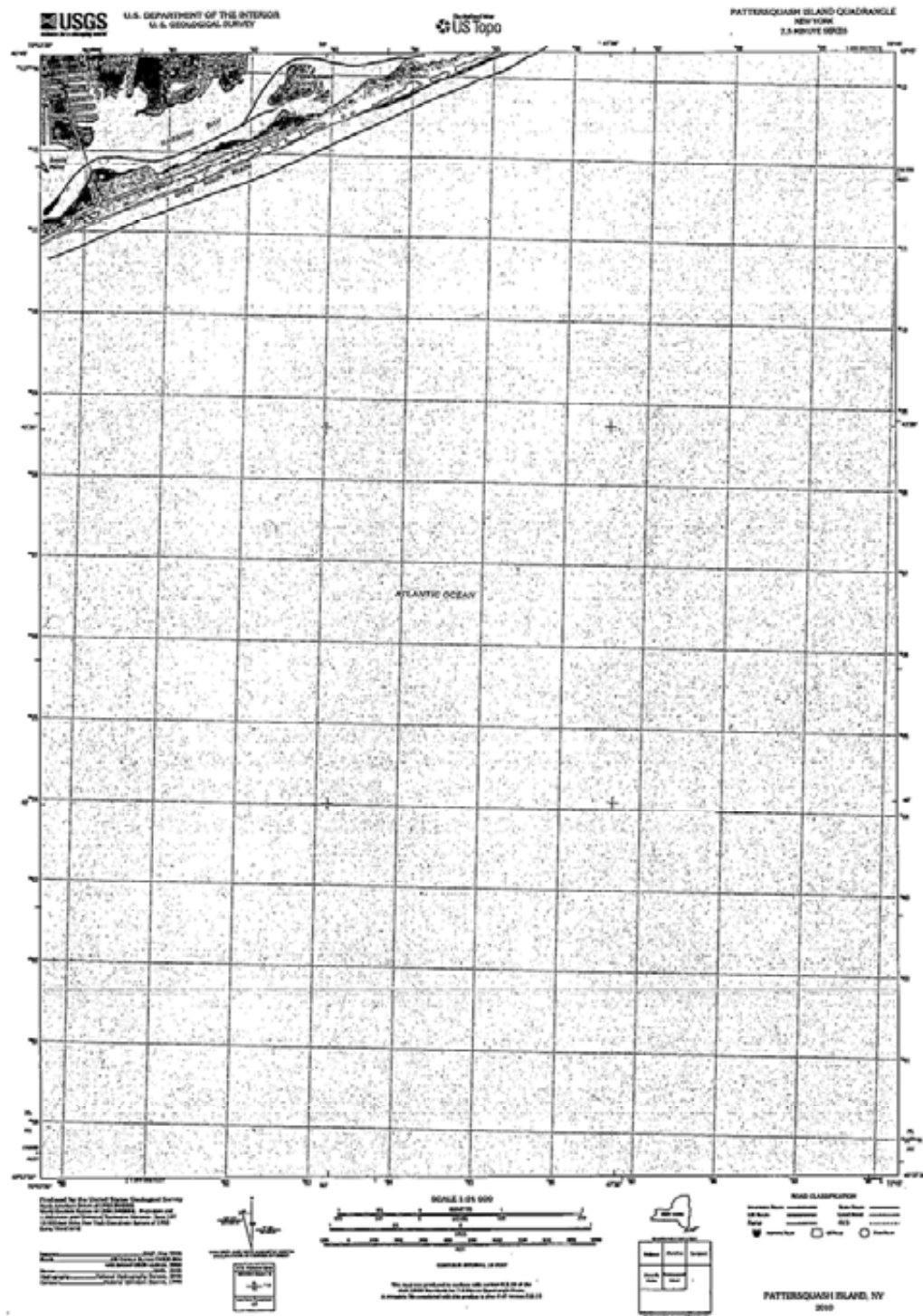
Enclosures (5)

cc: Ann Van Huizen, DSC-PDS  
Michelle Gibbons, NYSDEC - LI











**New York State Department of Environmental Conservation**

**Division of Fish, Wildlife and Marine Resources**

**Bureau of Wildlife, Region 1 Headquarters**

50 Circle Road, Stony Brook, NY 11790-3409

Phone: (631) 444-0310 • Fax: (631) 444-0272

Website: [www.dec.ny.gov](http://www.dec.ny.gov)



Joe Martens  
Commissioner

**RECEIVED**  
JUL 27 2011

July 22, 2011

FIRE ISLAND NATIONAL SEASHORE  
PATCHOGUE, NEW YORK 11772

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

Dear Ms. Valentine:

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

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

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

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

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

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

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

Sincerely,  


Michelle Gibbons  
Regional Wildlife Manager

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

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



Joe Martens  
Commissioner

March 5, 2012

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

Dear Ms. Ries:

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

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

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

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


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

# 184

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

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

Sincerely,

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

# 184

## Natural Heritage Report on Rare Species and Ecological Communities

NYS Dept. of Environmental Conservation and  
Natural Heritage Program625 Broadway  
Albany, NY 12233-4754  
518-402-8964

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

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

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

~All data are current as of the date of the report.



## BIRDS

*Ammodramus maritimus*

Once Use 5863

## Seaside Sparrow

NYS Legal Status Special Concern

NYS Rank S2S3

Imperiled

## Breeding

Federal Listing

Global Rank G4

Apparently secure

Last Report 2001-06-10

EO Rank E

County Suffolk

Town Babylon, Islip

Location Captree Island

Directions The birds were observed at Captree Island, along the Robert Moses Causeway south of West Islip. The birds were recorded to the east of the Causeway during 2001, but the exact location for the 1980 data is not available.

## Comments

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

General Quality and Habitat Salt marsh

*Ammodramus maritimus*

Once Use 11174

## Seaside Sparrow

NYS Legal Status Special Concern

NYS Rank S2S3

Imperiled

## Breeding

Federal Listing

Global Rank G4

Apparently secure

Last Report 2001-su

EO Rank E

County Suffolk

Town Brookhaven

Location Forge Point Marsh

Directions From Mastic Beach, go east on Neighborhood Road to the end of the road. Turn left and then take the first right into the entrance of the William Floyd Estate (Forge Point). Seaside sparrows were found in two areas of the marsh within the estate. To visit

Page 1 of 19

*Actitis macularia* (Rufous Turnstone) Species and Ecological Communities**Comments**

**General Quality and Habitat** The birds have been observed in two areas of a salt marsh located at the northern shore of a bay. The marsh is tidal in nature and contains drainage ditches. Some ditches are active and some are blocked with dams. Taller scrub areas border some of the ditches. Along the mouth of a creek, the vegetation is thick and composed of marsh grass and a mixture of coniferous and deciduous trees.

*Ammodramus maritimus*

Office Use 11175

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

**Comments**

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

*Ammodramus maritimus*

Office Use 11177

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

**Comments**

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

*Charadrius melodus*

Office Use 2496

Page 11 of 55

*Charadrius melodus* (Piping Plover) Species and Ecological Communities



Piping Plover	NYS Legal Status	Endangered	NYS Rank	S3B	Vulnerable
Breeding	Federal Listing	Endangered/Threat	Global Rank	G3	Rare
	Last Report	2008-sp	EO Rank	C	
	County	Suffolk			
	Town	Brookhaven			
	Location	Fire Island Sunken Forest			
	Directions	The plovers are at Fire Island Sunken Forest west of Cherry Grove. Access is by boat or 4-wheel drive vehicle. Drive down the beach to the vehicle free area, park, and walk to the nesting area.			
Comments	The rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of one pair per year over the last three years surveyed. Disturbances include illegal ORV use, recreation, pets, boats, and predation by feral cats, crows, fox, gulls, raccoons and snakes. Some Cherry Grove residents are against the protection of the birds. Sailors Haven contains a visitors center and marina along with a concession stand that is heavily visited. A dense residential neighborhood is located to the north.				
General Quality and Habitat	The plovers were observed on a sandy maritime beach on a barrier island. The surrounding area is maritime forest with boardwalks wandering through it. There is stabilized dune vegetation in some sections. Phragmites is along the bay shore.				

*Charadrius melodus*

Office Use 8716

Piping Plover	NYS Legal Status	Endangered	NYS Rank	S3B	Vulnerable
Breeding	Federal Listing	Endangered/Threat	Global Rank	G3	Rare
	Last Report	2008-06-16	EO Rank	A	
	County	Suffolk			
	Town	Brookhaven			
	Location	Westhampton Island West			
	Directions	The plovers were observed at Cupsogue County Park on the western edge of Westhampton Island, east of Moriches Inlet. The nests are along the beach. For access to the site, take Dune Road west to the end and park in the parking lot.			
Comments	The rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of six pairs per year over the last three years surveyed. Disturbances include ORVs, boaters, campers and dogs, fishermen entering protected areas, flooding, erosion, and predation by crows, gulls, feral cats, fox, and raccoons. Moriches Inlet and Fire Island is to the west. The Atlantic Ocean is to the south. Non-barrier islands are to the north.				
General Quality and Habitat	The plovers were observed at a barrier island maritime beach and dredge spoil with a gravel substrate. There is sparse to moderately dense vegetation that includes <i>Ammophila breviflora</i> , <i>Cakile edentula</i> and <i>Solidago sempivirens</i> . The habitat is narrow and eroding with steep dunes that are progressively getting wider.				

*Charadrius melodus*

Office Use 8201

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

---

*Natural Heritage Report on Rare Species and Ecological Communities*


---



<b>Directions</b>	Take Robert Moses Parkway south to Fire Island. Turn east at the traffic circle. Park at Field 5 in Robert Moses State Park. The birds nest along the beach and part way into the dunes from 800 meters west of Field 4 east to Field 5. Birds are also nesting
<b>Comments</b>	The rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of four pairs per year over the last three years surveyed. Disturbances include beach goers, official vehicle use, beach raking and removal of wrack, boats, development, and predation by crows, fox, feral cats, raccoons, dogs, snakes, gulls, and possibly peregrine falcons. Flooding occasionally occurs and washes away the nests. Two parking lots are adjacent to the nesting area.
<b>General Quality and Habitat</b>	The plovers were observed on a barrier island with maritime beaches and dunes. The dunes are steep and vegetated with <i>Ammophila brevifoliate</i> . The beach width is variable and quite dynamic. The beach is used as a bathing beach. Two parking lots are adjacent to the nesting area.

---

*Charadrius melodus*

Office Use 1224

<b>Piping Plover</b>	<b>NYS Legal Status</b>	Endangered	<b>NYS Rank</b>	S3B	Vulnerable
	<b>Federal Listing</b>	Endangered/Threat	<b>Global Rank</b>	G3	Rare
<b>Breeding</b>	<b>Last Report</b>	2005-06-09	<b>EO Rank</b>	A	
	<b>County</b>	Suffolk			
	<b>Town</b>	Brookhaven			
	<b>Location</b>	Fire Island East			
	<b>Directions</b>	The birds nest along the Great South Beach on Fire Island National Seashore. From the Long Island Expressway, take exit 66 South (William Floyd Parkway). Take the William Floyd Parkway to the end. The birds nest along the beach east of the parking lot to			
<b>Comments</b>	The rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of 17 pairs per year over the last three years surveyed. The birds are disturbed by recreational use, pedestrians, vehicles, boats, and flooding. Some beach goers ignore the posted signs that state dogs need to be leashed at all times. Beach goers also enter protected areas. Many campers pull right up to the string fence. Extremely heavy ORV use limits the nesting area. Moderate ORV use				
<b>General Quality and Habitat</b>	The birds were observed at a sandy maritime beach on a barrier island that is sparsely vegetated with <i>Cakile edentula</i> and <i>Artemisia stelleriana</i> at the base of the dunes vegetated with <i>Ammophila</i> . The beach is wide and narrows in some areas. New habitat was created in 1994 on the area that was overwashed in 1992 and 1993.				

*Charadrius melodus*

Office Use 9303

<b>Piping Plover</b>	<b>NYS Legal Status</b>	Endangered	<b>NYS Rank</b>	S3B	Vulnerable
	<b>Federal Listing</b>	Endangered/Threat	<b>Global Rank</b>	G3	Rare
<b>Breeding</b>	<b>Last Report</b>	1993-06-20	<b>EO Rank</b>	F	
	<b>County</b>	Suffolk			
	<b>Town</b>	Brookhaven			
	<b>Location</b>	Fire Island Wilderness Watch Hill			
	<b>Directions</b>	The plovers were observed at Fire Is and Wilderness, Watch Hill on Fire Island National Seashore. Access is by ferry from Patchogue. The plovers nest north of and adjacent to the marina.			
<b>Comments</b>	The plovers have not been reported active at this site since 1993.				
<b>General Quality and Habitat</b>	The plovers were observed on dredge spoil on the bay side of a barrier beach island. The substrate is sandy with grass cover around the site. It is open in the center. The dredge spoils is colonized by				

---

*Native Plant and Animal Species and Ecological Communities*


---




---

*Amphiphila breviflata* and weedy annuals.
 

---

*Charadrius melodus*

Office Use 9514

<b>Piping Plover</b>	<b>NYS Legal Status</b>	Endangered	<b>NYS Rank</b>	S3B	Variable
<b>Breeding</b>	<b>Federal Listing</b>	Endangered/Threatened	<b>Global Rank</b>	G3	Rare
	<b>Last Report</b>	2003-06-03	<b>EO Rank</b>	CD	
	<b>County</b>	Suffolk			
	<b>Town</b>	Brookhaven, Islip			
	<b>Location</b>	Fire Island Villages			
	<b>Directions</b>	The plovers were observed at Atlantic Beach and Point of Woods on the ocean side of Fire Island National Seashore.			
<b>Comments</b>	The rank is based on the draft state element occurrence rank specifications of February 15, 2001. One pair was observed over the last year surveyed. The last time this site was surveyed prior to 2008 was 2004, so one year's worth of data was used to assess the rank. The beach is prone to many disturbances and is heavily developed with beach houses.				
<b>General Quality and Habitat</b>	The plovers were observed at a maritime beach on a barrier island. The beach is about 150 feet wide and eroded. The beach is within a series of beach communities and is heavily developed with beach houses over or in place of the primary dune.				

*Charadrius melodus*

Office Use 7258

<b>Piping Plover</b>	<b>NYS Legal Status</b>	Endangered	<b>NYS Rank</b>	S3B	Variable
	<b>Federal Listing</b>	Endangered/Threatened	<b>Global Rank</b>	G3	Rare
<b>Breeding</b>	<b>Last Report</b>	2007-sp	<b>EO Rank</b>	D	
	<b>County</b>	Suffolk			
	<b>Town</b>	Brookhaven			
	<b>Location</b>	Fire Island Pines			
	<b>Directions</b>	The plovers nest at Cherry Grove and a 0.8 mile stretch of beach located about 0.5 miles west of Davis Park on the ocean side of Fire Island National Seashore.			
<b>Comments</b>	The rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of less than one pair per year over the last three years surveyed. This site was not surveyed in 2006. Disturbances include boats, development, flooding, pedestrians, dogs, vehicles, dredging, and predation by crows, gulls, fox and many feral cats. A 400-home community uses this area as their primary recreation beach. The Atlantic Ocean is to the south.				
<b>General Quality and Habitat</b>	The plovers were observed on a sandy maritime beach on a barrier island. There is little vegetation cover. The Water Island area is wide enough to support nesting. The area in general is heavily developed. Beach nourishment occurred in 1998.				

*Charadrius melodus*

Office Use 4472

<b>Piping Plover</b>	<b>NYS Legal Status</b>	Endangered	<b>NYS Rank</b>	S3B	Variable
	<b>Federal Listing</b>	Endangered/Threat	<b>Global Rank</b>	G3	Rare
Breeding	<b>Last Report</b>	2008-sp	<b>EO Rank</b>	A	

Page 5 of 30

---

*Relevant Agency Correspondence*


<b>County</b>	Suffolk
<b>Town</b>	Brookhaven
<b>Location</b>	Fire Island Wilderness
<b>Directions</b>	The plovers were observed along the ocean side of the Fire Island Wilderness, Fire Island National Seashore. The nesting area covers a stretch of beach starting approximately 1 mile east of Davis Town Park to approximately 0.5 miles west of Smith Point C.
<b>Comments</b>	The rank is based on the draft state element occurrence rank specifications of February 15, 2006. There was an average of 14 pairs per year over the last three years surveyed. Disturbances include a high red fox population, human recreation including beach combing and boating, ORVs (so far used only by the US National Park Service and Suffolk County Park police), deer, and predation by snakes, gulls, crows, feral cats, raccoons and loose dogs. A small residential community is to the west. The Atlantic Ocean.
<b>General Quality and Habitat</b>	The plovers were observed at a sandy maritime beach on a barrier island backed by an extensive maritime dune system. The vegetation is mostly <i>Ammophila</i> spp.

---

*Circus cyaneus*

Office Use 12686

<b>Northern Harrier</b>	<b>NYS Legal Status</b>	Threatened	<b>NYS Rank</b>	S3B,S3N	Vulnerable
	<b>Federal Listing</b>		<b>Global Rank</b>	G5	Denominator secure
	<b>Last Report</b>	2000-06-28	<b>EO Rank</b>	E	
	<b>County</b>	Suffolk			
	<b>Town</b>	Brookhaven			
	<b>Location</b>	Fire Island East			
	<b>Directions</b>	Fire Island is off the southern coast of Long Island. To access the eastern part of the island, follow Suffolk Boulevard south from Brookhaven across the Smith Point Bridge.			
<b>Comments</b>					
<b>General Quality and Habitat</b>	The birds were seen over a dune located on a large coastal island. The area was covered with thick undergrowth vegetation.				

*Egretta caerulea*

Office Use 439

Little Blue Heron	NYS Legal Status	Protected Bird	NYS Rank	S2	Impaired
	Federal Listing		Global Rank	G5	Denominator secure
	Breeding	Last Report	2007-05-30	EO Rank	D
	County	Suffolk			
	Town	Brookhaven			
	Location	West Inlet Island			
	Directions	The birds were observed at West Inlet Island which is in Moriches Bay just north of Moriches Inlet. Access is by boat launched at the Maple Avenue Dock which is off of Atlantic Avenue in East Moriches.			
Comments	The rank is based on the element global ranking form of April 21, 1988. There was an average of two pairs per year over the last three years surveyed. The birds are surveyed every third year. The birds are disturbed by boats and flooding. Predators include				

Page 6 of 29

---

*Return to Table Report on One Species and Ecological Communities*


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

---

*Egretta thula*

Office Use 3442

<b>Snowy Egret</b>	<b>NYS Legal Status</b>	Protected Bird	<b>NYS Rank</b>	S2S3	Imperiled
	<b>Federal Listing</b>		<b>Global Rank</b>	G5	Denotably secure
Breeding	<b>Last Report</b>	1985-05-21	<b>EO Rank</b>	F	
	<b>County</b>	Suffolk			
	<b>Town</b>	Islip			
	<b>Location</b>	Sexton Island			
	<b>Directions</b>	Sexton Island is in the Great South Bay, about 0.4 miles east of Carver Island and about 1.1 miles north of Fire Island. The birds nested on the east side of the island.			
<b>Comments</b>	The rank is based on the draft element global ranking form of April 21, 1988. The birds are surveyed every third year. Birds have not been seen nesting here since 1985. There is predation by gulls, crows, feral cats, snakes, fox, and rats. Disturbances include boats, development, flooding, and pedestrians. Fire Island National Seashore is to the south. Other salt marsh non-barrier islands are to the west.				
<b>General Quality and Habitat</b>	Sexton Island is a salt marsh and maritime beach on a non-barrier island. There are a few trees probably evergreen, and a dense shrubby interior. Birds nest in trees and shrubs.				

*Egretta thula*

Office Use 6792

Snowy Egret	NYS Legal Status	Protected Bird	NYS Rank	S2S3	Imperiled
	Federal Listing		Global Rank	G5	Denotably secure
	Breeding				
	Last Report	2007-05-30	EO Rank	C	
	County	Suffolk			
	Town	Brookhaven			
	Location	West Inlet Island			
	Directions	The birds were observed at West Inlet Island which is in Moriches Bay just north of Moriches Inlet. Access is by boat launched at the Maple Avenue Dock which is off of Atlantic Avenue in East Moriches.			
Comments	The rank is based on the draft element global ranking form of April 21, 1988. There was an average of 24 pairs per year over the last three years surveyed. The birds are surveyed every third year. The birds are disturbed by boats and flooding. Predators include gulls and crows. Fire Island and Westhampton Island are to the south and the Long Island mainland is to the north.				
General Quality and Habitat	The birds were observed on a non-barrier island consisting of dredge spoil and sparse to dense beach grass. There is a salt marsh in the north center of the island. A large gull colony is nearby.				

*Egretta thula*

Office Use 12161

<b>Snowy Egret</b>	<b>NYS Legal Status</b>	Protected Bird	<b>NYS Rank</b>	S2S3	Imperiled
--------------------	-------------------------	----------------	-----------------	------	-----------

---

*Natural Heritage Report on Rare Species and Ecological Communities*


Breeding	<b>Federal Listing</b>		<b>Global Rank</b>	G5	Demonstrably secure
	<b>Last Report</b>	2001-06-01	<b>EO Rank</b>	C	
	<b>County</b>	Suffolk			
	<b>Town</b>	Islip			
	<b>Location</b>	Islip Spoil Island			
	<b>Directions</b>	Islip Spoil Island is approximately 0.2 miles northeast from the westernmost point of Captree Island, and approximately 0.5 miles north of Sexton Island. It is accessible only by boat. The birds nest in the southeast corner of the island.			
<b>Comments</b>	The rank is based on the draft element global ranking form of April 21, 1988. This site has been active for one year, therefore, the rank is based on a single survey instead of a three-year average. Twenty pairs were observed. The birds are surveyed every third year. Disturbances include recreation and predation by gulls and crows. Captree Island is to the west and Sexton Island is to the southeast.				
<b>General Quality and Habitat</b>	Islip Spoil Island is a saltwater, non-barrier island with spoil and fill area habitat types.				

*Egretta thula*

Office Use 7557

Snowy Egret	NYS Legal Status	Protected Bird	NYS Rank	S2S3	Impaired	
	Federal Listing		Global Rank	G5	Demonstrably secure	
	Breeding	Last Report	1998-06-05	EO Rank	D	
		County	Suffolk			
		Town	Brookhaven			
		Location	Fire Island Wilderness Watch Hill			
		Directions	The egrets were observed at Fire Island Wilderness, Watch Hill on Fire Island National Seashore. Access is by ferry from Patchogue. The birds are east of the Watch Hill Marina.			
		Comments	The rank is based on the element global ranking form of April 21, 1988. One pair was observed over the course of two survey years. The birds are surveyed every third year. This site had not been surveyed since 2001.			
General Quality and Habitat	The egrets were observed on dredge spoil on the bay side of a barrier island with a sandy substrate with grass that is open in the center. The dredge spoil is colonized by <i>Ammophila proligata</i> and weedy annuals.					

*Egretta tricolor*

Office Use 11583

Breeding	<b>Tricolored Heron</b>	<b>NYS Legal Status</b>	Protected Bird	<b>NYS Rank</b>	S2	Impaired
		<b>Federal Listing</b>		<b>Global Rank</b>	G5	Demonstrably secure
		<b>Last Report</b>	2004-05-27	<b>EO Rank</b>	D	
		<b>County</b>	Suffolk			
		<b>Town</b>	Brookhaven			
		<b>Location</b>	West Inlet Island			
		<b>Directions</b>	The birds were observed at West Inlet Island which is in Moriches Bay just north of Moriches Inlet. Access is by boat launched at the Maple Avenue Dock which is off of Atlantic Avenue in East Moriches.			
<b>Comments</b>	The rank is based on the element global ranking form of April 21, 1988. There was an average of one pair per year during the the last two years surveyed. The birds are surveyed every third year. The birds					

Page 2 of 35

---

*Natural Heritage Report on Rare Species and Ecological Communities*


---



are disturbed by boats and flooding. Predators include gulls and crows. Fire Island and Westhampton Island are to the south and the Long Island mainland is to the north.

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

---

*Leucophaeus atricilla*

Office Use 12773

**Laughing Gull** **NYS Legal Status** Protected Bird **NYS Rank** S1 **Critical** Imperiled

**Federal Listing** **Global Rank** G5 **Demographically secure**

**Breeding** **Last Report** 2007-07-04 **EO Rank** D

**County** Suffolk

**Town** Islip

**Location** East Fire Island

**Directions** The birds were observed on a small island just west of East Fire Island, which is part of the Fire Island National Seashore. The island is north of the town of Duffield. Access is by boat.

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

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

---

*Plegadis falcinellus*

Office Use 14

**Glossy Ibis** **NYS Legal Status** Protected Bird **NYS Rank** S2 **Critical** Imperiled

**Federal Listing** **Global Rank** G5 **Demographically secure**

**Breeding** **Last Report** 2007-05-30 **EO Rank** C

**County** Suffolk

**Town** Brookhaven

**Location** West Inlet Island

**Directions** The birds were observed at West Inlet Island which is in Moriches Bay just north of Moriches Inlet. Access is by boat launched at the Maple Avenue Dock which is off of Atlantic Avenue in East Moriches.

**Comments** The rank is based on the element global ranking form of April 21, 1988. There was an average of 35 pairs per year over the last three years surveyed. The birds are surveyed every three years. The birds are disturbed by boats and flooding. Predators include gulls and crows. Fire Island and Westhampton Island are to the south and the Long Island mainland is to the north.

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

---

*Rynchops niger*

Office Use 5228

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

---

 Page 13 of 20
 

---

---

*Natural Heritage Report on Rare Species and Ecological Communities*


Breeding	<b>Federal Listing</b>		<b>Global Rank</b>	G5	Dem or strably secure
	<b>Last Report</b>	1997-07-18	<b>EO Rank</b>	F	
	<b>County</b>	Suffolk			
	<b>Town</b>	Brookhaven			
	<b>Location</b>	Ridge Island			
	<b>Directions</b>	The birds were observed at Ridge Island, north of Fire Island, Great South Beach. Access is by boat.			
<b>Comments</b>	The birds have not been reported as active at this site since 1997. This site has not been surveyed since 2001.				
<b>General Quality and Habitat</b>	The birds were observed on a non-barrier island. The natural community is probably salt marsh.				

*Rynchops niger*

Office Use 11584

Black Skimmer	NYS Legal Status	Special Concern	NYS Rank	S2	Imperiled
	Federal Listing		Global Rank	G5	Dem or strably secure
	Last Report	2004-06-30	EO Rank	F	
	County	Suffolk			
	Town	Brookhaven			
	Location	Pattersquash Island			
	Directions	The birds were observed at Pattersquash Island which is just north of Great South Beach, Fire Island National Seashore. Access is by boated launched at the Mastic Yacht Club located to the north on Long Island.			
Comments	The birds have not been active at this site since 2004.				
General Quality and Habitat	The area is a non-barrier island and probably a salt marsh. The surrounding water is shallow.				

*Rynchops niger*

Office Use 237

Black Skimmer	NYS Legal Status	Special Concern	NYS Rank	S2	Imperiled
	Federal Listing		Global Rank	G5	Demographically secure
	Breeding		EO Rank	F	
	Last Report	2004-06-15			
	County	Suffolk			
	Town	Brookhaven			
	Location	Carters Island			
	Directions	The birds were observed at Carters Island in Moriches Bay. Access is by boat.			
Comments	The birds have not been active at this site since 2004.				

---

*Natural Heritage Program on Rare Species and Ecological Communities*


---



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

---

*Rynchops niger*

Office Use 11950

**Black Skimmer**

<b>NYS Legal Status</b>	Special Concern	<b>NYS Rank</b>	S2	Impaired
<b>Federal Listing</b>		<b>Global Rank</b>	G5	Demonstrably secure
<b>Breeding</b>	<b>Last Report</b>	1992-06-26	<b>EO Rank</b>	F
	<b>County</b>	Suffolk		
	<b>Town</b>	Islip		
	<b>Location</b>	East Fire Island		
	<b>Directions</b>	The birds were observed on East Fire Island, which is part of the Fire Island National Seashore. The island is north of the town of Dunewood. Access is by boat.		

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

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

---

*Rynchops niger*

Office Use 1920

**Black Skimmer**

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

**Comments** This site has not been active since 1996.

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

---

*Rynchops niger*

Office Use 8792

Sheet 1 of 39

---

*Natural Heritage Report on Rare Species and Ecological Communities*


<b>Black Skimmer</b>	<b>NYS Legal Status</b>	Special Concern	<b>NYS Rank</b>	S2	Imperiled
	<b>Federal Listing</b>		<b>Global Rank</b>	G5	Denote: probably secure
Breeding	<b>Last Report</b>	2008-06-12	<b>EO Rank</b>	D	
	<b>County</b>	Suffolk			
	<b>Town</b>	Islip			
	<b>Location</b>	Sexton Island			
	<b>Directions</b>	Sexton Island is in the Great South Bay, about 0.4 miles east of Captree Island and about 1.1 miles north of Fire Island. Access is by boat.			
<b>Comments</b>	The rank is based on the draft global element occurrence rank specifications of April 12, 1987. There was an average of five pairs per year over the last three years surveyed. This site was not surveyed in 2007. There is predation by gulls, crows, feral cats, snakes, fox, and rats. Disturbances include boats, development, flooding, and pedestrians. Fire Island National Seashore is to the south. Other salt marsh non-barrier islands are to the west.				
<b>General Quality and Habitat</b>	The birds were observed on a salt marsh and maritime beach on a non-barrier island. There are a few trees and a dense shrubby interior. It is poor habitat for shorebird nesting.				

*Rynchops niger*

Office Use 515

<b>Black Skimmer</b>	<b>NYS Legal Status</b>	Special Concern	<b>NYS Rank</b>	S2	Imperiled
	<b>Federal Listing</b>		<b>Global Rank</b>	G5	Denote: probably secure
Breeding	<b>Last Report</b>	1999-06-16	<b>EO Rank</b>	F	
	<b>County</b>	Suffolk			
	<b>Town</b>	Brookhaven			
	<b>Location</b>	New Made Island			
	<b>Directions</b>	The skimmers were observed at New Made Island, which is 0.8 miles east of Forge Point, across the Moriches Bay. Access is by boat.			
<b>Comments</b>	This site has not been active since 1999.				
<b>General Quality and Habitat</b>	The area is an old dredge spoil island with a large pit in the center. The vegetation cover is overgrown and encroaching on the nesting habitat. Plant species include Phragmites, milkweed, goldenrod and grasses.				

*Rynchops niger*

Office Use 12344

<b>Black Skimmer</b>  Breeding	<b>NYS Legal Status</b>	Special Concern	<b>NYS Rank</b>	S2	Imperiled
	<b>Federal Listing</b>		<b>Global Rank</b>	G5	Denote: probably secure
	<b>Last Report</b>	2005-06-21	<b>EO Rank</b>	F	
	<b>County</b>	Suffolk			
	<b>Town</b>	Brookhaven			
	<b>Location</b>	Westhampton Island West			
	<b>Directions</b>	The skimmers were observed at Cuptogue County Park on the western edge of Westhampton Island, east of Moriches Inlet.			
<b>Comments</b>	The birds have not been observed as active at this site since 2005.				

## Natural Heritage Program on Rare Species and Ecological Communities



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

*Rynchops niger*

Office Use 99

<b>Black Skimmer</b>	<b>NYS Legal Status</b>	Special Concern	<b>NYS Rank</b>	S2	Impaired
	<b>Federal Listing</b>		<b>Global Rank</b>	G5	Den or strably secure
Breeding	<b>Last Report</b>	2005-08-13	<b>EO Rank</b>	F	
	<b>County</b>	Suffolk			
	<b>Town</b>	Brookhaven			
	<b>Location</b>	West Inlet Is and			
	<b>Directions</b>	The birds were observed at West Inlet Island which is in Moriches Bay, just north of Moriches Inlet. Access is by boat launched at the Maple Avenue Dock, which is off of Atlantic Avenue in East Moriches. The birds are found in groups around the periphery of			

**Comments** The birds were last observed as active in 2005.

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

*Rynchops niger*

Office Use 12775

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

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

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

*Sterna dougallii*

Office Use 9049

*Natural Heritage Report on Rare Species and Ecological Communities*

Roseate Tern  Breeding	NYS Legal Status	Endangered	NYS Rank	S1B	Critically imperiled
	Federal Listing	Endangered	Global Rank	G4	Apparently secure
	Last Report	2000-06-20	EO Rank	D	
	County	Suffolk			
	Town	Brookhaven			
	Location	Ridge Island			
	Directions	The birds were observed at Ridge Island, north of Fire Island, Great South Beach. Access is by boat.			
Comments	The rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of two pairs per year over the last three years surveyed. This site has not been surveyed since 2001. The birds are disturbed by boats. Predators include crows and gulls.				
General Quality and Habitat	The terns were observed at a non-barrier island. The natural community is probably salt marsh.				

*Sterna dougallii*

Coffin Use 2867

<b>Roseate Tern</b>	<b>NYS Legal Status</b>	Endangered	<b>NYS Rank</b>	S1B	Critically imperiled
Breeding	<b>Federal Listing</b>	Endangered	<b>Global Rank</b>	G4	Apparently secure
	<b>Last Report</b>	2005-06-02	<b>EO Rank</b>	D	
	<b>County</b>	Suffolk			
	<b>Town</b>	Islip			
	<b>Location</b>	Sexton Island			
	<b>Directions</b>	The birds were observed at Sexton Island which is in Great South Bay, about 0.4 miles east of Captree Island and about 1.1 miles north of Fire Island. Access is by boat.			
<b>Comments</b>	The rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of less than one pair per year over the last three years surveyed. This site was not surveyed in 2007. There is predation by gulls, crows, feral cats, snakes, fox, and rats. Disturbances include boats, development, flooding, and pedestrians. Fire Island National Seashore is to the south. Other salt marsh non-barrier islands are to the west.				
<b>General Quality and Habitat</b>	The birds were observed on a salt marsh and maritime beach on a non-barrier island. There are a few trees and a dense shrubby interior. It is poor habitat for shorebird nesting.				

*Sterna dougallii*

Coffin Use 12025

<b>Roseate Tern</b>	<b>NYS Legal Status</b>	Endangered	<b>NYS Rank</b>	S1B	Critically imperiled
Breeding	<b>Federal Listing</b>	Endangered	<b>Global Rank</b>	G4	Apparently secure
	<b>Last Report</b>	2005-06-28	<b>EO Rank</b>	D	
	<b>County</b>	Suffolk			
	<b>Town</b>	Brookhaven			
	<b>Location</b>	Pattersquash Island			
	<b>Directions</b>	The terns were observed at Pattersquash Island, located just north of Great South Beach, Fire Island National Seashore. Access is by boat from the Masco Yacht Club located to the north on Long Island.			

---

*Natural Heritage Report of Rare Species and Ecological Communities*


**Comments** The birds were last observed as active at this site in 2005.

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

---

*Sterna dougallii*

Office Use 2086

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

**Comments** The birds have not been reported as active at this site since 1996.

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

---

*Sterna dougallii*

Office Use 13154

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

**Comments** The rank is based on the draft state element occurrence rank specifications of February 15, 2006. There was an average of two pairs observed over one year surveyed. This site has been active for one year, therefore the rank is based on a single survey instead of a three-year average. Disturbances include boats, flooding, and predation by gulls.

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

---

*Sterna hirundo*

Office Use 1840

---

*Sterna fuscata* **Common Tern Species and Ecological Communities**


Common Tern	NYS Legal Status	Threatened	NYS Rank	S3B	Vulnerable
	Federal Listing		Global Rank	G5	Demonstrably secure
	Breeding	Last Report	1999-06-07	EO Rank	F
	County	Suffolk			
	Town	Brookhaven			
	Location	Fire Island Sunken Forest			
	Directions	The terns are at Fire Island Sunken Forest, west of Cherry Grove. Access is by boat or a 4-wheel drive vehicle. Drive down the beach to the vehicle-free area, park, and walk to the nesting area. The birds have also nested on the bay side.			
Comments	This site has not been reported as active since 1999.				
General Quality and Habitat	The terns were observed on a sandy maritime beach on a barrier island. The surrounding area is maritime forest with boardwalks wandering through it. There is stabilized dune vegetation in some sections. Phragmites is along the bay shore.				

*Sterna hirundo*

Office Use 8465

Common Tern	NYS Legal Status	Threatened	NYS Rank	S3B	Vulnerable
	Federal Listing		Global Rank	G5	Demonstrably secure
	Breeding	Last Report	2008-06-12	EO Rank	B
	County	Suffolk			
	Town	Islip			
	Location	Sexton Island			
	Directions	Sexton Island is in the Great South Bay, about 0.4 miles east of Captree Island and about 1.1 miles north of Fire Island. Access is by boat.			
Comments	The rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of 69 pairs per year over the last three years surveyed. This site was not surveyed in 2007. There is predation by gulls, crows, feral cats, snakes, fox, and rats. Disturbances include boats, development, flooding, and pedestrians. Fire Island National Seashore is to the south. Other salt marsh non-barrier islands are to the west.				
General Quality and Habitat	The birds were observed on a salt marsh and maritime beach on a non-barrier island. There are a few trees and a dense shrubby interior. It is poor habitat for shorebird nesting.				

*Sterna hirundo*

Office Use 2861

Common Tern	NYS Legal Status	Threatened	NYS Rank	S3B	Vulnerable
	Federal Listing		Global Rank	G5	Demonstrably secure
	Breeding				
	Last Report	2001-05-31	EO Rank	A	
	County	Suffolk			
	Town	Brookhaven			
	Location	Ridge Island			
	Directions	The birds were observed at Ridge Island, north of Fire Island, Great South Beach. Access is by boat.			
Comments	The rank is based on the draft state element occurrence rank specifications of February 15, 2006.				

Page 18 of 39

## Natural Heritage Program on Rare Species and Ecological Communities



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

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

*Sterna hirundo*

Office Use 9588

<b>Common Tern</b>	<b>NYS Legal Status</b>	Threatened	<b>NYS Rank</b>	S3B	Vulnerable
	<b>Federal Listing</b>		<b>Global Rank</b>	G5	Definitely secure
<b>Breeding</b>	<b>Last Report</b>	2003-06-20	<b>EO Rank</b>	F	
	<b>County</b>	Suffolk			
	<b>Town</b>	Brookhaven			
	<b>Location</b>	New Made Island			
	<b>Directions</b>	The terns were observed at New Made Island and the marsh to the southeast, located east of Forge Point in Moriches Bay. Access is by boat.			
<b>Comments</b>	This site has not been active since 2003.				
<b>General Quality and Habitat</b>	The area is an old dredge spoil island with a large pit in the center. The vegetation cover is overgrown and encroaching on the nesting habitat and includes Phragmites, milkweed, goldenrod and grasses.				

*Sterna hirundo*

Office Use 3068

<b>Common Tern</b>	<b>NYS Legal Status</b>	Threatened	<b>NYS Rank</b>	S3B	Vulnerable
	<b>Federal Listing</b>		<b>Global Rank</b>	G5	Definitely secure
<b>Breeding</b>	<b>Last Report</b>	2008-06-24	<b>EO Rank</b>	A	
	<b>County</b>	Suffolk			
	<b>Town</b>	Brookhaven			
	<b>Location</b>	Carters Island			
	<b>Directions</b>	The birds were observed at Carters Island in Moriches Bay. Access is by boat.			
<b>Comments</b>	This rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of 670 pairs per year over the last three years surveyed. The birds are disturbed by flooding and boats. There is also a lack of enough wrack material (nest substrate). Predators include gulls, crows, and rats. Fire Island National Seashore is to the south.				
<b>General Quality and Habitat</b>	The birds were observed on a flooded, salt marsh island with dense vegetation. The area is ditched.				

*Sterna hirundo*

Office Use 11951

---

*Statewide Biological Report on Rare Species and Ecological Communities*


Common Tern	NYS Legal Status	Threatened	NYS Rank	S3B	Vulnerable
	Federal Listing		Global Rank	G5	Demonstrably secure
	Breeding				
	Last Report	1994-06-03	EO Rank	F	
	County	Suffolk			
	Town	Islip			
	Location	East Fire Island			
	Directions	The birds were observed on East Fire Island, which is part of the Fire Island National Seashore. The island is north of the town of Dunewood. Access is by boat.			
Comments	The birds have not been observed as active at this site since 1994. This site has not been surveyed since 2001.				
General Quality and Habitat	The birds were observed on a salt marsh, non-barrier island. The nesting substrate is sand.				

*Sterna hirundo*

Offshore Use 12085

Common Tern	NYS Legal Status	Threatened	NYS Rank	S3B	Vulnerable
	Federal Listing		Global Rank	G5	Demonstrably secure
Breeding	Last Report	1999-06-23	EO Rank	F	
	County	Suffolk			
	Town	Brookhaven			
	Location	Fire Island East			
	Directions	The birds nest along the Great South Beach on Fire Island National Seashore. From the Long Island Expressway, take exit 68 south (William Floyd Parkway). Take the William Floyd Parkway to the end. The birds nest along the beach approximately 1 mile east.			
Comments	The birds have not been reported active at this site since 1999.				
General Quality and Habitat	The birds were observed at a sandy maritime beach on a barrier island that is sparsely vegetated with <i>Cakile edentula</i> . The beach is wide and narrows in some areas.				

*Sterna hirundo*

Offshore Use 11365

Common Tern	NYS Legal Status	Threatened	NYS Rank	S3B	Vulnerable
	Federal Listing		Global Rank	G5	Demonstrably secure
	Breeding				
	Last Report	2008-06-17	EO Rank	C	
	County	Suffolk			
	Town	Brookhaven			
	Location	Tuthill Cove Island			
	Directions	From East Moriches, follow Atlantic Avenue south to the marina at Tuthill Cove. Travel south by boat to the island in Tuthill Cove where the terns nest.			
Comments	The rank is based on the draft state element occurrence rank specifications of February 15, 2005.				

Page 18 of 39

---

*Natural Heritage Report on Rare Species and Ecological Communities*


---



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

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

---

*Sterna hirundo*

Official Use 5980

<b>Common Tern</b>	<b>NYS Legal Status</b> Threatened	<b>NYS Rank</b> S3B	Vulnerable
	<b>Federal Listing</b>	<b>Global Rank</b> G5	Demonstrably secure
<b>Breeding</b>	<b>Last Report</b> 2008-06-17	<b>EO Rank</b> B	
	<b>County</b> Suffolk		
	<b>Town</b> Brookhaven		
	<b>Location</b> Pattersquash Island		
	<b>Directions</b> The terns were observed at Pattersquash Island, located just north of Great South Beach, Fire Island National Seashore. Access is by boat launched at the Mastic Yacht Club located to the north on Long Island.		
<b>Comments</b>	The rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of 69 pairs per year over the last three years surveyed. The birds are disturbed by flooding and boats. Predators include crows, gulls, raccoons, and possibly fox. Fire Island is to the south and the Long Island mainland is to the north.		
<b>General Quality and Habitat</b>	The area is a non-barrier island and probably a salt marsh. The surrounding water is shallow.		

---

*Sterna hirundo*

Official Use 485

<b>Common Tern</b>	<b>NYS Legal Status</b> Threatened	<b>NYS Rank</b> S3B	Vulnerable
	<b>Federal Listing</b>	<b>Global Rank</b> G5	Demonstrably secure
<b>Breeding</b>	<b>Last Report</b> 2008-06-29	<b>EO Rank</b> D	
	<b>County</b> Suffolk		
	<b>Town</b> Brookhaven		
	<b>Location</b> Westhampton Island West		
	<b>Directions</b> The terns were observed at Cupsoque County Park on the western edge of Westhampton Island, east of Moriches Inlet. Most of the nests are along the beach, except for a few on the bay side north of the parking lot. For access to the site, take Dune Road west.		
<b>Comments</b>	The rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of six pairs per year over the last three years surveyed. Disturbances include ORVs, boaters, campers and dogs, fishermen entering protected areas, flooding, erosion, and predation by crows, gulls, feral cats, fox, and raccoons. Moriches Inlet and Fire Island is to the west. The Atlantic Ocean is to the south. Non-barrier islands are to the north.		
<b>General Quality and Habitat</b>	The birds were observed on a barrier island maritime beach and dredge spoil with a gravel substrate.		

---

## Natural Heritage Report of Rare Species and Ecological Communities

*Sterna hirundo*

Office Use 6583

Common Tern	NYS Legal Status	Threatened	NYS Rank	S3B	Vulnerable
	Federal Listing		Global Rank	G5	Denotably secure
Breeding	Last Report	2008-sp	EO Rank	D	
	County	Suffolk			
	Town	Brookhaven			
	Location	Fire Island Wilderness Watch Hill			
	Directions	The terns were observed at Fire Island Wilderness located on Watch Hill on Fire Island National Seashore. Access is by ferry from Patchogue. The colony is north of and adjacent to the marina.			
Comments	The rank is based on the draft state element occurrence rank specifications of February 15, 2011. Two pairs were observed over the last year surveyed. Prior to 2008, this site was last surveyed in 2002. There is a busy marina adjacent to the occurrence and development, pedestrians, and predation are threats and disturbances.				
General Quality and Habitat	The terns were observed on dredge spoil on the bay side of a barrier beach island. The substrate is sandy with grass cover around the site. It is open in the center. The dredge spoil is colonized by <i>Ammophila breviligulata</i> and weedy annuals.				

*Sterna hirundo*

Office Use 6335

Common Tern	NYS Legal Status	Threatened	NYS Rank	S3B	Vulnerable
	Federal Listing		Global Rank	G5	Denotably secure
Breeding	Last Report	1998-06-20	EO Rank	F	
	County	Suffolk			
	Town	Islip			
	Location	Fire Island Villages			
	Directions	The terns nest east of Atlantique Beach Municipal Park on the ocean side of Fire Island National Seashore, between East End Walk and Compass Avenue. Access is by boat or ORV.			
Comments	The terns have not been reported active at this site since 1998.				
General Quality and Habitat	The terns were observed at a maritime beach on a barrier island. The beach is about 150 feet wide and eroded. There is little to no wrack material and no beach vegetation. The beach is within a series of beach communities and is heavily developed with beach houses over or in place of the primary dune.				

*Sterna hirundo*

Office Use 1841

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

## Natural Heritage Report on Rare Species and Ecological Communities



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

<b>Comments</b>	The rank is based on the draft state element occurrence rank specifications of February 15, 2001. There was an average of 148 pairs per year over the past two years surveyed. Surveys were not conducted in 2006 or 2007. Disturbances include flooding, vegetative encroachment, boats, and predation by gulls, crows, fox, snakes, feral cats, and raccoons. Great South Bay is to the north and Fire Island National Seashore is to the south.
<b>General Quality and Habitat</b>	The terns were observed on a dredge spoil barrier island with a salt marsh natural community. The nesting substrate is dead herbaceous vegetation and wrack material.

*Sterna hirundo*

C/HA Use 12415

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

<b>Comments</b>	The rank is based on the draft state element occurrence rank specifications of February 15, 2001. There was an average of one pair per year over the last three years surveyed. This site was not surveyed in 2006. Disturbances include a high red fox population, human recreation including beach combing and boating, ORVs (so far used only by the US National Park Service and Suffolk County Park police), deer, and predation by snakes, gulls, crows, feral cats, raccoons and loose dogs. A small residential community.
-----------------	--

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

*Sterna hirundo*

C/HA Use 9585

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

<b>Comments</b>	The rank is based on the draft state element occurrence rank specifications of February 15, 2001. There was an average of 82 pairs per year over the last three years surveyed. The birds are disturbed by boats, flooding, and erosion. Predators include gulls and crows. Fire Island and Westhampton Island are to the south and the Long Island mainland is to the north.
-----------------	---

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

## Natural Heritage Record on Rare Species and Ecological Communities

*Sterna hirundo*

Coffin Use 11890

<b>Common Tern</b>	<b>NYS Legal Status</b>	Threatened	<b>NYS Rank</b>	S3B	Vulnerable
	<b>Federal Listing</b>		<b>Global Rank</b>	G5	Demonstrably secure
Breeding	<b>Last Report</b>	2005-06-07	<b>EO Rank</b>	D	
	<b>County</b>	Suffolk			
	<b>Town</b>	Brookhaven			
	<b>Location</b>	Hospital Island			
	<b>Directions</b>	Hospital Island is in Great South Bay north of Fire Island Great South Beach. Access is by boat.			
<b>Comments</b>	The rank is based on the draft state element occurrence rank specifications of February 15, 2005. One pair has nested over the course of the last three years this site was surveyed. The birds are disturbed by flooding, boats, and pedestrians. Predators include crows, gulls, and fox. Fire Island is to the south.				
<b>General Quality and Habitat</b>	The habitat appears to be a marsh based on 1994-1999 orthoimagery.				

*Sternula antillarum*

Coffin Use 6732

Least Tern	NYS Legal Status	Threatened	NYS Rank	S3B	Vulnerable
	Federal Listing		Global Rank	G4	Apparently secure
	Breeding				
	Last Report	2007-sp	EO Rank	D	
	County	Suffolk			
	Town	Brookhaven			
	Location	Fire Island Sunken Forest			
	Directions	The birds were observed at Fire Island Sunken Forest, west of Cherry Grove. Access is by boat or a 4-wheel drive vehicle. Drive down the beach to the vehicle free area, park, and walk to the nesting area. The birds have also nested on the Great South Bay.			
Comments	The rank is based on the draft state element occurrence rank specifications of February 15, 2005. The colony is small. Exact numbers are unknown. Disturbances include illegal ORV use, recreation, pets, boats, and predation by feral cats, crows, fox, gulls, raccoons and snakes. Some Cherry Grove residents are against the protection of the birds. Sailors Haven contains a visitors center and marina along with a concession stand that is heavily visited. A dense residential neighborhood is to the east.				
General Quality and Habitat	The terns were observed on a sandy maritime beach on a barrier island. The surrounding area is maritime forest with boardwalks wandering through it. There is stabilized dune vegetation in some sections. Phragmites is along the bay shore.				

*Sternula antillarum*

Coffin Use 2559

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

*Leucurus v. elegans* on Fire Species and Ecological Communities

<b>Location</b>	Fire Island Pines
<b>Directions</b>	The terns were observed at a 0.8 mile stretch of beach located about 0.5 miles west of Davis Park on the ocean side of Fire Island National Seashore.
<b>Comments</b>	The terns have not been reported active at this site since 1999.
<b>General Quality and Habitat</b>	The terns were observed on a sandy maritime beach on a barrier island. There is little vegetation cover. The Water Island area is wide enough to support nesting. The area in general is heavily developed. Beach nourishment occurred in 1998. A 400-home community uses this area as their primary recreation beach.

*Sterna antillarum*

Off-Isle Use 9000

Least Tern	NYS Legal Status	Threatened	NYS Rank	S3B	Vulnerable
	Federal Listing		Global Rank	G4	Apparently secure
	Breeding				
	Last Report	1995-06-20	EO Rank	F	
	County	Suffolk			
	Town	Brookhaven			
	Location	Carters Island			
	Directions	The birds were found at Carters Island in Moriches Bay. Access is by boat.			
Comments	Terns have not been observed as active at this site since 1995				
General Quality and Habitat	The birds were observed on a flooded, salt marsh island with dense vegetation. The area is ditched.				

*Sterna antillarum*

Off-Isle Use 3190

<b>Least Tern</b>	<b>NYS Legal Status</b>	Threatened	<b>NYS Rank</b>	S3B	Vulnerable
	<b>Federal Listing</b>		<b>Global Rank</b>	G4	Apparently secure
<b>Breeding</b>	<b>Last Report</b>	1996-08-26	<b>EO Rank</b>	F	
	<b>County</b>	Suffolk			
	<b>Town</b>	Brookhaven			
	<b>Location</b>	John Boyle Island			
	<b>Directions</b>	The birds were observed at John Boyle Island in Great South Bay north of Fire Island and about 1.3 mi west of Smith Point. Access is by boat.			
<b>Comments</b>	This site has not been active since 1996.				
<b>General Quality and Habitat</b>	The area is an island in a large bay between a barrier island and the mainland.				

## Natural Heritage Program on Rare Species and Ecological Communities

*Sternula antillarum*

Offshore Use 3040

Least Tern	NYS Legal Status	Threatened	NYS Rank	S3B	Vulnerable
Breeding	Federal Listing		Global Rank	G4	Apparently secure
	Last Report	2008-06-12	EO Rank	D	
	County	Suffolk			
	Town	Islip			
	Location	Sexton Island			
	Directions	Sexton Island is in the Great South Bay, about 0.4 miles east of Captree Island and about 1.1 miles north of Fire Island. Access is by boat.			
Comments	The rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of less than one pair per year over the last three years surveyed. This site was not surveyed in 2007. There is predation by gulls, crows, feral cats, snakes, fox, and rats. Disturbances include boats, development, flooding, and pedestrians. Fire Island National Seashore is to the south. Other salt marsh non-barrier islands are to the west.				
General Quality and Habitat	The birds were observed on a salt marsh and maritime beach on a non-barrier island. There are a few trees and a dense shrubby interior. It is poor habitat for shorebird nesting.				

*Sternula antillarum*

Offshore Use 2535

Least Tern	NYS Legal Status	Threatened	NYS Rank	S3B	Vulnerable
	Federal Listing		Global Rank	G4	Apparently secure
Breeding	Last Report	2008-06-29	EO Rank	D	
	County	Suffolk			
	Town	Brookhaven			
	Location	Westhampton Island West			
	Directions	The terns were observed at Cupsoque County Park on the western side of Westhampton Island, east of Moriches Inlet. Most of the nests are along the beach, except for a few on the bay side north of the parking lot. For access to the site take Dune Road west.			
Comments	The rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of 11 pairs per year over the last three years surveyed. Disturbances include ORVs, boaters, campers and dogs, fishermen entering protected areas, flooding, erosion, and predation by crows, gulls, feral cats, fox, and raccoons. Moriches Inlet and Fire Island is to the west. The Atlantic Ocean is to the south. Non-barrier islands are to the north.				
General Quality and Habitat	The terns were observed at a barrier island maritime beach and dredge spoil with a gravel substrate. There is sparse to moderately dense vegetation that includes <i>Ammophila breviligulata</i> , <i>Cakile edentula</i> and <i>Solidago sempivirens</i> . The habitat is narrow and eroding with steep dunes that are progressively getting wider.				

*Sternula antillarum*

Offshore Use 6290

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

## Natural Heritage Report on Rare Species and Ecological Communities



<b>County</b>	Suffolk
<b>Town</b>	Islip
<b>Location</b>	Fire Island Lighthouse
<b>Directions</b>	Take Robert Moses Parkway south to Fire Island. Turn east at the traffic circle and park at Field 5 in Robert Moses State Park. The birds nest along the beach and also part way into the dunes between Field 4 and Field 5. Occasionally they use the grass.
<b>Comments</b>	The rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of one pair per year over the last three years surveyed. Human disturbances include beach-goers, off-road vehicle use, boats, and development. Predation by gulls, crows, fox, feral cats, raccoons, dogs, and snakes is also a threat. Flooding has been a problem. There are two parking lots adjacent to the nesting area.
<b>General Quality and Habitat</b>	The least terns are nesting on a barrier island with a maritime beach, dunes, and grassland. The dunes are steep and vegetated with <i>Ammophila breviligulata</i> . The beach width is variable and quite dynamic. The beach is used as a bathing beach. There are two parking lots adjacent to the nesting area. In 1992 the beach was unsuitable for nesting due to severe erosion resulting in a too narrow beach.

*Sterna antillarum*

Off the Use 1119

<b>Least Tern</b>	<b>NYS Legal Status</b>	Threatened	<b>NYS Rank</b>	S3B	Vulnerable
	<b>Federal Listing</b>		<b>Global Rank</b>	G4	Apparently secure
<b>Breeding</b>	<b>Last Report</b>	1998-06-20	<b>EO Rank</b>	F	
	<b>County</b>	Suffolk			
	<b>Town</b>	Brookhaven, Islip			
	<b>Location</b>	Fire Island Villages			
	<b>Directions</b>	The terns nest at Atlantic Beach Municipal Park and Point of Woods on the ocean side of Fire Island National Seashore. Access is by boat or ORV.			
<b>Comments</b>	The terns have not been reported active at this site since 1998.				
<b>General Quality and Habitat</b>	The terns were observed on a maritime beach on a barrier island. The beach is about 150 feet wide and eroded. There is little to no wrack material and no beach vegetation. The beach is within a series of beach communities and is heavily developed with beach houses over or in place of the primary dune.				

*Sterna antillarum*

Off the Use 5389

Least Tern	NYS Legal Status	Threatened	NYS Rank	S3B	Vulnerable
	Federal Listing		Global Rank	G4	Apparently secure
Breeding	Last Report	2008-06-28	EO Rank	C	
	County	Suffolk			
	Town	Brookhaven			
	Location	Fire Island East			
	Directions	The birds nest along the Great South Beach on Fire Island National Seashore. From the Long Island Expressway, take exit 68 South (William Floyd Parkway). Take the William Floyd Parkway to the end. The birds nest along the beach east of the parking lot.			
Comments	The rank is based on the draft state element occurrence rank specifications of February 15, 2005. There was an average of 18 pairs per year over the last three years surveyed. The birds are disturbed by recreational use, pedestrians, vehicles, boats, and				

Page 25 of 39

## Natural Heritage Report on Rare Species and Ecological Communities



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

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

*Sterna antillarum*

Off the Use 1154

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

**Federal Listing** **Global Rank** G4 **Apparently secure**

**Breeding** **Last Report** 1996-06-26 **EO Rank** F

**County** Suffolk

**Town** Brookhaven

**Location** Fire Island Wilderness Long Cove

**Directions** The terns nest on an island north of Long Cove on the bay side of Fire Island National Seashore. Access is by a boat that can navigate through shallow waters.

**Comments** This site has not been reported as active since 1996.

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

*Sterna antillarum*

Off the Use 5692

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

**Federal Listing** **Global Rank** G4 **Apparently secure**

**Breeding** **Last Report** 2008-sp **EO Rank** D

**County** Suffolk

**Town** Brookhaven

**Location** Fire Island Wilderness Watch Hill

**Directions** The terns were observed at Fire Island Wilderness, Watch Hill on Fire Island National Seashore. Access is by ferry from Patchogue. The colony is north of and adjacent to the marina.

**Comments** The rank is based on the draft state element occurrence rank specifications of February 15, 2007. Five pairs were observed over the last year surveyed. Prior to 2008, this site was last surveyed in 2002. Threats include boats, development, pedestrians, vehicles, deer, and predation by crows, gulls, feral cats, raccoons and snakes. There is a high red fox population. This site is adjacent to a 180-vessel marina.

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

*Sterna antillarum*

Off the Use 2536

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

High Salt Marsh	NYS Legal Status	Unlisted	NYS Rank	9334	Vulnerable
	Federal Listing		Global Rank	G4	Apparently secure
	Last Report	1998-09-18	EQ Rank	A8	
	County	Suffolk			
	Town	Brookhaven			
	Location	Fire Island Wilderness			
	Directions	From shirely, go south on Route 46 (William Floyd Parkway) and then over Smith Point			

## Natural Heritage Report on Rare Species and Ecological Communities



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

<b>Comments</b>	This is a large complex of marsh barrier beach segments with minimal to marginal disturbing disturbance and minimal disruption to overwash and other dynamic processes. Human disturbance on marsh is minimal although it can be heavy in some adjacent and near by communities.
<b>General Quality and Habitat</b>	The community is located in a 545 acre salt marsh complex formed on an extensive barrier beach complex stretching from Smith Point west to Davis Park. This segment is part of a larger barrier complex forming south shore of Long Island from Shinnecock Bay west to Coney Island. The community is formed at the bay side (lagoon side) and is classified as back barrier marsh or a flood tidal delta marsh on some islands (Oertel and Woo 1994). The high salt marsh covers about 375 acres and is primarily developed

## Maritime beach

Office Use 5364

Maritime Beach	NYS Legal Status	Unlisted	NYS Rank	S3S4	Vulnerable
	Federal Listing		Global Rank	G5	Definitely secure
	Last Report	2001-09-28	EO Rank	AB	
	County	Suffolk			
	Town	Babylon, Brookhaven, Islip			
	Location	Fire Island			
	Directions	The beach is along the south shore of Fire Island from Democrat Point east to Moriches Inlet. Access to Fire Island is from Robert Moses Causeway, William Floyd Parkway, or by ferry.			
Comments	A 32 mile long maritime beach along the south shore of Fire Island, 7 miles of which is designated as Federal Wilderness Area where driving is not allowed for most of the year. Natural processes are affected by stabilization and nourishment in some areas.				
General Quality and Habitat	A large sandy maritime beach along the south shore of a barrier island. The maritime beach extends 32 miles along the south shore of Fire Island from Democrat Point east to Moriches Inlet. The maritime beach grades into marine intertidal gravel/sand beach oceanward and maritime dunes inland. The island is mostly state, federal, and county owned parkland. A seven mile stretch is Federal Wilderness Area. Several towns with residences occur near the beach for approximately 7 miles from Kismet to Oakleyville.				

## Maritime dunes

Office Use 8079

Maritime Dunes	NYS Legal Status	Unlisted	NYS Rank	S3	Vulnerable
	Federal Listing		Global Rank	G4	Apparently secure
	Last Report	2001-09-28	EO Rank	BC	
	County	Suffolk			
	Town	Babylon, Islip			
	Location	Fire Island Democrat Point			
	Directions	The dunes are at the west end of Fire Island from Democrat Point east to the town of Kismet. Take Robert Moses Causeway south to Robert Moses State Park.			
Comments	The dunes are large with good diversity and processes fairly intact, but with some recent seasonal development and many exotic plants near roads. The western portion is unfragmented by paved roads. The eastern portion is fragmented by roads and parking areas.				
General Quality and Habitat	S. A large maritime dunes along a 5-mile stretch of Fire Island extending from Democrat Point east to the Town of Kismet. The maritime dunes are bordered by maritime beach towards the ocean. The dunes				

Page 28 of 38

---

*Natural Heritage Report on Rare Species and Ecological Communities*


---



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

---

*Maritime freshwater interdunal swales*
*Off to Use* 1140

**Maritime Freshwater Interdunal Swales**
**NYS Legal Status** Unlisted

**NYS Rank** S2

Imperiled

**Federal Listing**
**Global Rank** G3G4

Rare

**Last Report** 2005-08-31

**EO Rank** B

**County** Suffolk

**Town** Brookhaven

**Location** Fire Island Wilderness

**Directions** The interdunal swales are in wetlands among dunes 0.5 mi south of Hospital Island on Fire Island.

**Comments**

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

**General Quality and Habitat**

This is a small patch of maritime freshwater swales among low elevation maritime dunes. Other communities in the area include maritime shrubland, brackish interdunal swales, maritime pitch pine dune woodland, and reedgrass-purple loosestrife marsh. A high salt marsh/low salt marsh complex occurs along the north shore of the barrier island and a large, sandy maritime beach runs along the south shore. The landscape also includes patches of successional maritime forest, maritime holly forest, parking lots,

---

*Maritime holly forest*
*Off to Use* 5615

**Maritime Holly Forest**
**NYS Legal Status** Unlisted

**NYS Rank** S1

Critically Imperiled

**Federal Listing**
**Global Rank** G1G2

Critically Imperiled

**Last Report** 2000-08-08

**EO Rank** AB

**County** Suffolk

**Town** Brookhaven

**Location** Fire Island Sunken Forest

**Directions** Sunken Forest. From Sailor's Haven Ferry Terminal in Sayville, take the ferry to Sunken Forest/Sailor's Haven Visitor's Center and follow the signs. Follow the boardwalk west through the forest. On the 7 1/2 minute USGS topographic map, the community is

**Comments**

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

**General Quality and Habitat**

An old-growth holly forest primarily located behind the secondary dune of a barrier island. Trees on the dune ridges are very gnarled due to wind exposure and the pruning influence of salt spray. The surrounding communities, which comprise a >75 acre coastal forest/shrub/grassland complex, include maritime shrubland/successional maritime forest, scrub forest, maritime dunes, and highbush blueberry shrub swamp. There is severe deer browsing of understory, and some areas completely lack understory, except

---

## Natural Heritage Report on Rare Species and Ecological Communities



## Maritime pitch pine dune woodland

Office Use 8198

Maritime Pitch Pine Dune Woodland	NYS Legal Status	Unlisted	NYS Rank	S1	Critically Imperiled
	Federal Listing		Global Rank	G2G3	Imperiled
	Last Report	1998-09-18	EO Rank	B	
	County	Suffolk			
	Town	Brookhaven			
	Location	Fire Island Wilderness			
	Directions	From Shirley, go south on Route 46 (William Floyd Parkway) and then over Smith Point bridge. Stop at the visitor center. With permission from the National Park Service, let a little air out of the tires and drive on the beach west about 2.8 mi. Walk north.			
Comments	This is a small and very narrow maritime pitch pine dune woodland with good diversity in natural processes in an excellent, intact landscape.				
General Quality and Habitat	This maritime pitch pine dune woodland is in a narrow band of stabilized dunes on a barrier island. The woodland grades into maritime dunes, maritime shrubland, and maritime interdune grasses. The dunes are on the north half of the island facing Great South Bay. Salt marsh occurs to the north. Maritime beach occurs to the south. There are no roads in the wilderness area, but vehicles drive on the beach.				

## Salt panne

Office Use 8199

Salt Panne	NYS Legal Status	Unlisted	NYS Rank	S3	Vulnerable
	Federal Listing		Global Rank	G3G4	Rare
	Last Report	1998-09-18	EO Rank	BC	
	County	Suffolk			
	Town	Brookhaven			
	Location	Fire Island Wilderness			
	Directions	From Shirley, go south on Route 46 (William Floyd Parkway) and then over Smith Point bridge. Stop at the visitor center and ask permission to drive on the beach. With permission from the National Park Service, let a little air out of the tires and drive north.			
Comments	The salt pannes are in a good landscape setting. The pannes are ditched, but recovering with good vegetation diversity. The pannes often found with a complex of high marsh as well as panne species.				
General Quality and Habitat	The salt panne is located in a 545 acre salt marsh complex formed on an extensive barrier beach complex stretching from Smith Point west to Davis Park. This segment is part of a larger barrier complex forming the south shore of Long Island from Shinnecock Bay west to Coney Island. The salt marsh complex is formed at the bay-side (lagoon side) and is classified as a back-barrier marsh or a flood tidal delta marsh on some islands (Oerte and Woo 1992). The high marsh is formed on 200-400 m wide patches and				

## Salt shrub

Office Use 8677

<b>Salt Shrub</b>	<b>NYS Legal Status</b>	Unlisted	<b>NYS Rank</b>	S4	Aparently secure
	<b>Federal Listing</b>		<b>Global Rank</b>	G5	Demonstrably secure
	<b>Last Report</b>	1998-09-18	<b>EO Rank</b>	B	
	<b>County</b>	Suffolk			
	<b>Town</b>	Brookhaven			

---

*Natural Heritage Report for Rare Species and Ecological Communities*


---



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

---

Total of 8 COMMUNITIES

---

**OTHER**


---

*Gull Colony*

Office Use 7195

<b>Gull Colony</b>	<b>NYS Legal Status</b>	Unlisted	<b>NYS Rank</b>	SNR	Rank not assigned
	<b>Federal Listing</b>		<b>Global Rank</b>	GNR	Globaly not ranked
Breeding	<b>Last Report</b>	2004-05-27	<b>EO Rank</b>	B	
	<b>County</b>	Suffolk			
	<b>Town</b>	Brookhaven			
	<b>Location</b>	West Inlet Island			
	<b>Directions</b>	The gulls were observed at West Inlet Island, north of Moriches Inlet. Access is by boat launched at the Maple Avenue dock, off of Atlantic Avenue in East Moriches.			
<b>Comments</b>	The rank is based on the element global ranking form of April 22, 1988. There was an average of 987 pairs per year over the last 3 years surveyed. The gulls are surveyed every third year, but were not surveyed in 1998.				
<b>General Quality and Habitat</b>	West Inlet Island is a non-barrier island consisting of dredge spoil and sparse to dense beach grass. There is a salt marsh in the north center of the island. There is a heron colony nearby.				

Total of 1 OTHER

---

**REPTILES**


---

*Kinosternon subrubrum*

Office Use 10130

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

Page 31 of 39

## Natural Heritage Report on Rare Species and Ecological Communities



	<b>Location</b>	Old Inlet Marsh
	<b>Directions</b>	The turtles were found near Old Inlet Marsh. They were also found in a marsh near Hospital Island and Pelican Island. Take William Floyd Parkway south to Fire Island, turn west on Fire Island Road. Park at the end and walk west to the marshes.
<b>Comments</b>	The rank is based on NatureServe's Generic Element Occurrence Rank. Specific date of January 11, 2008. The population appears to be small and dispersed, although hard data is lacking. Evidence of successful reproduction has been observed, and the male:female ratio is 1:1. The site is located within a protected, undeveloped national seashore on a barrier island. Stochastic events such as winter storms or other climate-related changes such as sea level rise may or may not disrupt the population.	
<b>General Quality and Habitat</b>	The marsh near Old Inlet is a freshwater <i>Scirpus</i> marsh in a larger coastal marsh ranging from salt to freshwater. The entire marsh has been ditched. The marsh near Hospital Island and Pelican Island has also been ditched. The area occupied by the turtles contains a 1.5 ft-deep ponded area that goes dry, ditches, wetlands, swales, and semi-ponded damp areas.	

Total of 1 REPTILES

## VASCULAR PLANTS

*Amaranthus pumilus*

Office Use 3631

**Seabeach  
Amaranth**

<b>NYS Legal Status</b>	Endangered	<b>NYS Rank</b>	S2	Imperiled
<b>Federal Listing</b>	Threatened	<b>Global Rank</b>	G2	Imperiled
<b>Last Report</b>	2005-08	<b>EO Rank</b>	A	
<b>County</b>	Suffolk			
<b>Town</b>	Brookhaven, Southampton			
<b>Location</b>	Westhampton Island West			
<b>Directions</b>	The plants were surveyed Westhampton Island along the beach from the point at Moriches Inlet east to the beginning of "The Dunes" development.			

**Comments** This is a good population of vigorous individuals in limited, but good habitat. There is an average of 20,000 plants over 5 years.

**General Quality and Habitat** 2005: Most of the plants were inside string fencing. 2000: All plants were on the old beach near the point or on newly replenished beach within fencing. 1998: Only a few plants were found north of Dune Road. There are many plants in between houses south of Dune Road which will probably be extirpated by next year. Plants seem to be successfully colonizing the new replenished beach. There is little in the way of dune development or dune vegetation. Regrading of Dune Road has affected the habitat. Cupsgrove

*Amaranthus pumilus*

Office Use 222

**Seabeach  
Amaranth**

<b>NYS Legal Status</b>	Endangered	<b>NYS Rank</b>	S2	Imperiled
<b>Federal Listing</b>	Threatened	<b>Global Rank</b>	G2	Imperiled
<b>Last Report</b>	2003-08	<b>EO Rank</b>	C	
<b>County</b>	Suffolk			
<b>Town</b>	Brookhaven			
<b>Location</b>	Fire Island East			

---

*Natural Heritage Report on Rare Species and Ecological Communities*


---



<b>Directions</b>	The plants are on the south shore of Fire Island, located within 0.5 miles of Moriches Inlet, between 27 and 34.5 m leeward of the mean tide line. The plants are east of a jeep trail cut-in point (Burma Road) generally near or within the piping plover
<b>Comments</b>	A few plants are in good habitat if it is protected from ORVs. An average of 120 plants were observed over five years were observed.
<b>General Quality and Habitat</b>	A barrier beach where the wider sections (1000 feet) support diffuse drifting vegetation stands. Part of the shoreline exhibits wave erosion in the form of a dropoff (about 5 ft in places) near the mean high tide line. The plants were found in driftlines. The beach has a very windblown appearance. ORV use of the beach is very heavy.

---

*Amaranthus pumilus*

Critical Use 7024

<b>Seabeach Amaranth</b>	<b>NYS Legal Status</b>	Endangered	<b>NYS Rank</b>	S2	Imperiled
	<b>Federal Listing</b>	Threatened	<b>Global Rank</b>	G2	Imperiled
	<b>Last Report</b>	2006-08	<b>EO Rank</b>	C	
	<b>County</b>	Suffolk			
	<b>Town</b>	Brookhaven			
	<b>Location</b>	Fire Island Sunken Forest			
	<b>Directions</b>	The plants are at Fire Island National Seashore at the Sunken Forest Natural Area west of Cherry Grove. 1990: The plants are along the beach. 1996: The plants are in the western half of Sailors Haven vehicle-free beach.			
<b>Comments</b>	There are 52 plants averaged over five years.				
<b>General Quality and Habitat</b>	A barrier beach				

*Amaranthus pumilus*

Critical Use 4094

<b>Seabeach Amaranth</b>	<b>NYS Legal Status</b>	Endangered	<b>NYS Rank</b>	S2	Imperile
	<b>Federal Listing</b>	Threatened	<b>Global Rank</b>	G2	Imperile
	<b>Last Report</b>	2006-08	<b>EO Rank</b>	C	
	<b>County</b>	Suffolk			
	<b>Town</b>	Brookhaven			
	<b>Location</b>	Fire Island Wilderness			
	<b>Directions</b>	From Patchogue, take the ferry to Watch Hill. 1992: One plant is at the vehicle free area at Watch Hill and two other plants are just east of Bellport Beach. 1995 and 1996: The plants are at Old Inlet Beach, 1.5 mile west of Old Inlet and at Barrett's Cove.			
<b>Comments</b>	There is an average of 42 plants.				
<b>General Quality and Habitat</b>	A barrier beach				

## Natural Heritage Report on Rare Species and Ecological Communities

*Amaranthus pumilus*

Office Use 5961

**Seabeach  
Amaranth**

<b>NYS Legal Status</b>	Endangered	<b>NYS Rank</b>	S2	Imperiled
<b>Federal Listing</b>	Threatened	<b>Global Rank</b>	G2	Imperiled
<b>Last Report</b>	2006-08	<b>EO Rank</b>	C	
<b>County</b>	Suffolk			
<b>Town</b>	Islip			
<b>Location</b>	Fire Island Villages			
<b>Directions</b>	2001: The plants are along Atlantique Beach just east of the National Seashore area. 1990: The plants are along the beach area on the ocean side of the Fair Harbor section of Fire Island. The plants are about 100 feet east of the "Broadway" beach access.			

**Comments** There were 67 plants averaged over five years in an isolated and threatened habitat.

**General Quality and Habitat** This is a barrier island beach that is built up and heavily used.

*Amaranthus pumilus*

Office Use 1963

**Seabeach  
Amaranth**

<b>NYS Legal Status</b>	Endangered	<b>NYS Rank</b>	S2	Imperiled
<b>Federal Listing</b>	Threatened	<b>Global Rank</b>	G2	Imperiled
<b>Last Report</b>	2006-08	<b>EO Rank</b>	C	
<b>County</b>	Suffolk			
<b>Town</b>	Brookhaven			
<b>Location</b>	Fire Island Pines			
<b>Directions</b>	The plants are at the Barrett Beach Park section of Fire Island Pines in front of a foredune.			

**Comments** There are 98 plants averaged over five years.

**General Quality and Habitat** This is a narrow barrier beach in front of a foredune.

*Amaranthus pumilus*

Office Use 6806

**Seabeach  
Amaranth**

<b>NYS Legal Status</b>	Endangered	<b>NYS Rank</b>	S2	Imperiled
<b>Federal Listing</b>	Threatened	<b>Global Rank</b>	G2	Imperiled
<b>Last Report</b>	2006-08	<b>EO Rank</b>	C	
<b>County</b>	Suffolk			
<b>Town</b>	Islip			
<b>Location</b>	Fire Island Lighthouse			

---

*Natural Heritage Report on Rare Species and Ecological Communities*


---



<b>Directions</b>	The plants are within bird fencing on the barrier beach from the parking lot east to the first parking lot (Field 4).
<b>Comments</b>	There were 80 plants averaged over 5 years.
<b>General Quality and Habitat</b>	This is a heavily used barrier beach. The plants survive within string fencing for birds.

---

*Carex hornemuthodes*

Office Use 12722

<b>Marsh Straw Sedge</b>	<b>NYS Legal Status</b>	Threatened	<b>NYS Rank</b>	S2S3	Imperiled
	<b>Federal Listing</b>		<b>Global Rank</b>	G4G5	Apparently secure
	<b>Last Report</b>	1985-06-07	<b>EO Rank</b>	E	
	<b>County</b>	Suffolk			
	<b>Town</b>	Brookhaven			
	<b>Location</b>	Forge Point			
	<b>Directions</b>	Forge Point is east of Mastic Beach. Go to William Floyd Estate located between Laurence Creek and Home Creek in Mastic Beach at the southeast edge of Forge Point. The probable location was in the salt marsh at the end of the "vista looking" from the house.			

**Comments**

**General Quality and Habitat** The probable location was in the salt marsh.

---

*Carex venusta*

Office Use 2523

<b>Dark-green sedge</b>	<b>NYS Legal Status</b>	Endangered	<b>NYS Rank</b>	S1	Critically imperiled
	<b>Federal Listing</b>		<b>Global Rank</b>	G4	Apparently secure
	<b>Last Report</b>	1999-su	<b>EO Rank</b>	E	
	<b>County</b>	Suffolk			
	<b>Town</b>	Brookhaven			
	<b>Location</b>	Forge Point			
	<b>Directions</b>	From the junction of Wavecrest Drive and Washington Avenue in Mastic, go west on Washington Avenue 0.1 mi to the entrance of the park unit. Park in a public lot and find the manager. The plants are near the edge of the marsh east of a mowed vista near a			

**Comments**

**General Quality and Habitat** Old estate that is now part of Fire Island National Seashore. Many abandoned fires and fire suppressed pine barrens with channelized streams. The marsh is ditched and has a fair amount of Phragmites. Vista to water mowed from old house to marsh.

---

## Natural Heritage Report on Rare Species and Ecological Communities

*Helianthus angustifolius*

Office Use 6725

**Swamp  
Sunflower****NYS Legal Status** Threatened**NYS Rank** S2

Imperiled

**Federal Listing****Global Rank** G5

Demonstrably secure

**Last Report** 2006-08-31**EO Rank** C**County** Suffolk**Town** Brookhaven**Location** Fire Island Wilderness**Directions** August 30, 1985: The plants are in the Fire Island Wilderness about 0.1 mi. WSW of the circle at the south end of William Floyd Parkway, along a jeep trail in the north center of Fire Island, and about 0.5 mi south of Hospital Island growing in wet sand dune.**Comments** There are only 30-50 plants in excellent, but small habitat.**General Quality and Habitat** 1985: A small shallow depressions in dunes; some have open cranberry mats, some have shrub thickets. The plants are in a shrubby, wet maritime interdunal swale. Associated species: *Panicum virgatum*, *Myrica pensylvanica*, *Sabatia stellaris*, *Vaccinium macrocarpon*, *Xyris* sp. and *Prunus maritima*. 2006: The plants occurred in a good wet maritime interdunal swale dominated by *Cladium mariscoides* and *Panicum virgatum*. The swale is distinctive in the area and much wetter than the dunes, but drier than the other.*Helianthus angustifolius*

Office Use 517

**Swamp  
Sunflower****NYS Legal Status** Threatened**NYS Rank** S2

Imperiled

**Federal Listing****Global Rank** G5

Demonstrably secure

**Last Report** 1997-su**EO Rank** C**County** Suffolk**Town** Brookhaven**Location** Forge Point**Directions** Forge Point is east of Mastic Beach. Go to William Floyd Estate located between Laurence Creek and Home Creek in Mastic Beach at the southeast end of Forge Point. The plants are in three groups between the upper salt marsh and field and woods at the end.**Comments** There are 60 plants in protected habitat that is threatened with *Phragmites*.**General Quality and Habitat** This is a large estate run by the National Park Service. The marsh is *Phragmites*-fringed and protected.*Polygonum glaucum*

Office Use 3692

**Seabeach  
Knotweed****NYS Legal Status** Rare**NYS Rank** S3

Vulnerable

**Federal Listing****Global Rank** G3

Rare

**Last Report** 1985-08-30**EO Rank** C**County** Suffolk**Town** Brookhaven**Location** Fire Island Wilderness

---

*Natural Heritage Report on Rare Species and Ecological Communities*


<b>Directions</b>	The plants are on Fire Island in a beach embayment on the ocean beach at Long Point. Only one embayment was present in 1985, (the embayment will move from year to year). The plants are in the drift line among debris.
<b>Comments</b>	This is a very small population in habitat that is abused by ORVs.
<b>General Quality and Habitat</b>	An ORV-impacted beach/backshore and piles of tidal debris with drift line vegetation.

---

*Polygonum glaucum*

City Use 8797

<b>Seabeach Knotweed</b>	<b>NYS Legal Status</b>	Rare	<b>NYS Rank</b>	S3	Vulnerable
	<b>Federal Listing</b>		<b>Global Rank</b>	G3	Rare
	<b>Last Report</b>	1990-09	<b>EO Rank</b>	CD	
	<b>County</b>	Suffolk			
	<b>Town</b>	Brookhaven			
	<b>Location</b>	Fire Island Sunken Forest			
	<b>Directions</b>	Fire Island National Seashore, Sunken Forest Natural Area west of Cherry Grove. The plants are along the beach.			
<b>Comments</b>	4 plants in defensible habitat, may have been washed away by October. Check again in 1991.				
<b>General Quality and Habitat</b>	A barrier beach.				

*Polygonum glaucum*

City Use 8725

Seabeach Knotweed	NYS Legal Status	Rare	NYS Rank	S3	Vulnerable
	Federal Listing		Global Rank	G3	Rare
	Last Report	1990-09-11	EO Rank	CD	
	County	Suffolk			
	Town	Islip			
	Location	Fire Island Villages			
	Directions	The plant is in the village area of Fire Island on the beach at Robbins Road between Atlantic and Ocean Beach.			
Comments	1 plant.				
General Quality and Habitat	Barrier beach.				

---

*Natural Heritage Report on Rare Species and Ecological Communities*


---

*Polygonum glaucum*

Office Use 440

**Seabeach Knotweed****NYS Legal Status** Rare**NYS Rank** S3

Vulnerable

**Federal Listing****Global Rank** G3

Rare

**Last Report** 2003-08-21**EO Rank** A**County** Suffolk**Town** Brookhaven,  
Southampton**Location** Weethampton Island West**Directions** Group 1 is on the bay side of Dune Road at the beginning of "The Dunes" development, about 3.2 mi east of Moriches Inlet. In 2003 most of the plants were growing on the northern half of the spit that extends north from the island in this location. To reach**Comments** Over 2200 plants were seen in good habitat.**General Quality and Habitat** Approximately 2 miles of barrier beach on the east side of Moriches Inlet with an extensive area of fairly well-developed dunes. The northeast end is salt marsh, while the extreme west end has the appearance of being frequently washed over. The dunes in the Pikes Beach area have been frequently washed away and rebuilt. Currently, most of the plants grow on a large sand spit that extends north from the main island into a large bay. Many plants were seen between slats of snow fences.*Polygonum glaucum*

Office Use 124

**Seabeach Knotweed****NYS Legal Status** Rare**NYS Rank** S3

Vulnerable

**Federal Listing****Global Rank** G3

Rare

**Last Report** 2003-08-13**EO Rank** B**County** Suffolk**Town** Brookhaven**Location** Fire Island East**Directions** The plants are on the south shore of eastern Fire Island between DE and 6.9 miles west of Moriches Inlet in sparse vegetation within tern and plover fencing. 2013: All plants were found inside piping plover string fencing.**Comments** There are 408 plants in good habitat.**General Quality and Habitat** A maritime beach in diffuse wrack assemblage. The plants are in sparse vegetation within tern and plover string fencing.*Sabatia campanulata*

Office Use 8254

**Slender Marsh-pink****NYS Legal Status** Endangered**NYS Rank** S1

Critically imperiled

**Federal Listing****Global Rank** G5

Demonstrably secure

**Last Report** 2006-08-31**EO Rank** C**County** Suffolk

---

*Natural Heritage Program on Rare Species and Ecological Communities*


---



<b>Town</b>	Brookhaven
<b>Location</b>	Fire Island Wilderness
<b>Directions</b>	The plants are in the Fire Island Wilderness, about 0.5 mi south of Hospital Island. The site visited in 2006 is about 150 meters west of the hunting sign in an old jeep trail run. Follow the trail to where it is very wet and filled with <i>Cladium</i> . The plants are in a small depression.
<b>Comments</b>	There are 40-50 plants in excellent habitat.
<b>General Quality and Habitat</b>	A small shallow depression in dunes, some with open cranberry mats and some with scrub thickets. The community is a maritime interdunal swale.

---

*Sporobolus clandestinus*

Cattle Use 307

<b>Rough</b>	<b>NYS Legal Status</b>	Endangered	<b>NYS Rank</b>	S1	Critical Imperiled
<b>Rush-grass</b>	<b>Federal Listing</b>		<b>Global Rank</b>	G5	Demographically secure
	<b>Last Report</b>	1985-06-10	<b>EO Rank</b>	E	
	<b>County</b>	Suffolk			
	<b>Town</b>	Islip			
	<b>Location</b>	Fire Island Lighthouse			
	<b>Directions</b>	Just east of Fire Island lighthouse.			

**Comments****General Quality and Habitat** Maritime dunes and swales.

Total of 18 VASCULAR PLANTS

More detailed information about many of the rare and listed animals in New York, including biology, identification, habitat, conservation, and management, are available online in Natural Heritage's Conservation Guides at [www.acris.nynhp.org](http://www.acris.nynhp.org), from NatureServe Explorer at <http://www.natureserve.org/explorer>, and from NYSDEC at <http://www.dec.ny.gov/animals/7494.html> (for animals), and from USDA's Plants Database at <http://plants.usda.gov/index.html> (for plants).

More detailed information about many of the natural community types in New York, including identification, dominant and characteristic vegetation, distribution, conservation, and management, is available online in Natural Heritage's Conservation Guides at [www.acris.nynhp.org](http://www.acris.nynhp.org). For descriptions of all community types, go to <http://www.dec.ny.gov/animals/29384.html> and click on Draft Ecological Communities of New York State.

# Natural Heritage Report on Rare Species and Ecological Communities



NYS Dept. of Environmental Conservation  
Natural Heritage Program

625 Broadway, 5th floor  
Albany, NY 12233-4754  
518-402-8964



## Historical Records

The following plants and animals were documented in the vicinity of the project site at one time, but have not been documented there since 1979 or earlier, or there is uncertainty regarding their continued presence.

There is no recent information on these plants and animals in the vicinity of the project site and their current status there is unknown. In most cases the precise location of the plant or animal in this vicinity at the time it was last documented is also unknown and therefore location maps are generally not provided.

If appropriate habitat for these plants or animals is present in the vicinity of the project site, it is possible that they may still occur there.

Natural Heritage Report on Rare Species and Ecological Communities (continued)



## DRAGONFLIES AND DAMSELFLIES

### *Ichnura ramburii*

Off-site Use 12587

#### Rambur's Forktail

NYS Legal Status Unlisted

NYS Rank S2

Imperiled

Federal Listing

Global Rank G5

Demonstrably secure

Last Report 1913-pre

EO Rank H

County Suffolk

Town Babylon, Brookhaven, Islip

Location Fire Island

Directions Fire Island is off the southern coast of Long Island. To access the western part of the island from Islip, take the Robert Moses Causeway south past Captree Island to Fire Island. To access the eastern part of the island, follow Suffolk Boulevard south of

#### Comments

#### General Quality and Habitat

The damselfly was found on an island that is over 3 miles long

Total 1 DRAGONFLIES AND

## VASCULAR PLANTS

### *Digitaria filiformis*

Off-site Use 2516

#### Slender Crabgrass

NYS Legal Status Threatened

NYS Rank S1

Critically imperiled

Federal Listing

Global Rank G5

Demonstrably secure

---

*Natural Heritage Report on Rare Species and Ecological Communities (Historical)*


---



<b>Last Report</b>	1955-09-19	<b>EO Rank</b>	F
<b>County</b>	Suffolk		
<b>Town</b>	Brookhaven		
<b>Location</b>	East Moriches		
<b>Directions</b>	Specimen label: East Moriches.		

**Comments** The natural areas north of Harts Road, east of Pine Street, and west of East Moriches-Riverhead Road were searched. No plants nor appropriate habitat were found.

**General Quality and Habitat**

---

*Helianthus angustifolius*

Office Use 8652

**Swamp  
Sunflower**

<b>NYS Legal Status</b>	Threatened	<b>NYS Rank</b>	S2	Imperiled
<b>Federal Listing</b>		<b>Global Rank</b>	G5	Demonstrably secure
<b>Last Report</b>	1918-09-14	<b>EO Rank</b>	H	
<b>County</b>	Suffolk			
<b>Town</b>	Brookhaven			
<b>Location</b>	Smith Point Shirley			
<b>Directions</b>	Specimen label: Sandy swamp, near Smith's Point.			

**Comments**

**General Quality and Habitat**

Specimen label: Sandy swamp.

---

*Rumex fueginus*

Office Use 7497

**Golden Dock**

<b>NYS Legal Status</b>	Endangered	<b>NYS Rank</b>	S1	Critically imperiled
<b>Federal Listing</b>		<b>Global Rank</b>	G4G5	Apparently secure
<b>Last Report</b>	1924-08-19	<b>EO Rank</b>	H	
<b>County</b>	Suffolk			
<b>Town</b>	Brookhaven			
<b>Location</b>	Fire Island Villages			
<b>Directions</b>	Specimen label: Beach of bay, northeast of inn on Point O'Woods, Fire Island.			

**Comments**

**General Quality and Habitat**

Beach of bay.

*Suaeda linearis*

Office Use 8747

**Narrow-leaf  
Sea-blite****NYS Legal Status** Endangered**NYS Rank** S1

Critically / imperiled

**Federal Listing****Global Rank** G5

Demonstrably secure

**Last Report** 1968-10-03**EO Rank** H**County** Suffolk**Town** Brookhaven**Location** Fire Island Wilderness Watch Hill**Directions** Watch Hill salt marshes.**Comments****General Quality and Habitat**

Salt marsh.

**Total** 4 VASCULAR PLANTS

More detailed information about many of the rare and listed animals in New York, including biology, identification, habitat, conservation, and management, are available online in Natural Heritage's Conservation Guides at [www.acris.nynhp.org](http://www.acris.nynhp.org), from NatureServe Explorer at <http://www.natureserve.org/explorer>, and from NYSDEC at <http://www.dec.ny.gov/animals/7494.html>. (for animals), and from USDA's Plants Database at <http://plants.usda.gov/index.html> (for plants).



IN REPLY REFER TO:

## United States Department of the Interior

### NATIONAL PARK SERVICE FIRE ISLAND NATIONAL SEASHORE

120 Laurel Street  
Patchogue, New York 11772  
(631) 687-4750

L-7615 (Deer Management Plan DEIS)

May 30, 2014

Ms. Ruth Pierpont  
Deputy SHPO, Division for Historic Preservation  
New York State Office of Parks, Recreation & Historic Preservation  
Pebbles Island State Park  
P.O. Box 189  
Waterford, New York 12188-0189

Dear Ms. Pierpont:

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

When the Seashore initiated consultation under section 106 of the National Historic Preservation Act (NHPA) in a letter dated July 13, 2011 (enclosed), we intended to use the plan/EIS for compliance with both section 106 of the NHPA and NEPA. At this time, the extent of effects on cultural resources is uncertain; therefore, we are making an effect determination of no adverse effect for the issuance of the plan/EIS. In accord with our 2008 nationwide Programmatic Agreement we will undertake case-by-case consultation when locations and effects for each undertaking outlined in the plan/EIS can be more clearly identified. The Seashore will provide the New York State Historic Preservation Officer with a copy of the plan/EIS when it is ready for public release later this year. The NPS continues to welcome your input on any aspect of the project at any time during the preparation of the plan/EIS.

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

Sincerely,

A handwritten signature in black ink, appearing to read "Chris Soller", written in a cursive style.

K. Christopher Soller  
Superintendent

cc: Morgan Elmer, NPS-DSC  
Tricia Wingard, VHB

Enclosure



IN REPLY REFER TO:

## United States Department of the Interior

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

L-7615 (Deer Management Plan DEIS)

May 30, 2014

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

Dear Mr. Carroll:

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

When the Seashore initiated consultation under section 106 of the National Historic Preservation Act (NHPA) in a letter dated July 13, 2011 (enclosed), we intended to use the plan/EIS for compliance with both section 106 of the NHPA and NEPA. At this time, the extent of effects on cultural resources is uncertain; therefore, we are making an effect determination of no adverse effect for the issuance of the plan/EIS. In accord with our 2008 nationwide Programmatic Agreement we will undertake case-by-case consultation when locations and effects for each undertaking outlined in the plan/EIS can be more clearly identified. The Seashore will provide the Unkechaug Indian Nation with a copy of the plan/EIS when it is ready for public release later this year. The NPS continues to welcome your input on any aspect of the project at any time during the preparation of the plan/EIS.

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

Sincerely,

A handwritten signature in black ink, appearing to read "Chris Soller". The signature is fluid and cursive, with the first name "Chris" and last name "Soller" clearly distinguishable.

K. Christopher Soller  
Superintendent

cc: Morgan Elmer, NPS-DSC  
Tricia Wingard, VHB

Enclosure



## United States Department of the Interior

### NATIONAL PARK SERVICE FIRE ISLAND NATIONAL SEASHORE

120 Laurel Street  
Patchogue, New York 11772  
(631) 687-4750

IN REPLY REFER TO:

L-7615 (Deer Management Plan DEIS)

May 30, 2014

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

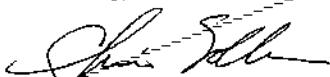
Dear Mr. King:

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

When the Seashore initiated consultation under section 106 of the National Historic Preservation Act (NHPA) in a letter dated July 13, 2011 (enclosed), we intended to use the plan/EIS for compliance with both section 106 of the NHPA and NEPA. At this time, the extent of effects on cultural resources is uncertain; therefore, we are making an effect determination of no adverse effect for the issuance of the plan/EIS. In accord with our 2008 nationwide Programmatic Agreement we will undertake case-by-case consultation when locations and effects for each undertaking outlined in the plan/EIS can be more clearly identified. The Seashore will provide the Shinnecock Indian Nation with a copy of the plan/EIS when it is ready for public release later this year. The NPS continues to welcome your input on any aspect of the project at any time during the preparation of the plan/EIS.

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

Sincerely,



K. Christopher Soller  
Superintendent

cc: Morgan Elmer, NPS-DSC  
Tricia Wingard, VHB

Enclosure

This page intentionally left blank.

**APPENDIX B**  
**VEGETATION MONITORING PLAN**



## INTRODUCTION

The vegetation monitoring plan enables the Seashore to analyze how vegetation within the boundaries of Fire Island National Seashore (Seashore) responds to management actions implemented as a result of the White-tailed Deer Management Plan and Environmental Impact Statement (plan/EIS). It also allows for the Seashore to monitor specific vegetation targets defined in the plan/EIS.

Specific targets have been established for forested areas of the park which include: The Sunken Forest, Talisman, Blue Point, and The William Floyd Estate. Due to the difficulty in establishing vegetation targets in habitat types other than forests, such as an early successional open swale habitat, the Lighthouse and Otis Pike High Dune Wilderness Area do not have specific vegetation targets. The desired condition in these areas would be to simply see a positive response in vegetation and an increase in native species diversity. Below is an overview of the plan. Please note, detailed protocols for monitoring are not included in this document but will be available in a separate document.

While not all areas throughout Fire Island can be monitored, data collected in surveyed areas can act as indicators for other non-surveyed areas. Only vegetation on federal tracts within the boundaries of the Seashore will be surveyed as part of this vegetation monitoring plan. Areas that fall within this plan are (from west to east) Lighthouse, Sunken Forest, Talisman, Blue Point, Otis Pike Fire Island High Dune Wilderness Area, and the William Floyd Estate. Monitoring of vegetation within established permanent plots will occur every 3 years (during the field season from May-September) after implementation of the plan/EIS. For logistical reasons, these surveys can be staggered within the 3 year period.

## VEGETATION AREAS

### LIGHTHOUSE

This area is primarily characterized by northern beach grass, dune, interdune beach grass, beach heather mosaic, northern dune shrub land, maritime deciduous shrub forest, brackish meadow, northern interdunal cranberry swale, and northern salt shrub (Klopfer et al. 2002). Permanent plots will be established in 2014 before the implementation of the plan/EIS.

### SUNKEN FOREST

The Sunken Forest is an old-growth maritime holly forest and is ranked as a critically imperiled (G1 status) habitat. The desired future condition of the Sunken Forest is to maintain the character of the maritime holly forest in perpetuity by ensuring the regeneration of key canopy constituent tree species and a reasonable representation of herbs and shrubs reminiscent of its floristic composition when the Seashore was established.

**Targets.** The Sunken Forest vegetation monitoring utilizes 10m x 10m permanent vegetation plots established by Hank Art in 1967 (Art 1976). Targets for the Sunken Forest were created by utilizing data collected in 1967, a time in which deer were rarely seen on Fire Island. These targets fall into the range of what was observed in 1967.

**TABLE B-1. TARGET FOR DENSITY OF SAPLINGS (>1 M IN HEIGHT AND <3.0 CM DBH) IN THE SUNKEN FOREST. ADAPTED FROM (ART 1976)**

Common Name	Scientific Name	Stems/hectare
Canadian serviceberry	<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 B-2. TARGET FOR DENSITY OF SHRUBS (>1 M IN HEIGHT AND < 3.0 CM DBH) IN THE SUNKEN FOREST. ADAPTED FROM (ART 1976)**

Common Name	Scientific Name	Stems/hectare
Chokeberry	<i>Aronia arbutifolia</i>	400-750
Inkberry	<i>Ilex glabra</i>	300-550

**TABLE B-3. TARGET FOR PERCENT COVER OF ALL VASCULAR PLANTS < 1 M TALL IN THE SUNKEN FOREST. ADAPTED FROM (ART 1976)**

Common Name	Scientific Name	Form	Percent cover
Canada mayflower	<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%
Canadian serviceberry	<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 B-4. A REVISED FORM OF  
DOMIN-KRAJINA COVER CLASS**

Class	Domin-Krajina
1	<1%
2	1%
3	2-5%
4	6-10%
5	11-25%
6	26-33%
7	34-50%
8	51-75%
9	76-95%

## TALISMAN AND BLUE POINT

Talisman and Blue Point are similar areas which mostly consist of maritime deciduous scrub forests and are also characterized by maritime holly forest (Klopfer et al. 2002). To monitor whether these two locations reach adequate recruitment or not, the Seashore modified the recruitment index and weighting factors established by McWilliams et al. 2005 (table C-5). While it was difficult to compare these forests to others in the Northeast, this modification seemed most appropriate after reviewing literature (see references below), considering vegetation survey methods practiced at this site, and reviewing the data available. These sections of maritime forests are also extremely stunted due to the conditions they grow in (barrier island). Permanent vegetation plots established in 2012 by Jordan Raphael (NPS Biologist) are used to monitor vegetation targets.

**Targets.** Densities of living “seedlings” are recorded within each 100 m<sup>2</sup> (10 m x 10 m) permanent vegetation plot. There are 2 size class categories that need to be surveyed, and weighting factors are applied to each seedling according to its size class (table C-5). For example, one seedling that is greater than 150 cm in height and less than 1 cm DBH is equivalent to 50 “seedlings.” Forest regeneration targets (adequate recruitment) will be reached when an average of 2 seedlings per square meter (20,000 seedlings per ha) is observed. Table 6 is a list of species (genus for *Quercus*) that are used to monitor targets; these 7 added together must reach the threshold of 2 seedlings per m<sup>2</sup> (20,000 seedlings per ha). *Prunus serotina* (black cherry) is left out of the targets due to its dominance within the understory. Evidence suggests that deer avoid this species, and it has increased in dominance as a result (Horsley, Stout, and DeCalesta 2003; Forrester 2004).

**TABLE B-5. SIZE CLASS WEIGHING. MODIFIED FROM  
MCWILLIAMS ET AL. 2005**

Height Class	Weighting Factor
100-150 cm in height	20
>150 cm in height and <1 cm DBH	50

**TABLE B-6. LIST OF TARGET “SEEDLING” SPECIES FOR EACH AREA**

Blue Point and Talisman	
Common Name	Scientific Name
American holly	<i>Ilex opaca</i>
Canadian serviceberry	<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 C-7 provides a list of species that will be monitored in the maritime forest on Fire Island (Sunken Forest, Talisman, and Blue Point). This is subject to change if an increase of a new species is detected.

**TABLE B-7. LIST OF SPECIES THAT WILL BE MONITORED IN THE MARITIME FOREST ON FIRE ISLAND**

Common Name	Scientific Name	Form
Canada mayflower	<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
Canadian serviceberry	<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 B-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 in 2014, before the implementation of the plan/EIS.

### WILLIAM FLOYD ESTATE

The wooded lots of the William Floyd Estate is dominated by coastal oak-heath forest and also characterized by pitch pine-oak forest, maritime deciduous scrub forest, acidic red maple basin swamp forest (red maple-tupelo dominant) (Klopfer et al. 2002).

The Seashore has adopted recruitment index and weighting factors established and defined by McWilliams et al. 2005 (table C-8). This seemed most appropriate after reviewing literature (see references below), considering vegetation survey methods practiced at this site, and reviewing the data available. Permanent vegetation plots established by Jordan Raphael (NPS Biologist) in 2013 are used to monitor vegetation targets.

**Targets.** Forest regeneration targets (adequate recruitment) will be reached when an average of 2 seedlings (native and deer preferred species) per square meter is observed (McWilliams et al. 2005). To monitor for vegetation targets, the densities of living seedlings greater than 5 cm in height but less than 1 cm DBH are recorded within the four 1 m<sup>2</sup> subplots located at the corners of each 100 m<sup>2</sup> (10 x 10 m) plot. There are four height class categories that are surveyed, and weighting factors are applied to each seedling according to its height class (table C-2). For example, one seedling that is greater than 150 cm in height and less than 1 cm DBH is equivalent to 50 seedlings that are 5 cm–30 cm in height.

**TABLE B-8. HEIGHT CLASS AND WEIGHTING FACTORS  
MODIFIED FROM MCWILLIAMS ET AL. 2005**

Height Class	Weighting Factor
5-30 cm	1
30-100 cm	2
100-150 cm	20
>150 cm and < 1 cm DBH	50

Common nonnative invasive species found on Fire Island and the William Floyd Estate. This is subject to change if an increase of a new species is detected.

**TABLE B-9. LIST OF NONNATIVE INVASIVE SPECIES FOUND ON FIRE ISLAND AND THE WILLIAM FLOYD ESTATE**

<b>Common Name</b>	<b>Scientific Name</b>
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>Artemesia 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>

## REFERENCES

- Art, H. W.  
1976      *Ecological Studies of the Sunken Forest, Fire Island National Seashore, New York.* Scientific Monograph Series No, 7. National Park Service, Washington, D.C.
- Art, H. W.  
1987      *The Impacts of Hurricane Gloria, Deer and Trails, the Sunken Forest, Fire Island National Seashore, NY.* Final Report to the North Atlantic Regional Office, National Park Service.
- Art, H. W.  
1990      *The “Smokey Hollow” Cranberry Bog. Fire Island Pines.* Fire Island National Seashore. New York (Unpublished).
- Art, H. W.  
1990      “Fire Island National Seashore Vegetation/Deer Research.” Letter to Mary K. Foley, dated January 29, 1990.
- Forrester, J. A.  
2004      *Ecological Dynamics of a Rare Maritime Ilex Opaca Forest.* Doctoral dissertation. SUNY College of Environmental Science and Forestry. Syracuse, New York.
- Forrester, J. A., and D. J. Leopold  
2006      “Extant and Potential Vegetation of an Old-growth Maritime *Ilex opaca* Forest.” *Plant Ecology* 183: 349–359.
- 2007      “Disturbance History and Mortality Patterns in a Rare Atlantic Barrier Island Maritime Holly Forest.” *Natural Areas Journal*. 27(2) 169-182.
- Forrester, J. A., D. J. Leopold, and H. B. Underwood  
2008      *The Role of Disturbance in the Long-term Viability of a Coastal Maritime Forest Fragment.* Technical report NPS/NER/NRTR—2008/104.
- Horsley, S. B., S. L. Stout, and D. S. DeCalesta  
2003      “White-tailed Deer Impacts on the Vegetation Dynamics of a Northern Hardwood Forest.” *Ecological Applications* 13: 98-118.
- Klopfer, S. D., A. Olivero, L. Sneddon, and J. Lundgren  
2002      *Final Report of the NPS Vegetation Mapping Project at Fire Island National Seashore.* USGS and Conservation Management Institute, Virginia Tech.
- Marquis, D. A.  
1981      *Effect of Deer Browsing on Timber Production in Allegheny Hardwood Forests of Northwestern Pennsylvania.* United States Department of Agriculture Forest Service, Broomall, PA.
- Marquis, D. A., R.L. Ernst, and S.L. Stout  
1992      *Prescribing Silvicultural Treatments in Hardwood Stands of the Alleghenies (Revised).* General Technical Report NE-96. U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station, Radnor, PA.
- Marquis, D.A., ed.  
1994      *Quantitative Silviculture for Hardwood Forests of the Alleghenies.* Gen. Tech. Rep. NE-183. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 143 p.

- McWilliams, W. H., S. L. Stout, T. W. Bowersox, and L. H. McCormick  
1995 "Adequacy of Advance Tree-seedling Regeneration in Pennsylvania's Forests." *Northern Journal of Applied Forestry* 12:187-191.
- McWilliams, W. H., C. L. Alerich, B. J. Butler, M.L. Hoppus, A. J. Lister, R. S. Morin, C. H. Perry, J. A. Westfall, E. H. Wharton, and C. W. Woodall  
2004 *Pennsylvania's Forests 2004*. USDA Forest Service. Resource Bulletin NRS-20.
- McWilliams, W. H., T. W. Bowersox, P. H. Brose, D. A. Devlin, J. C. Finley, K. W. Gottschalk, S. Horsley, S. L. King, B. M. LaPoint, T. W. Lister, L. H. McCormick, G. W. Miller, C. T. Scott, H. Steele, K. C. Steiner, S. L. Stout, J. A. Westfall, and R. L. White  
2005 Measuring Tree Seedlings and Associated Understory Vegetation in Pennsylvania's Forests. In: R. E. McRoberts, G. A. Reams, P. C. Van Deusen, W. H. McWilliams, C. J. Cieszewski, eds. Proceedings of the fourth annual forest inventory and analysis symposium; Gen. Tech. Rep. NC-252. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 21-26
- National Park Service (NPS)  
2009 *Forest Health: Tree Regeneration*. Northeast Temperate Network Resource Brief  
2011 *Vegetation Monitoring in the Sunken Forest and Other Significant Natural Zones (2010-2011 Summary)*. Fire Island National Seashore. New York (Unpublished). Prepared by J. Raphael.  
2013 *Summary of Vegetation Monitoring in Blue Point/Talisman and Hurricane Sandy Impact*. Fire Island National Seashore. New York (Unpublished). Prepared by J. Raphael.  
2013 *Summary of Vegetation Monitoring in the William Floyd Estate. Fire Island National Seashore*. New York (Unpublished). Prepared by J. Raphael.
- Shirer, R., and C. Zimmerman  
2010 *Forest Regeneration in New York State*. The Nature Conservancy, Eastern New York Chapter, Albany, New York, USA.
- Tierney, G., and D. Faber-Langendoen  
2006 *Northeast Temperate Network Forest Monitoring Protocols (Version 1.0)*. Northeast Temperate Network. Philadelphia, PA: National Park Service
- Tierney, G., B. Mitchell, K. Miller, J. Comiskey, A. Kozlowski, and D. Faber-Langendoen  
2012 *Northeast Temperate Network long-term Forest Monitoring Protocol: 2012 revision*. Natural Resource Report NPS/NETN/NRR—2012/507. National Park Service, Fort Collins, Colorado.
- Underwood, H. B.  
2005 *White-tailed Deer Ecology and Management on Fire Island National Seashore* (Fire Island National Seashore Science Synthesis Paper). Technical Report NPS/NER/NRTR—2005/022. National Park Service. Boston, MA.
- Underwood, H. B.  
2011 *Supporting Data Analysis and Interpretation for the Fire Island National Seashore Science Advisory Team* (Unpublished).

**APPENDIX C**  
**DEER MONITORING PLAN**



## **INTRODUCTION**

Deer population and deer behaviors will be monitored to gauge success of actions taken to meet Seashore objectives for the White-tailed Deer Management Plan and Environmental Impact Statement (plan/EIS) for Fire Island National Seashore. Objectives are written for the entire Seashore (Seashore-wide), as well as for specific areas such as the Sunken Forest, Fire Island communities, and the William Floyd Estate.

As outlined in chapter 2 of the plan/EIS, targets have been defined for deer population and deer behavior. This monitoring plan serves as a strategic operating plan for monitoring deer population and deer behavior throughout the life of the plan/EIS. Data collected will be used to inform Seashore managers on the success of management actions in the preferred alternative.

## **DEER POPULATION MONITORING**

### **BACKGROUND**

Distance sampling surveys have been conducted at Fire Island National Seashore to estimate white-tailed deer densities within certain areas of Fire Island since 1995 (Underwood, Verret, and Fischer 1998). This annual effort was done in tandem with the long-term fertility control research project through 2009 and has been continued since. The Seashore has been separated into several locales/sites for surveying: Robert Moses State Park, Lighthouse Tract, Kismet to Lonelyville, Ocean Beach to Ocean Bay Park, Sailors Haven, Fire Island Pines, Davis Park, Fire Island Wilderness and the William Floyd Estate. The goal each year is to survey all sites; however, not all locales are surveyed every year due to staffing, budgetary and time constraints. Protocols are outlined in Underwood, Verret, and Fischer (1998) and were updated in NPS (2009).

Distance sampling theory accounts for partial detection, assuming that only animals directly on the survey route or transect will be detected, and that the probability of detection will decrease away from the transect line (Buckland et al 1993). This alleviates the need to correct for missed animals. The detection function describes the decrease in ability of the surveyor to detect objects with increasing distance from the transect. The area around the transect where objects are counted can be computed from this function. This model is then used to calculate the effective strip width (ESW), where the number of animals detected inside the ESW equals the number of animals detected outside the ESW.

The Seashore uses DISTANCE 6.0 (Thomas et al 2010), a free software program, to fit the detection function, calculate the ESW and fit a density function to the distance sampling data collected. This process is used to generate deer densities for white-tailed deer within each of the study units at Fire Island National Seashore. The Seashore has partnered with Dr. H. B Underwood (USGS and SUNY-ESF) in generating deer densities from DISTANCE 6.0 from field data collected by NPS staff and interns.

### **SURVEY PROCEDURES/DATA COLLECTION**

Sites, along with routes, for monitoring deer populations across Fire Island and at the William Floyd Estate are detailed in Underwood, Verret, and Fischer (1998) and NPS (2009). The name and length of each boardwalk or road is stored in a digital database for community sites (except Davis Park) and the William Floyd Estate. Samples of boardwalk segments or roads are drawn randomly

for a given survey. The total number of boardwalks or roads selected is based upon a minimum length of transect required to achieve a desired level of precision (Underwood, Verret, and Fischer 1998). For all other sites with smaller areas and accessibility there are predetermined routes that meet the length requirement for a desired level of precision (Underwood, Verret, and Fischer 1998; NPS 2009). Community sites and most natural areas on Fire Island are surveyed every year, whereas the William Floyd Estate and Fire Island Wilderness are surveyed every 2-3 years. Once the plan/EIS is implemented, these areas would also be surveyed annually.

Surveys are initiated either 20 minutes before official sunrise or timed so the survey is finished just before sunset. This is to ensure sampling is conducted when deer are most active. In addition, the surveyor must proceed slowly in order to scan both sides of the transect thoroughly and with equal efficiency. If conducting the survey from within a vehicle, speeds are constrained to no more than 10 mph.

When a deer group ( $\geq 1$  deer) is encountered, data should be collected as rapidly and quietly as possible. Ideally, deer should be detected and observed before they become aware of the researcher's presence. Binoculars are utilized to observe details of appearance and behavior when necessary (e.g., determining sex or age at a distance).

In the communities (with random survey routes), observations of deer are recorded on the first passage through a segment of the selected boardwalk. Any observations made while backtracking through a boardwalk are not counted. The surveyor should take the shortest route from one selected boardwalk to the next to minimize the time lapse between observations. This also allows deer less time to travel, thereby reducing the chances of viewing the same animal more than once. A map and pre-determined route should be chosen and studied before starting the survey.

The following is a list of data to be collected in the field:

#### 1) Herd Composition

Individuals within each deer group encountered are classified according to sex and age at the time of sampling. Group size is also included. If group membership is questionable, distances and angles to each deer are recorded as if it were alone. These observations are marked uniquely, then discussed and resolved later.

Sex is classified as (1) male, (2) female or (3) unknown. Age is classified as (1) fawn (less than 1 year-old), (2) yearling (between 1-2 years old), (3) adult (greater than 2 years old) and (4) unknown. In addition, it should be noted whether fawns have spots visible on their coats. Physical morphological criteria developed from numerous observations of deer are used to determine the sex and age of individuals.

#### 2) Perpendicular Distance

After initial observations are made, the perpendicular distance from the observer is recorded using a hand-held laser rangefinder. If the deer has moved from its original location, the distance from another object close by can be used. The distance is estimated for deer less than 15 m away by the observer.

If the perpendicular distance cannot be measured directly, the following measurements are taken: (1) radial distance (i.e., distance from where you located deer), (2) transect direction (compass bearing), and (3) object direction (compass bearing). These measurements are used to

calculate the angle to the object and perpendicular distance is computed later in DISTANCE. In addition, a GPS point should be recorded for each detection.

### 3) Ancillary Data

Ancillary data includes: information on the initial, habituation/reactive and undesirable food conditioning behavior of deer in each detection (Table B-1); forage type, if applicable (table B-1); start/end times of each survey; and GPS points for each detection.

**NOTE:** There are three properties of distance data that are fundamental for reliable density estimation:

- 1) The person/s surveying a particular unit must remain the same within sampling of that unit due to individual differences in detection.
- 2) There must be enough objects observed by the surveyor/s to adequately describe the probability of detection as a function of the perpendicular distance from the transect. In sum, the more objects (i.e., deer) observed, the smoother the representation of the detection function. For distance data of deer at Fire Island National Seashore we aim for 60-80 detections per site each year. This number may need to be adjusted in the future, as the preferred alternative is implemented and the white-tailed deer population declines.
- 3) The transect length needs to be sufficient to achieve a desired level of precision. Based on estimates generated in DISTANCE, the total length needed to travel has been estimated for each study site.

## DEER BEHAVIOR MONITORING

Behavioral data of deer is collected in conjunction with distance sampling data. Initial behaviors of deer when first sighted were collected from 1995 through 2007. Undesired behaviors were also noted, such as a deer feeding from a trash can. However, it's uncertain how standardized and consistent these notes have been through time.

Since 2008, we have followed a standard protocol for monitoring deer behavior. First, we use the same sites used for distance sampling and categorize them as Community or Non-community. Community sites include: Kismet to Lonelyville, Ocean Beach to Ocean Bay Park, Fire Island Pines and Davis Park. Non-community sites include: Robert Moses State Park, Lighthouse Tract, Sailors Haven, Wilderness-West (Watch Hill to Bellport Beach) and Wilderness-East (Bellport Beach to Wilderness Visitor Center). A specific objective in the White-tailed Deer and Vegetation Management plan/EIS is to reduce human-deer interactions within Fire Island communities (i.e., community sites). Non-community sites provide the Seashore with acceptable targets (rather than just zero) for deer behaviors related to human-deer interactions.

Two different kinds of deer behavior are recorded: (1) initial behaviors, including food conditioning behaviors and forage type (if applicable); and (2) habituation/reactive behaviors (table B-1). Initial behavior refers to the behavior that the majority of the group are engaged in at the time of detection. Habituation/reactive behaviors describe response to the observer's presence; an individual or group of deer within a detection is considered unaffected if they do not react to the observer's presence. The behaviors during the surveys could be affected by the distance of the deer from the transect, and whether an individual or deer group is aware of the observer's presence. Behaviors are coded (table B-1) and proportions calculated.

**TABLE C-1: BEHAVIOR AND FORAGE TYPE CATEGORIES AND CODES DURING  
WHITE-TAILED DEER DISTANCE SAMPLING SURVEYS, POST-2008**

Initial Behaviors		Food Conditioning Behaviors	
Code	Activity	Code	Activity
ST	Standing	F4	Foraging from a 4-Poster device
FO	Foraging	FT	Foraging from an overturned trash can
BE	Bedding	FD	Being directly fed by a person
WA	Walking		
RU	Running		
Habituation/Reactive Behaviors		Forage Type	
Code	Activity	Code	Type
AP	Approached	N	Native plant
UN	Unaffected	NNP	Non-native plant or food
WA	Walked away		
RA	Ran away		

Three additional food conditioning behaviors are also noted: (1) foraging from a 4-Poster device, (2) foraging from an overturned trash can/s, or (3) being fed by a person. These are noted in addition to the initial and habituation/reactive behaviors already being recorded for each detection, if they occurred. Since 2008 these three additional behaviors have only been observed in community areas.

Forage type is a subcategory of foraging and is noted when applicable as (1) native plants or (2) nonnative plants or food. Nonnative plants or food includes ornamental plantings, identifiable nonnative plants, corn from 4-Poster devices, garbage or any other food items.

## REFERENCES

- Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake  
1993      *Distance Sampling: Estimating Abundance of Biological Populations*. Chapman and Hall, London.
- National Park Service (NPS)  
2009      *Distance Sampling of White-tailed Deer at Fire Island National Seashore*.  
Unpublished Strategic Operating Plan. Prepared by L. Ries.
- Thomas, L., S. T. Buckland, E. A. Rexstad, J. L. Laake, S. Strindberg, S. L. Hedley, J. Bishop, T. A. Marques, and K. P. Burnham  
2010      “Distance Software: Design and Analysis of Distance Sampling Surveys for Estimating Population Size.” *Journal of Applied Ecology* 47: 5-14.
- Underwood, H. B., F. D. Verret, and J. P. Fischer  
1998      *Density and Herd Composition of White-tailed Deer populations of Fire Island National Seashore*. Report to the National Park Service.

This page intentionally left blank.

**APPENDIX D**  
**REVIEW OF WHITE-TAILED DEER**  
**FERTILITY CONTROL**



## INTRODUCTION

Managing the high density of certain wildlife species has become a topic of public concern (Rutberg et al. 2004). Species such as Canada geese (*Branta canadensis*), coyotes (*Canis latrans*), and white-tailed deer (*Odocoileus virginianus*) have become either locally or regionally highly dense in many areas in the United States (Fagerstone et al. 2002). Traditional wildlife management techniques such as hunting and trapping are often unfeasible, publicly unacceptable, or illegal in many parks, urban, and suburban areas, forcing wildlife managers to seek alternative management methods (Kilpatrick and Walter 1997; Muller, Warren, and Evans 1997). The use of reproductive control as a wildlife management tool has been studied for several decades.

For reproductive control agents to effectively reduce population size, treatment with an agent must decrease the reproductive rate to less than the mortality rate in a closed population with no immigration or emigration. In an open population, where there is much animal movement into and out of an area being considered for treatment, the use of fertility control agents is not likely to be successful in decreasing a population (Rudolph, Porter, and Underwood 2000). Good estimates of population emigration, immigration, birth and survival rates are needed before predictive models can be used to approximate the effort required to successfully use contraception as a population management technique.

The purpose of this document is to provide NPS managers at Fire Island National Seashore with: (1) a brief overview of contemporary reproductive control options as they pertain to white-tailed deer; (2) an outline of the primary advantages, disadvantages and challenges related to the application of wildlife fertility control agents including population management challenges, regulatory issues, potential logistical issues, and consumption issues; (3) an evaluation of current fertility control agents against criteria established by the Seashore for use of a reproductive control agent. This document is not intended to be exhaustive but to provide a scientifically sound basis for understanding and evaluating deer management alternatives that include reproductive control of female deer.

It is important to note that some of the most critical elements of a successful population level fertility control program focus on ecological and logistical questions rather than the efficacy of fertility control agents in individual animals. It should also be noted that technology and regulation is changing rapidly in this field and updated information should be reviewed prior to implementation of a deer management program that involves fertility control.

There is general agreement that controlling large, open, free-ranging populations of wild ungulates solely with a contraceptive vaccine is impractical and unlikely to succeed because of the logistical difficulties of treating significant numbers of deer (Rutberg et al. 2004; Garrott et al. 1992; Garrott 1995; Warren 2000; Rudolph, Porter, and Underwood 2000; Cowan, Pech, and Curtis 2002; Merrill, Cooch, and Curtis 2003, 2006). There is also agreement that fertility control as an exclusive means of managing populations cannot reduce wildlife population size rapidly (Rutberg and Naugle 2008a; Kirkpatrick and Turner 2008). The few long-term (greater than 10 years) research projects evaluating population level effects of porcine zona pellucida vaccine (PZP) on long-lived species (horses and deer) support this statement. At Assateague Island National Seashore, PZP treatments were successful in reducing the wild horse population 16% (from 160 to 135 individuals) between 1994 and 2009 (15 years). The park expects to reach the target population size of 80–100 horses in another 5–8 years (Zimmerman, pers. comm., 2009). At Fire Island National Seashore, the Fire Island communities funded a research study through The Humane Society of the United States to evaluate the viability of immunocontraception as a newly emerging form of deer population control. The program began in 1993 and ended in 2009, lasting 16 years. Seashore staff report a 33% reduction in

overall deer population size (from approximately 600 to 400 individuals) between 1994 and 2009 (Bilecki, pers. comm., 2009). In the most intensively treated areas of Fire Island, deer population size decreased up to 55% over 15 years (Rutberg and Naugle 2008a). All population level studies have been conducted in relatively closed populations. The appropriateness of fertility control as a deer management tool is heavily dependent on specific park objectives, local deer population dynamics, and the purpose and need for management.

## CURRENT TECHNOLOGY

The area of wildlife contraception is constantly evolving as new technologies are developed and tested. For the sake of brevity, this appendix will only discuss reproductive control as it applies to female deer. There is a general understanding in white-tailed deer biology that managing the female component of the population is more important than managing the male component. Based on the polygamous breeding behavior of white-tailed deer, treating males with reproductive control would be ineffective when the goal is population management (Warren 2000; Garrott and Siniff 1992).

Regulation of wildlife fertility control agents can be confusing. If a product is intended for use in a food-producing animal, it must be deemed safe for human consumers. Regardless of its use in food animals, a fertility control agent must be considered safe for use in the target species and not present environmental health hazards to non-target species. Until 2006, the Food and Drug Administration (FDA) was the agency responsible for regulation of wildlife contraceptives and their potential for drug residues. In 2006, the Environmental Protection Agency assumed responsibility for regulating contraceptives for use in free-ranging wildlife and feral animals (Fagerstone et al. 2010). After a product is federally registered with the EPA it must also be registered for use in each individual state where a wildlife management agency or organization would like to apply a product.

The EPA in consultation with the contraceptive manufacturer/sponsor will determine the safety of the product and marking requirements for free-ranging animals treated with contraceptives. Prior to EPA registration products can be studied in free-ranging populations to gather safety and efficacy data under an experimental use permit (EUP) which is obtained from the EPA by the product's sponsor. Until products are registered by the EPA, and marking requirements made explicit, animals treated with any fertility control product should be permanently marked.

Marking is also needed for long-term monitoring of contraceptive efficacy in individual animals, determining which deer have been treated during implementation and for efficient re-treatment, and to monitor population vital rates. Finally, while NPS units have jurisdiction for wildlife management within their borders, parks are strongly encouraged to cooperate and coordinate with state agencies to manage cross boundary wildlife resources whenever possible (43 CFR § 24). Therefore, parks should also communicate with appropriate state agencies regarding marking of treated animals in areas where deer may cross park boundaries. The disadvantages of permanent marking are primarily related to the substantial additional labor and costs of the first year's capture and marking of treated animals, sustainability of this effort over the long-term, capture associated stress to individual deer (compared to remote delivery), and potential social acceptance concerns. Despite these drawbacks, marking is nearly always warranted when considering a fertility control program.

There are three basic categories of reproductive control technology: (1) immunocontraceptives (vaccines), (2) non-immunological methods (pharmaceuticals), and (3) physical sterilization.

## Immunocontraceptives

It has been suggested that immunocontraceptive vaccines offer significant promise for future wildlife management (Rutberg et al. 2004). Immunocontraception involves injecting an animal with a vaccine that stimulates its immune system to produce antibodies against a protein (antigen) involved in reproduction (Warren 2000). In order to induce sufficient antibody production, an adjuvant is combined with the antigen. An adjuvant is a product that increases the intensity and duration of the immune system's reaction to the vaccine. There are two primary types of antigens used in reproductive control vaccines in deer: porcine zona pellucida (PZP) and gonadotropin releasing hormone (GnRH).

Neither PZP nor GnRH vaccines are 100% effective in preventing pregnancy. Using a 2 dose vaccination protocol Curtis et al. (2002) demonstrated approximately 85-90% decrease in the number of fawns born per female after vaccination with either GnRH or PZP immunocontraceptive vaccines in white-tailed deer. Likewise, Rutberg and Naugle (2008a) showed a 75% decrease in annual fawn production using traditional PZP vaccination in two relatively closed white-tailed deer populations and most recently demonstrated 95-100% decrease in fawning the first year and 65-70% the second year after a single vaccination using several long-term and delayed release PZP vaccines (Rutberg et al. 2013). In a more contemporary version of the GnRH vaccine, Gionfriddo et al. (2009, 2011) found approximately 70-90% infertility the first year and 40-50% infertility the second year in white-tailed deer after a single vaccination. The GnRH vaccine has not been evaluated at the population level. Efficacy generally decreases as antibody production wanes when using any immunocontraceptive. Reduced pregnancy rates can usually be expected for 1-2 years post-treatment with immunocontraceptive vaccines although there is the potential for longer-term or even permanent sterility (Fraker et al. 2002; Miller et al. 2008, 2009; Gionfriddo et al. 2011; Rutberg et al. 2013). Duration of infertility is strongly related to the conjugate-antigen design, the adjuvant used, how the vaccine is delivered, and the host's immune system (Miller et al. 2008, Kirkpatrick et al. 2009).

**Porcine Zona Pellucida (PZP).** The majority of immunocontraceptive research in wildlife has been conducted using PZP vaccines. PZP vaccines stimulate production of antibodies directed towards specific outer surface proteins of domestic pig ova (eggs). Pig ova are sufficiently similar to many other mammals' ova and antibodies produced will cross-react with the vaccinated animal's own ovum. PZP antibodies prevent fertilization, presumably by blocking the sperm attachment sites on the zona which surrounds the ovum. There are currently several PZP vaccine products being developed, one is called SpayVac®, another is simply called PZP, and finally there is heat extruded and cold evaporated pelleted PZP. Each can be mixed with different adjuvants which may change their efficacy.

SpayVac® (ImmunoVaccine Technologies, Halifax) uses a liposome preparation of PZP mixed with an adjuvant to induce antibody production. This vaccine has been evaluated in a variety of species, including captive and to a lesser extent free-ranging white-tailed deer (Brown et al. 1997; Fraker et al. 2002; Locke et al. 2007; Rutberg and Naugle 2009; Rutberg et al. 2013). Potential advantages of SpayVac® compared to the native PZP vaccine are: 1) a more rapid immune response, 2) higher antibody titers, 3) a higher proportion of antibodies that bind to target sites, and 4) longer duration of efficacy (Fraker and Bechert 2007; Miller et al. 2009). Although little long-term data on population level effects exists for SpayVac®, it is assumed effects are similar to those for the native PZP formulation. The second PZP vaccine, often called "native" PZP, has been used extensively in captive wildlife species in the course of investigating its effectiveness (Kirkpatrick et al. 1997; Turner, Kirkpatrick, and Liu 1996; Walter et al. 2002a, 2002b). This vaccine requires multiple vaccinations (e.g., 2 the first year and yearly thereafter) to maintain high antibody titers. The native PZP vaccine

has also been tested at length in free-ranging white-tailed deer (Rutberg and Naugle 2008a; Naugle et al. 2002; Rudolph, Porter, and Underwood 2000; Rutberg et al. 2004; Walter et al. 2002a, 2002b; Walter, Kilpatrick, and Gregonis 2003). Potential benefits of the native vaccine include the ability to deliver the vaccine remotely via darts, its safety in pregnant deer and non-target species (Barber and Fayrer-Hosken 2000), and the availability of at least some long-term data on population level effects (Rutberg and Naugle 2008a).

Finally, the delayed release heat extruded or cold evaporated pelleted vaccine has recently been tested in free-ranging deer. Advantages are increased efficacy and single application which lasts up to two years but requires hand-injection and has strict vaccine storage requirements (Rutberg et al. 2013). There are no long-term or population level data on this new technology.

Challenges to the use of all PZP vaccines include lack of regulatory approval for use in free-ranging deer populations, behavioral impacts (e.g., continued estrous cycling), out of season fawning, and possibly changes in body condition. None of the PZP vaccines are currently registered for use in free-ranging deer but may be in the future (see above for regulatory issues).

PZP based vaccines often cause out of season breeding behavior in treated deer because reproductive hormones which are responsible for estrous cycling are not suppressed (Miller et al. 2009; McShea et al. 1997; Fraker et al. 2002; McShea and Rappole 1997). Repeated estrous cycling has the potential to extend the population breeding season and male/female rutting behaviors. Additionally, extended estrous seasons may result in late pregnancies if the vaccine fails (Fraker et al. 2002; McShea et al. 1997). Fawning later in the summer/fall may lead to higher fawn mortality as winter ensues. Any effect that extends the rut also has the potential for secondary effects to both male and female deer. Increased attempts to breed may result in increased deer movements. It has been suggested that this may encourage deer-vehicle collisions. However, the only known research evaluating this specific issue reported that deer treated with PZP were at no greater risk of being involved in a deer-vehicle collision than untreated deer (Rutberg and Naugle 2008b).

Increased activity during rut can be energetically costly for both sexes. While this is likely offset by the lack of pregnancy demands in female deer it may have cumulative effects on energy expenditures in male deer (Walter, Kilpatrick, and Gregonis 2003; McShea et al. 1997). Alternatively, PZP-treated females may experience increased body condition and a longer life span compared to untreated individuals as a result of reduced energetic costs of pregnancy and lactation (Warren 2000; Hone 1992). For example, at Assateague Island National Seashore, the life span of horses treated with PZP has been extended from an average age at death of 20 years to 26-30 years (Kirkpatrick and Turner 2008; Zimmerman, pers. comm., 2009). Longer life span may extend the time needed to observe a decline in population size (Kirkpatrick and Turner 2008). Studies in white-tailed deer investigating effects on body condition are equivocal (Walter, Kilpatrick, and Gregonis 2003; McShea et al. 1997). There are no long-term studies investigating potential extended survival in free-ranging wild deer.

Successful field application of a fertility control program requires both an effective agent and a practical delivery system (Cowan, Pech, and Curtis 2002). Although PZP vaccines may be successfully delivered remotely through darting, the native PZP vaccine that has been tested most extensively requires a series of two initial doses followed by periodic boosters in order to maintain infertility. The need for multiple doses leads to significant logistical issues when working with free-ranging white-tailed deer, particularly when the number of deer to be treated is high. SpayVac® does not require a first year booster and may prove to be easier to implement because follow-up doses would only be required every 3-7 years (Fraker, pers. comm., 2009), however, to our knowledge SpayVac® has not been delivered remotely. The new long-term pellets cannot be delivered via dart.

Many studies have modeled and a few field studies have tested population-level effects of PZP vaccination (Rutberg et al. 2004; Nielsen, Porter, and Underwood 1997; Rudolph, Porter, and Underwood 2000; Rutberg and Naugle 2008a; Rutberg et al. 2013). Research evaluating the effectiveness of PZP in reducing the size of deer populations has focused on moderate to high density deer populations of relatively small size (less than 300-500 individuals). Within these populations, long-term (greater than 10 years) data indicates that population size may gradually decline using PZP treatments (Kirkpatrick and Turner 2008; Rutberg and Naugle 2008a). Rutberg and Naugle (2008a) reported a 27% decline in the size of a small, relatively closed, suburban deer population (approximately 250 deer) between 1997 and 2002, as a result of PZP treatments and potentially other stochastic events. However, level of success in reducing population size varies widely. For example, deer density on Fire Island National Seashore was significantly reduced in some areas but reduced very little in other areas likely due to inability to treat significant numbers of does in certain areas (Rutberg and Naugle 2008a; Underwood 2005). Site specific modeling using accurate population demographic and vital rate data as well as knowledge of local deer behavior, land access availability and likelihood of achieving treatment application goals is needed to determine how fast a population can be reduced and how deep a reduction can be achieved.

Additional information on PZP may be obtained at:

[http://www.aphis.usda.gov/wildlife\\_damage/nwrc/research/reproductive\\_control/index.shtml](http://www.aphis.usda.gov/wildlife_damage/nwrc/research/reproductive_control/index.shtml) or  
<http://www.pzpinfo.org>.

**Gonadotropin Releasing Hormone (GnRH) Vaccines.** GnRH is a small neuropeptide (a protein-like molecule made in the brain) that plays a necessary role in reproduction. It is naturally secreted by the hypothalamus (a region of the brain that regulates hormone production), which directs the pituitary gland to release hormones (luteinizing hormone and follicle stimulating hormone) that control the function of reproductive organs (Hazum and Conn 1988). In an attempt to interrupt this process, research has focused on eliminating the ability of GnRH to trigger the release of reproductive hormones. One option is vaccination against GnRH. Antibodies produced in response to vaccination likely attach to GnRH in the hypothalamic region and prevent the hormone from binding to receptors in the pituitary gland, thus suppressing the secretion of reproductive hormones and preventing ovulation.

GnRH vaccines have been investigated in a variety of wild and domestic ungulates (hoofed mammals) (Adams and Adams 1990; Curtis et al. 2002; Miller, Johns, and Killian 2000c; Miller, Rhyan, and Drew 2004). One GnRH vaccine that has been developed specifically for wildlife contraception is GonaCon™. GonaCon™ is registered with the EPA as a restricted use pesticide to control white-tailed deer fertility. The label requires marking the treated animal to prevent accidental re-injection and giving the vaccine by hand-injection which limits the potential for non-target animal and environmental exposure to the vaccine.

Potential benefits of this vaccine include a relatively long-lasting contraceptive effect (1-2 years and potentially longer) and possibly the lack of repeated estrous cycles (Curtis et al. 2002). In free-ranging white-tailed deer, GonaCon™ is estimated to be 70–90% effective in preventing pregnancy during the first year post-treatment, and approximately 40–50% effective in the second year (Gionfriddo et al. 2009, 2011), however long-term field efficacy data currently does not exist. Although the label indicates a minimum of 1 year efficacy, the contraceptive effect typically lasts two years and possibly longer in some individuals (Fagerstone et al. 2008). Repeated estrous cycling and other behavioral changes in white-tailed deer have not been consistently documented in association with GnRH vaccines (Curtis et al. 2008). However, Killian et al. (2008) reported that behavioral expressions of estrus were only decreased for 1–2 years post-treatment and increased in subsequent

years despite does remaining infertile and Curtis et al. (2002) reported sporadic and delayed estrous cycling with prolonged fawning season in GnRH vaccinated deer as contraceptive effects waned.

GnRH vaccines have many of the same challenges associated with PZP including the need for repeated treatment to maintain long-term infertility, and the need to mark treated animals. Additionally, as with any vaccine which uses the adjuvant AdjuVac™, immune response to the adjuvant may interfere with determination of the animal's Johne's disease status (a gastrointestinal disease of potential regulatory importance for domestic livestock) (Miller et al. 2008). Managers should be aware of this prior to vaccination if neighboring lands have domestic livestock grazing.

Other challenges to use of GonaCon™ include potential health effects on treated deer (Kirkpatrick, Lyda, and Frank 2011), lack of information related to effectiveness at the population level in free-ranging deer, and requirement for hand-injection. Killian et al. 2006a concluded that GonaCon™ was safe for deer and that there were no adverse health impacts associated with unintentional repeated vaccination. Granulomas (a localized inflammatory response to the vaccine that occurs at the site of injection and can persist for many years post-treatment) and injection site abscesses are consistently associated with vaccination; however, they do not appear to cause negative health impacts (Curtis et al. 2008; Gionfriddo et al. 2009). Overall, no debilitating, long-term impacts on health or changes in behavior have been consistently associated with GnRH vaccination in female deer.

Similar site specific modeling and population data are required for evaluating the potential for success in managing a free-ranging deer population with GonaCon™ as was described for PZP immunocontraception.

Additional information may be obtained at:

[http://www.aphis.usda.gov/wildlife\\_damage/nwrc/research/reproductive\\_control/index.shtml](http://www.aphis.usda.gov/wildlife_damage/nwrc/research/reproductive_control/index.shtml)

### **Non-immunological Reproductive Control Methods**

This group of reproductive control agents includes GnRH agonists, GnRH toxins, steroid hormones, and contragestives.

**GnRH Agonists.** GnRH agonists are highly active analogs of GnRH which are similar in structure and action to the endogenous hormone. The exact mechanism of action of GnRH agonists is not completely understood; regardless they suppress the biological activity of endogenous GnRH. As a result of this suppression, reproductive hormones are not released (Aspden et al. 1996; D'Occhio, Aspden, and Whyte 1996). Continuous administration of the agonist is necessary to maintain infertility. This can be accomplished with controlled-release formulations or surgically implanted pumps or by daily administration.

Not all agonists have the same effects in all species. In fact, some can have an effect that is the opposite of what is intended. The wide variation in response is likely due to a combination of type of agonist, dose, treatment regime, reproductive status, sex, and species (Becker and Katz 1997). Therefore, it is important to fully understand the effects of a product on a given species. Although many GnRH agonists are used in human as well as veterinary medicine only a few have been investigated in wildlife species (Becker and Katz 1997; Vickery 1986). GnRH agonists have been tested primarily in mule deer and elk and been shown to both suppress reproductive hormones and prevent pregnancy (Baker et al. 2002, 2004, 2005; Conner et al. 2007).

- **Leuprolide acetate:** Leuprolide is a GnRH agonist that when administered as a controlled-release formulation, results in 100% pregnancy prevention in treated female elk and mule deer (Baker et al. 2002, 2004; Conner et al. 2007). In addition, the treatment is reversible, and the effects last only for a single breeding season (Baker et al. 2004; Trigg et al. 2001). Advantages of leuprolide acetate are that it is 100% effective in preventing pregnancy, is safe for human consumption (Baker et al. 2004), can be delivered remotely (Baker et al. 2005), does not result in physiological side effects, and there are few behavioral effects (Baker et al. 2004). Treatment did not suppress reproductive behavior during the breeding season but also did not prolong behaviors into the non-breeding season.

Leuprolide is FDA-approved for use in humans and has been used experimentally in cervids. It is not currently approved for use in free-ranging wildlife as a fertility control drug. It is not known if this application will be pursued in the future. The need to deliver leuprolide subcutaneously via hand injection has traditionally been considered a significant barrier to the long-term application of this drug as a wildlife management tool. However, Baker et al. (2005) successfully applied the treatment through dart delivery which may extend the practical application of this contraceptive.

Treatment using leuprolide differs from GnRH vaccines in that it does not require an adjuvant and does not induce an antibody reaction. Therefore, inflammatory responses to adjuvant components and other physiological effects, often observed with immunocontraceptives, have not been observed in association with leuprolide. It does, however, require a slow release implant that remains under the skin or in the muscle. Additionally, leuprolide does not likely pose a threat to the environment or nontarget species because the drug is not absorbed through the oral route of administration (Baker et al. 2004). Marking requirements for animals treated with leuprolide implants are currently unknown because it is not a registered wildlife contraceptive.

One drawback to the use of leuprolide is the need to treat animals within a short timeframe prior to the breeding season (Conner et al. 2007). If a female is not retreated each year then she has the same chances of becoming pregnant as an animal that was never treated. The need to treat a potentially large number of individuals within a short period of time on an annual basis reduces the feasibility of leuprolide as a wildlife management tool, particularly for large, free-ranging, open deer populations.

- **Histrelin acetate:** Histrelin acetate is effective in suppressing a key reproductive hormone in white-tailed deer (Becker and Katz 1995). However, testing was conducted using a mini-pump that was surgically implanted under the animal's skin. This is an infeasible route of administration in free-ranging animals. In the future, a delivery system with slow release characteristics may help to make this a more feasible option for free-ranging wildlife. It is likely that histrelin acetate will also suppress ovulation and pregnancy in white-tailed deer, although this remains to be tested.

**GnRH Toxins.** GnRH toxins consist of a cellular toxin that is combined with a GnRH analog (either agonist or antagonist). A GnRH analog is a synthetic peptide similar to the body's own gonadotropin-releasing hormone. Using the analog as a carrier, a cellular toxin can be delivered to specific cells in the pituitary which produce reproductive hormones. Internalization of the toxin leads to cell death. When this occurs, the production of reproductive hormones (leuteinizing hormone and follicle stimulating hormone) is affected. This process has been studied in male dogs (Sabeur et al. 2003), domestic sheep (Nett et al. 1999), rats (Kovacs et al. 1997), and female mule deer

(Baker et al. 1999) but the technology is still in the developmental stages and not ready for use in free-ranging wildlife.

**Steroid Hormones.** The field of wildlife contraception began with research examining the manipulation of reproductive steroid hormones (Matschke 1977a, 1977b, 1980). Treatment usually entails the application of synthetic hormones, such as norgestomet, and melangestrol acetate (Jacobsen, Jessup, and Kesler 1995; DeNicola, Kesler, and Swihart 1997a; Fagerstone et al. 2010). Available products are administered via slow release implants or repeated feeding and have demonstrated variable efficacy and duration of infertility. Most products that are available are used in domestic animal or zoological veterinary medicine and have not been tested widely in free-ranging wildlife. Issues related to using steroids include difficulties in treating large numbers of animals for extended periods of time, potential reproductive tract pathological side effects experienced by the treated animals, and concerns over the consumption of treated animals by nontarget species and humans. Although many of these hormones are used as growth promotants in domestic food animal production, they are not labeled for use in free-ranging wildlife. Currently, this method of contraception is not being pursued by the wildlife management community.

**Contragestives.** Contragestives are products that prevent or terminate pregnancy. Progesterone is the primary gestational hormone for maintaining pregnancy in mammals. Many contragestives act by preventing progesterone production or blocking its effect, thereby affecting pregnancy. The primary contragestive that has been researched for use in domestic animals and white-tailed deer is an analog of Prostaglandin F<sub>2α</sub> (PGF<sub>2α</sub>) (Becker and Katz 1994; DeNicola, Kesler, and Swihart 1997b; Waddell et al. 2001). Lutalyse® is a commercially available form of PGF<sub>2α</sub>. Unlike many of the other alternatives, there are no issues related to consumption of the meat when the animal has been treated with this product. Challenges with contragestives include timing of administration, efficacy, potential to rebreed if breeding season is not finished, and the potential for aborted fetuses on the landscape. These limitations make their use in free-ranging populations for fertility control purposes unlikely.

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

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

## **EVALUATION OF FERTILITY CONTROL AGENTS BASED ON SELECTION CRITERIA ESTABLISHED BY FIRE ISLAND NATIONAL SEASHORE**

Five criteria were established for Fire Island National Seashore that reflect minimum desired conditions for using a reproductive control agent. Only when these criteria are met would reproductive control be implemented. These criteria assume that the agent poses no significant health risk to the deer.

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

**TABLE D-1. EVALUATION OF FERTILITY CONTROL AGENTS BASED ON  
SELECTION CRITERIA FOR FIRE ISLAND NATIONAL SEASHORE**

<b>Agent</b>	<b>Criterion 1 Federally Approved and State Registered</b>	<b>Criterion 2 Multi-year efficacy (3+)</b>	<b>Criterion 3 Capable of remote administration</b>	<b>Criterion 4 Meat Safe for Humans</b>	<b>Criterion 5 Minimal Impact on Deer Behavior</b>
<b>Immunocontraceptives</b>					
"Native" PZP	No	No	Yes	Likely, but need EPA approval	No – repeated estrous cycles
SpayVac®	No	Possibly <sup>c</sup>	Unknown		No – repeated estrous cycling
Long-term pelleted PZP	No	Possibly <sup>d</sup>	No		Unknown – likely repeated estrous cycles
GnRH	No <sup>a</sup>	Possibly <sup>e</sup>	Possibly <sup>f</sup>	Yes	Yes
<b>GnRH Agonists</b>					
Leuprolide Acetate	No	No	Yes	Likely but need EPA approval	Yes
Histrelin Acetate	No	No	No	Likely but need EPA approval	Unknown
<b>Other</b>					
GnRH Toxins	No	Unknown	Unknown	Likely but unknown	Unknown
Steroid Hormones	No	No	Unknown	Unlikely, but need regulatory guidance	Unknown
Contragestives	No	No	Yes	Yes	Yes
Physical sterilization - ovariectomy	Not applicable <sup>g</sup>	Yes - permanent	No	Yes – after anesthesia withdrawal date	No – lack of reproductive hormones will change reproductive behaviors and likely social behaviors
Physical sterilization – tubal ligation	Not applicable <sup>g</sup>	Yes - permanent	No	Yes – after anesthesia withdrawal date	No – repeated estrous cycles

- a Federally approved but not registered in the state of New York for use in free ranging white-tailed deer populations.
- b Recent research demonstrates excellent efficacy using a single dose of native PZP primer combined with heat extruded pellets in year 1 (96%), moderate in year two (74%), and little efficacy by year three (Rutberg et al. 2013). The data regarding cold evaporated pellets is inconclusive (Rutberg et al. 2013).
- c SpayVac® has demonstrated 80%-100% efficacy for up to 5-7 years in horses and deer (Fraker, pers. comm., 2009; Miller et al. 2009; Killian et al. 2008). The term "possibly" is used because long-term studies (greater than 5 years) have been conducted only in captive deer and had a small sample size in each treatment group (N=5) (Miller et al. 2009). The only longer term study in free-ranging white-tailed deer did not evaluate past the third year (Rutberg et al. 2013).
- d Long-term pelleted PZP has not been adequately evaluated past year two in free-ranging deer to determine extended efficacy (Rutberg et al. 2013)
- e Research on one-shot, multiyear GnRH vaccine in penned/captive deer indicates GonaCon is 88-100% effective in year 1, 47-100% effective in year 2, and 25-80% effective up to 5 years post-treatment (Miller et al. 2008). The term "possibly" is used because the multi-year formulation has been used only in captive deer, had a small sample size, and lacks confidence intervals on the data. Work in free-ranging deer suggests lower efficacy rates and shorter duration of efficacy (Gionfriddo et al. 2009, 2011).
- f Work published in elk used dart delivery to administer the GnRH vaccine (Killian et al. 2009).
- g Not applicable because this is a veterinary procedure rather than a product. The procedure requires general anesthesia, a veterinarian to perform surgery, post-operative antibiotics, and is likely associated with a higher mortality rate (approximately 6%; MacLean et al. 2006) than anesthesia alone (approximately 1.5%; Rutberg et al. 2013). Results in permanent sterilization.

## REFERENCES AND SELECTED BIBLIOGRAPHY

- Adams, T. H., and B. M. Adams  
1990 "Reproductive function and feedlot performance of beef heifers actively immunized against GnRH." *Journal of Animal Science* 68:2793-2802.
- Asa, C. S., L. J. D. Zaneveld, L. Munson, M. Callahan, and A. P. Byers  
1996 "Efficacy, safety, and reversibility of a bisdiamine male-directed oral contraceptive in gray wolves (*Canis lupus*)." *Journal of Zoo and Wildlife Medicine* 27:501-506.
- Aspden, W. J., A. Rao, P. T. Scott, I. J. Clark, T. E. Trigg, J. Walsh, and M. J. D'Occhio  
1996 "Direct Actions of the Luteinizing Hormone-releasing Hormone Agonist, Deslorelin, on Anterior Pituitary Contents of Luteinizing Hormone (LH) and Follicle-Stimulating Hormone (FSH), LH and FSH Subunit Messenger Ribonucleic Acid, and Plasma Concentrations of LH and FSH in Castrated Male Cattle." *Biology of Reproduction* 55:386-92. Available on the Internet at <http://www.biolreprod.org/cgi/reprint/55/2/386>.
- Ataja, A. M., T. N. Barry, R. M. Hoskinson, and P. R. Wilson  
1992 "Effects of active immunization on growth and plasma hormone concentrations in red deer stags during their second year." *Journal of Agricultural Science* 118:371-377.
- Atkinson, S., W. G. Gilmartin, and B. L. Lasley  
1993 "Testosterone response to a gonadotrophin-releasing hormone agonist in Hawaiian monk seals (*Monachus schauinslandi*)." *Journal of Reproduction and Fertility* 97:35-38.
- Baker, D. L., T. M. Nett, N. T. Hobbs, R. B. Gill, and M. M. Miller  
1999 Evaluation of GnRH-toxin conjugate as an irreversible contraceptive in female mule deer. The Wildlife Society 6<sup>th</sup> Annual Conference, Austin, Texas, USA.
- Baker, D. L., M. A. Wild, M. M. Conner, H. B. Ravivarapu, R. L. Dunn, and T. M. Nett  
2002 "Effects of GnRH agonist (leuprolide) on reproduction and behavior in female wapiti (*Cervus elaphus nelsoni*)." *Reproduction Supplement* 60:155-167.  
2004 "Gonadotropin-releasing hormone agonist: a new approach to reversible contraception in female deer." *Journal of Wildlife Diseases* 40:713-724.
- Baker, D. L., M. A. Wild, M. D. Hussain, R. L. Dunn, and T. M. Nett  
2005 "Evaluation of remotely delivered leuprolide acetate as a contraceptive agent in female elk (*Cervus elaphus nelsoni*)." *Journal of Wildlife Diseases* 41:in press.
- Barber, M. R., and R. A. Fayer-Hosken  
2000 "Evaluation of somatic and reproductive immunotoxic effects of the porcine zona pellucida vaccination." *Journal of Experimental Zoology* 286:641-646.
- Barlow, N. D.  
1997 "Modeling immunocontraception in disseminating systems." *Reproduction Fertility and Development* 9:51-60.

- Barlow, N. D., J. M. Kean, and C. J. Briggs  
 1997 "Modeling the relative efficacy of culling and sterilization for controlling populations." *Wildlife Research* 24:129-141.
- Becker, S. E., W. J. Enright, and L. S. Katz  
 1999 "Active immunization against gonadotropin-releasing hormone in female white-tailed deer." *Zoo Biology* 18:385-396.
- Becker, S. E., and L. S. Katz  
 1994 "Effects of exogenous prostaglandin-F<sub>2</sub>" (PGF<sub>2</sub>) on pregnancy status in white-tailed deer." *Zoo Biology* 13:315-323.  
 1995 "Effects of a gonadotropin-releasing hormone agonist on serum luteinizing hormone concentrations in female white-tailed deer." *Small Ruminant Research* 18:145-150.  
 1997 Gonadotropin-releasing hormone (GnRH) analogs or active immunization against GnRH to control fertility in wildlife. In: Kreeger, T. J. ed. *Contraception in Wildlife Management*. USDA-APHIS Technical Bulletin 1853, Washington, D.C., USA.
- Beekman, N. J. C. M., W. M. M. Schaaper, J. A. Turkstra, and R. H. Meloen  
 1999 "Highly immunogenic and fully synthetic peptide-carrier constructs targeting GnRH." *Vaccine* 17:2043-2050.
- Bertschinger, H. J., C. S. Asa, P. P. Calle, J. A. Long, K. Bauman, K. DeMatteo, W. Jochle, T. E. Trigg, and A. Human  
 2001 "Control of reproduction and sex related behaviour in exotic wild carnivores with the GnRH analogue deslorelin: preliminary observations." *Journal of Reproduction and Fertility Supplement* 57: 275-283.
- Bertschinger, H. J., T. E. Trigg, W. Jochle, and A. Human  
 2002 "Induction of contraception in some African wild carnivores by down regulation of LH and FSH secretion using the GnRH analogue deslorelin." *Reproduction Supplement* 60:41-52.
- Bickle, C. A., J. F. Kirkpatrick, and J. W. Turner  
 1991 "Contraception in striped skunks with norplant® implants." *Wildlife Society Bulletin* 19:334-338.
- Bilecki, M.  
 2009 Personal communication between Mike Bilecki, Natural Resource Manager, FIIS and Kristina Heister, Natural Resource Manager, VAFO on 3/10/2009 regarding the use of fertility control on FIIS.
- Bonneau, M., R. Dufour, C. Chouvet, C. Roulet, W. Meadus, and E. J. Squires  
 1994 "The effects of immunization against luteinizing hormone-releasing hormone on performance, sexual development, and levels of boar taint-related compounds in intact male pigs." *Journal of Animal Science* 72:14-20.

- Boone, J. L., and R. G. Wiegert  
1994 "Modeling deer herd management: sterilization is a viable option." *Ecological Modeling* 72:175-186.
- Boulanger, J. R., P. D. Curtis, E. G. Cooch, and A. J. DeNicola  
2012 "Sterilization as an alternative deer control technique: a review." *Human-Wildlife Interactions* 6(2):273-282.
- Bradley, M. P.  
1997 Immunocontraceptive vaccines for control of fertility in the European red Fox (*Vulpes vulpes*). In: Kreeger, T. J. ed. *Contraception in Wildlife Management*. USDA-APHIS Technical Bulletin 1853, Washington, D.C., USA.
- Bradley, M. P., L. A. Hinds, and P. H. Bird  
1997 "A bait-delivered immunocontraceptive vaccine for the European red fox (*Vulpes vulpes*) by the year 2002?" *Reproduction, Fertility, and Development* 9:111-116.
- Brooks, R. P., M. W. Flemming, and J. J. Kennelly  
1980 "Beaver colony response to fertility control: evaluating a concept." *Journal of Wildlife Management* 44:568-575.
- Brown, B. W., P. E. Mattner, P. A. Carroll, E. J. Holland, D. R. Paull, R. M. Hoskinson, and R. D. G. Rigby  
1994 "Immunization of sheep against GnRH early in life: Effects on reproductive function and hormones in rams." *Journal of Reproduction and Fertility* 101:15-21.
- Brown, R. G., W. D. Bowen, J. D. Eddington, W. C. Kimmins, M. Mezei, J. L. Parsons, and B. Pohajdak  
1997 "Evidence for a long-lasting single administration contraceptive vaccine in wild grey seals." *Journal of Reproductive Immunology* 35:53-64.
- Concannon, P. W., A. Yeager, D. Frank, and A. Iyampillai  
1990 "Termination of pregnancy and induction of premature luteolysis by the antiprogestagen, mifepristone, in dogs." *Journal of Reproduction and Fertility* 88:99-104.
- Conner, M. M., D. L. Baker, M. A. Wild, J. G. Powers, M. D. Hussain, and R. L. Dunn  
2007 "Fertility control in free-ranging elk using gonadotropin-releasing hormone agonist leuprolide: Effects on reproduction, behavior, and body condition." *Journal of Wildlife Management* 71:2346-2356.
- Cowan P., R. Pech, and P. Curtis  
2002 Field applications of fertility control for wildlife management In: Holt WV, A. R. Pickard, Rodger JC, et al., eds. *Reproductive Science and Integrated Conservation*: Cambridge University Press.
- Curtis, P. D., R. L. Pooler, M. E. Richmond, L. A. Miller, G. F. Mattfeld, and F. W. Quimby  
2002 "Comparative effects of GnRH and porcine zona pellucida (PZP) immunocontraceptive vaccines for controlling reproduction in white-tailed deer (*Odocoileus virginianus*)." *Reproduction Supplement* 60:131-141.

- Curtis, P. D., M. E. Richmond, L. A. Miller, and F. W. Quimby  
 2007 "Pathophysiology of White-tailed Deer Vaccinated with Porcine Zona Pellucida Immunocontraceptive." *Vaccine* 25: 4623-4630.
- 2008 "Physiological effects of gonadotropin-releasing hormone immunocontraception on white-tailed deer." *Human-Wildlife Conflicts* 2(1): 68-79.
- Daels, P. F., and J. P. Hughes  
 1995 "Fertility control using intrauterine devices: an alternative for population control in wild horses." *Theriogenology* 44:629-639.
- Dalin, A. M., O. Andresen, and L. Malmgren  
 2002 "Immunization against GnRH in mature mares: antibody titres, ovarian function, hormonal levels and oestrous behaviour." *Journal of Veterinary Medicine Series A* 49:125-131.
- Davis, S. A., and R. P. Pech  
 2002 "Dependence of population response to fertility control on the survival of sterile animals and their role in regulation." *Reproduction Supplement* 60:89-103.
- Deigert, F. A., A. E. Duncan, K. M. Frank, R. O. Lyda, and J. F. Kirkpatrick  
 2003 "Immunocontraception of captive exotic species. III. Contraception and population management of fallow deer (*Cervus dama*)." *Zoo Biology* 22:261-268.
- de Jersey, J., P. H. Bird, N. K. Verma, and M. P. Bradley  
 1999 "Antigen-specific systemic and reproductive tract antibodies in foxes immunized with *Salmonella typhimurium* expressing bacterial and sperm proteins." *Reproduction, Fertility, and Development* 11:219-228.
- DeLiberto, T. J., A. Seglund, W. Jochle, and B. Kimball  
 2002 "Assessment of cabergoline as a reproductive inhibitor in coyotes (*Canis latrans*)." *Reproduction Supplement* 60:53-64.
- DeNicola, A. J., D. J. Kesler, and R. K. Swihart  
 1997a "Dose determination and efficacy of remotely delivered norgestomet implants on contraception of white-tailed deer." *Zoo Biology* 16:31-37.
- 1997b "Remotely delivered prostaglandin F<sub>2</sub> implants terminate pregnancy in white-tailed deer." *Wildlife Society Bulletin* 25:527-531.
- DeNicola, A. J. and R. K. Swihart  
 1997 "Capture-induced Stress in White-tailed Deer." *Wildlife Society Bulletin* 25(2):500-3.
- D'Occhio, M. J., W. J. Aspden, and T. R. Whyte  
 1996 "Controlled, Reversible Suppression of Oestrous Cycles in Beef Heifers and Cows Using Agonists of Luteinizing Hormone Gonadotropin-Releasing Hormone." *Journal of Animal Science* 74:218-25.

- Dowsett, K. F., U. Tshewang, L. M. Knott, A. E. Jackson, and T. E. Trigg  
1993 "Immunocastration of colts and immunospeying of fillies." *Immunology and Cell Biology* 71:501-508.
- Dunshea, F. R., C. Colantoni, K. Howard, I. McCauley, P. Jackson, K. A. Long, S. Lopaticki, E. A. Nugent, J. A. Simons, J. Walker, and D. P. Hennessy  
2001 "Vaccination of boars with a GnRH vaccine (Improvac) eliminates boar taint and increases growth performance." *Journal of Animal Science* 79:2524-2535.
- Eilts, B. E.  
2002 "Pregnancy termination in the bitch and queen." *Clinical Techniques in Small Animal Practice* 17:116-123.
- Fagerstone, K. A., M. A. Coffey, P. D. Curtis, R. A. Dolbeer, G. J. Killian, L.A. Miller, and L. M. Wilmot  
2002 "Wildlife Fertility Control." *Wildlife Society Technical Review* 02-2, 29.
- Fagerstone, K. A., L. A. Miller, J. D. Eisemann, J. R. O'Hare, and J. P. Gionfriddo  
2008 "Registration of Wildlife Contraceptives in the United States of America, with OvoControl and GonaCon Immunocontraceptive Vaccines as Examples." *Wildlife Research* 35:586-592.
- Fagerstone, K. A., L. A. Miller, G. Killian, and C. A. Yoder  
2010 "Review of issues concerning the use of reproductive inhibitors, with particular emphasis on resolving human-wildlife conflicts in North America." *Integrative Zoology* 1:15-30.
- Fahim, M. S., M. Wang, M. F. Sutcu, Z. Fahim, and R. S. Youngquist  
1993 "Sterilization of dogs with intra-epididymal injection of zinc arginine." *Contraception* 47: 107-122.
- Ferro, V. A., R. Costa, K. C. Carter, M. J. A. Harvey, M. M. Waterston, A. B. Mullen, C. Matschke, J. F. S. Mann, A. Colston, and W. H. Stimson  
2004a "Immune responses to a GnRH-based anti-fertility immunogen, induced by different adjuvants and subsequent effect on vaccine efficacy." *Vaccine* 22:1024-1031.
- Ferro, V. A., M. A. H. Khan, D. McAdam, A. Colston, E. Aughey, A. B. Mullen, M. M. Waterston, and M. J. A. Harvey  
2004b "Efficacy of an anti-fertility vaccine based on mammalian gonadotrophin releasing hormone (GnRH-I) – a histological comparison in male animals." *Veterinary Immunology and Immunopathology* 101:73-86.
- Fraker, M. A.  
2009 Personal communication between M. A. Fraker and Kristina Heister, Natural Resource Manager, Valley Forge National Historical Park, National Park Service, regarding SpayVac® use in white-tailed deer.
- Fraker, M. A., R. G. Brown, G. E. Gaunt, J. A. Kerr, and B. Pohajdak  
2002 "Long lasting, single dose immunocontraception of feral fallow deer in British Columbia." *Journal of Wildlife Management* 66(4):1141-1147.

Fraker, M. A. and U. Bechert

- 2007 SpayVac® – a long-lasting, single-dose PZP contraceptive vaccine for practical wildlife population control. Abstract. 6<sup>th</sup> International Conference on Fertility Control for Wildlife. September 3-5, 2007.

Frank, K. M., R. O. Lyda, and J. F. Kirkpatrick

- 2005 “Immunocontraception of captive exotic species IV. Species differences in response to the porcine zona pellucida vaccine, timing of booster inoculations, and procedural failures.” *Zoo Biology*: 1-10.

Freudenberger, D. O., P. R. Wilson, T. N. Barry, Y. X. Sun, R. W. Purchas, and T. E. Trigg

- 1993 “Effects of immunization against GnRH upon body growth, voluntary food intake and plasma hormone concentration in yearling red deer stags (*Cervus elaphus*).” *Journal of Agricultural Sciences* 121:381-388.

Fromme, B., P. Eftekhari, M. Van Regenmortel, J. Hoebeke, A. Katz, and R. Millar

- 2003 “A novel retro-inverso gonadotropin-releasing hormone (GnRH) immunogen elicits antibodies that neutralize the activity of native GnRH.” *Endocrinology* 144:3262-3269.

Garrott R. A.

- 1995 “Effective management of free-ranging ungulate populations using contraception.” *Wildlife Society Bulletin*: 445-452.

Garrott, R. A., J. G. Cook, M. M. Bernoco, J. F. Kirkpatrick, L. L. Cadwell, S. Cherry, and B. Tiller

- 1998 “Antibody response of elk immunized with porcine zona pellucida.” *Journal of Wildlife Disease* 34:539-546.

Garrott, R. A., D. B. Siniff, J. R. Tester, T. C. Eagle, E. D. Plotka

- 1992 “A Comparison of Contraceptive Technologies for Feral Horse Management.” *Wildlife Society Bulletin* Vol. 20 No. 3.

Garrott, R. A., and D. B. Siniff

- 1992 “Limitations of male-oriented contraception for controlling feral horse populations.” *Journal of Wildlife Management* 56:456-464.

Garza, F., D. L. Thompson, D. D. French, J. J. Wiest, R. L. St. George, K. B. Ashley, L. S. Jones, P. S. Mitchell, and D. R. McNeill

- 1986 “Active immunization of intact mares against gonadotropin-releasing hormone: differential effects on secretion of luteinizing hormone and follicle-stimulating hormone.” *Biology of Reproduction* 35:347-352.

Gionfriddo, J. P., J. D. Eisemann, K. J. Sullivan, R. S. Healey, L. A. Miller, K. A. Fagerstone, R. M. Engeman, and C. A. Yoder

- 2009 “Field test of a single-injection gonadotropin-releasing hormone immunocontraceptive vaccine in female white-tailed deer.” *Wildlife Research* 36:177-184.

Gionfriddo, J. P., A. J. Denicola, L. A. Miller, and K. A. Fagerstone

- 2011 “Efficacy of GnRH Immunocontraception of wild white-tailed deer in New Jersey.” *Wildlife Society Bulletin* 35:142-148.

- Gorman, S. P., J. K. Levy, A. L. Hampton, W. R. Collante, A. L. Harris, and R. G. Brown  
2002 "Evaluation of a porcine zona pellucida vaccine for the immunocontraception of domestic kittens (*Felis catus*).” *Theriogenology* 58:135-149.
- Gross, J. E.  
2000 "A dynamic simulation model for evaluating effects of removal and contraception on genetic variation and demography of Pryor Mountain wild horses.” *Biological Conservation* 96:319-330.
- Haight, R. G., and L. D. Mech  
1997 "Computer Simulation of Vasectomy for Wolf Control.” *Journal of Wildlife Management* 61:1023-1031.
- Hardy, C. M., G. Clydesdale, K. J. Mobbs, J. Pekin, M. L. Lloyd, C. Sweet, G. R. Shellman, and M. A. Lawson  
2004 "Assessment of contraceptive vaccines based on recombinant mouse sperm protein PH20.” *Reproduction* 127:325-334.
- Harrenstien, L. A., L. Munson, L. M. Chassy, I. K. M. Liu, and J. F. Kirkpatrick  
2004 "Effects of porcine zona pellucida immunocontraceptives in zoo felids.” *Journal of Zoo and Wildlife Medicine* 35:271-279.
- Hazum, E., and P. M. Conn  
1988 "Molecular Mechanisms of Gonadotropin Releasing Hormone (GnRH) Action: I. The GnRH Receptor.” *Endocrine Review* 9 (4): 379-86.
- Heilmann, T. J., R. A. Garrott, L. L. Cadwell, and B. L. Tiller  
1998 "Behavioral response of free-ranging elk treated with an immunocontraceptive vaccine.” *Journal of Wildlife Management* 62:243-250.
- Hobbs, N. T., D. C. Bowden, and D. L. Baker  
2000 "Effects of fertility control on populations of ungulates: general, stage structured models.” *Journal of Wildlife Management* 64:473-491.
- Hone, J.  
1992 "Rate of Increase and Fertility Control.” *Journal of Applied Ecology* 29:695-698.
- Hsu, C. T., C. Y. Ting, C. J. Ting, T. Y. Chen, C. P. Lin, J. Whang-Peng, and J. Hwang  
2000 "Vaccination against gonadotropin-releasing hormone (GnRH) using toxin receptor-binding domain-conjugated GnRH repeats.” *Cancer Research* 60:3701-3705.
- Jacob J., J. Matulessy, and Sudarmaji  
2004 "Effects of imposed sterility on movement patterns of female ricefield rats.” *Journal of Wildlife Management* 68:1138-1144.
- Jacobsen, N. K., D. A. Jessup, and D. J. Kesler  
1995 "Contraception in captive black-tailed deer by remotely delivered norgestomet ballistic implants.” *Wildlife Society Bulletin* 23:718-722.

- Jewgenow, K., M. Quest, W. Elger, T. B. Hildebrandt, H. H. D. Meyer, G. Strauss, and F. Gortiz  
2001 "Administration of Antiprogesterin J956 for Contraception in Bears: A Pharmacological Study." *Theriogenology* 56:601-611.
- Jöchle, W., and M. Jöchle  
1993 "Reproduction in a feral cat population and its control with a prolactin inhibitor cabergoline." *Journal of Reproduction and Fertility Supplement* 47:419-424.
- Kennelly, J. J., and K. A. Converse  
1997 Surgical Sterilization: an underutilized procedure for evaluating the merits of induced sterility. In: Kreeger, T. J. ed. *Contraception in Wildlife Management*. USDA-APHIS Technical Bulletin 1853, Washington, D.C., USA.
- Kerr, P. J., R. J. Jackson, A. J. Robinson, J. Swan, L. Silvers, N. French, H. Clarke, D. F. Hall, and M. K. Holland  
1999 "Infertility in female rabbits (*Oryctolagus cuniculus*) alloimmunized with the rabbit zona pellucida protein ZPB either as a purified recombinant protein or expressed by recombinant myxoma virus." *Biology of Reproduction* 61:606-613.
- Kesler, D.  
1997 Remotely delivered contraception with needle-less norgestomet implants. In: Kreeger, T. J. ed. *Contraception in Wildlife Management*. USDA-APHIS Technical Bulletin 1853, Washington, D.C., USA pp171-184.
- Killian, G., L. Miller, N. K. Diehl, J. Rhyan, and D. Thain  
2004 Evaluation of three contraceptive approaches for population control of wild horses. *Proceedings of the Vertebrate Pest Conference* 21:263-268.
- Killian, G., J. Eisemann, D. Wagner, J. Werner, D. Shaw, R. Engeman, and L. Miller  
2006a "Safety and toxicity evaluation of GonaCon™ immunocontraceptive vaccine in white-tailed deer." *Vertebrate Pest Conference* 22:82-87.
- Killian, G., L. Miller, J. Rhyan, and H. Doten  
2006b "Immunocontraception of Florida Feral Swine with a Single-dose GnRH Vaccine." *American Journal of Reproductive Immunology* 55:378-384.
- Killian, G., D. Wagner, and L. A. Miller  
2006 "Observation on the Use of the GnRH Vaccine GonaCon™ in Male White-tailed Deer." *Wildlife Damage Management Conference* 11:256-263.
- Killian G, D. Wagner, K. Fagerstone, L. Miller  
2008 Long-term efficacy and reproductive behavior associated with GonaCon use in white-tailed deer (*odocoileus virginianus*). *Proceedings - Vertebrate Pest Conference*. 2008, no. 23.
- Killian, G., T. Kreeger, J. Rhyan, K. Fagerstone, and L. Miller  
2009 "Observations on the use of Gonacon in captive female elk (*Cervus elaphus*)." *Journal of Wildlife Disease* 45:184-188.

Killian, G. J., and L. A. Miller

- 2001 Behavioral observations and physiological implications for white-tailed deer treated with two different immunocontraceptives. Proceedings of the Ninth Wildlife Damage Management Conference. October 5-8, 2000. The Pennsylvania State University. University Park, PA. Pages 283-291.

Kilpatrick, J. F., I. K. M. Liu, J. W. Turner, R. Naugle, and R. Keiper

- 1992 "Long term Effects of Porcine Zona Pellucidae Immunocontraception on Ovarian Function in Feral Horses (*Equus caballus*).” *Journal of Reproduction and Fertility* 94:437-44.

Kilpatrick, H. J., S. M. Spohr, and A. J. DeNicola

- 1997 "Darting Urban Deer: Techniques and Technology.” *Wildlife Society Bulletin* 25 (2): 542-46.

Kilpatrick, H. J., and W. D. Walter

- 1997 "Urban Deer Management: A Community Vote.” *Wildlife Society Bulletin* 25:388-91.

Kirkpatrick, J. F.

- 2007 "Measuring the effects of wildlife contraception: the argument for comparing apples with oranges.” *Reproduction Fertility and Development* 19:548-552.

Kirkpatrick, J. F., P. P. Calle, P. Kalk, I. K. M. Liu, and J. W. Turner

- 1996a "Immunocontraception of captive exotic species. II. Formosan sika deer (*Cervus Nippon Taiouanus*), axis deer (*Cervus axis*), himalayan tahr (*Hemitragus jemlahicus*), roosevelt elk (*Cervus elaphus roosevelti*), reeves' muntjac (*Muntiacus reevesi*), and sambar deer (*Cervus unicolor*).” *Journal of Zoo and Wildlife Medicine* 27:482-495.

Kirkpatrick, J. F. I. K. M. Liu, and J. W. Turner Jr.

- 1990 "Remotely-delivered Immunocontraception in Feral Horses.” *Wildlife Society Bulletin* 18:326-330.

Kirkpatrick, J. F., R. Naugle, I. K. M. Liu, M. Bernoco, and J. Turner

- 1995 "Effects of seven consecutive years of porcine zonae pellucidae contraception on ovarian function in feral mares.” *Biology of Reproduction* Monograph Series 1:411-418.

Kirkpatrick, J. F., and A. Turner

- 2003 "Absence of effects from immunocontraception on seasonal birth patterns and foal survival among barrier island wild horses.” *Journal of Applied Animal Welfare Science* 6:301-308.

- 2008 "Achieving Population Goals in a Long-lived Wildlife Species (*Equus caballus*) with Contraception.” *Wildlife Research* 35:513-519.

Kirkpatrick, J. F., and J. W. Turner Jr.

- 1985 "Chemical Fertility Control and Wildlife Management.” *BioScience* 35:485-491.

- 1991 "Reversible contraception in nondomestic animals.” *Journal of Zoo and Wildlife Medicine* 22:392-408.

- 2002 "Reversibility of action and safety during pregnancy of immunization against porcine zona pellucida in wild mares (*Equus caballus*)." *Reproduction Supplement* 60:197-202.
- Kirkpatrick, J. F., J. W. Turner Jr., I. K. M. Liu, and R. Fayer-Hosken  
1996b "Applications of pig zona pellucida immunocontraception to wildlife fertility control." *Journal of Reproduction and Fertility Supplement* 50:183-189.
- Kirkpatrick, J. F., J. W. Turner Jr., I. K. M. Liu, and R. Fayer-Hosken, and A. T. Rutberg  
1997 "Case studies in wildlife immunocontraception: wild and feral equids and white-tailed deer." *Reproductive, Fertility, and Development* 9: 105-110.
- Kirkpatrick, J. F., A. Rowan, N. Lamberski, R. Wallace, K. Frank, and R. Lyda  
2009 "The practical side of immunocontraception: zona proteins and wildlife." *Journal of Reproductive Immunology* 83:151-157.
- Kirkpatrick, J. F., R. O. Lyda, and K. M. Frank  
2011 "Contraceptive Vaccines for Wildlife: A Review." *American Journal of Reproductive Immunology* 66:40-50.
- Knox, W. M., K. V. Miller, and R. L. Marchinton  
1988 "Recurrent Estrous Cycles in White-tailed Deer." *Journal of Mammalogy* 69:384-86.
- Kovacs, M., A. V. Schally, A. Nagy, M. Koppan, and K. Groot  
1997 Recovery of pituitary function after treatment with a targeted cytotoxic analog of luteinizing hormone-releasing hormone. *Proceedings of the National Academy of Sciences* 94:1420-1425.
- Kreeger, T. J. ed.  
1997 *Contraception in Wildlife Management*. USDA-APHIS Technical Bulletin 1853, Washington, D.C., USA.
- Ladd, A., G. Prabhu, Y. Y. Tsong, T. Probst, W. Chung, and R. B. Thau  
1988 "Active immunization against gonadotropin-releasing hormone combined with androgen supplementation is a promising antifertility vaccine for males." *American Journal of Reproductive Immunology and Microbiology* 17:121-127.
- Ladd, A., Y. Y. Tsong, A. M. Walfield, and R. Thau  
1994 "Development of an antifertility vaccine for pets based on active immunization against luteinizing hormone-releasing hormone." *Biology of Reproduction* 51:1076-1083.
- Lengwinat, T., H. H. D. Meyer, and W. Jöchle  
2001 "Effectiveness of cabergoline for termination of pregnancy in silver fox (*Vulpes vulpes fulva*)." *Reproduction in Domestic Animals* 36:257-260.
- Levy, J. K., L. A. Miller, P. C. Crawford, J. W. Ritchey, M. K. Ross, and K. A. Fagerstone  
2004 "GnRH Immunocontraception of Male Cats." *Theriogenology* 62(6):1116-1130.
- Lincoln, G. A.  
1987 "Long-term stimulatory effects of a continuous infusion of LHRH agonist on testicular function in male red deer (*Cervus elaphus*)." *Journal of Reproduction and Fertility* 80:257-261.

- Lincoln, G. A., H. M. Fraser, and T. J. Fletcher  
1982 "Antler growth in male red deer (*Cervus elaphus*) after active immunization against LH-RH." *Journal of Reproduction and Fertility* 66:703-708.
- Liu, I. K. M., J. W. Turner, E. M. G. Van Leeuwen, D. R. Flanagan, J. L. Hedrick, K. Murata, V. M. Lane, and M. P. Morales-Levy  
2005 "Persistence of anti-zonae pellucidae following a single inoculation of porcine zonae pellucidae in the domestic equine." *Reproduction* 129:181-190.
- Locke, S. L., M. W. Cook, L. A. Harveson, D. S. Davis, R. R. Lopez, N. J. Silvy, and M. A. Fraker  
2007 "Effectiveness of SpayVac® for reducing white-tailed deer fertility." *Journal of Wildlife Diseases* 43:726-730.
- MacLean, R. A., N. E. Mathews, D. M. Grove, E. S. Frank, and J. Paul-Murphy  
2006 "Surgical technique for tubal ligation in white-tailed deer (*Odocoileus virginianus*)." *Journal of Zoo and Wildlife Medicine* 37:354-360.
- Malmgren, L., O. Andresen, and A. M. Dalin  
2001 "Effect of GnRH immunization of hormonal levels, sexual behaviour, semen quality and testicular morphology in mature stallions." *Equine Veterinary Journal* 33:75-83.
- Matschke, G. H.  
1977a "Antifertility Action of Two Synthetic Progestins in Female White-tailed Deer." *Journal of Wildlife Management* 41:194-196.  
1977b "Fertility Control in White-tailed Deer by Steroid Implants." *Journal of Wildlife Management* 41:731-735.  
1980 "Efficacy of Steroid Implants in Preventing Pregnancy in White-tailed Deer." *Journal of Wildlife Management* 44:756-758.
- McCue, P. M., V. J. Farquhar, and E. L. Squires  
2000 "Effect of the GnRH agonist deslorelin acetate on pituitary function and follicular development in the mare." *Reproduction* 46:355-356.
- McShea, W. J., S. L. Monfort, S. Hakim, J. Kirkpatrick, I. Liu, J. W. Turner, Jr., L. Chassy, and L. Munson  
1997 "The effect of immunocontraception on the behavior and reproduction of white-tailed deer." *Journal of Wildlife Management* 61:560-569.
- McShea, W. J., and J. H. Rappole  
1997 "Herbivores and the Ecology of Forest Understory Birds." Pp. 298-309 in W. J. McShea, H. B. Underwood and J. H. Rappole (eds.), *The Science of Overabundance, Deer Ecology and Population Management*. Washington, D.C.: Smithsonian Institution Press.
- Meloan, R. H., J. A. Turkstra, H. Lankhof, W. C. Puijk, W. M. M. Schaaper, G. Dijkstra, C. J. G. Wensing, and R. B. Oonk  
1994 "Efficient immunocastration of male piglets by immunoneutralization of GnRH using a new GnRH-like peptide." *Vaccine* 12:741-746.

- Merrill, J. A., E. G. Cooch, and P. D. Curtis  
 2003 "Time to reduction: factors influencing management efficacy in sterilizing overabundant white-tailed deer." *Journal of Wildlife Management* 67:267-279.
- 2006 "Managing an overabundant deer population by sterilization: effects of immigration, stochasticity and the capture process." *Journal of Wildlife Management* 70:268-277.
- Miller, L. A., and K. A. Fagerstone  
 2000 Induced infertility as a wildlife management tool. Proceedings of the Vertebrate Pest Conference 19:160-168.
- Miller, L. A., B. E. Johns, and D. J. Elias  
 1998 "Immunocontraception as a Wildlife Management Tool: Some Perspectives." *Wildlife Society Bulletin* 26: 237-243.
- Miller, L. A., B. E. Johns, D. J. Elias and K. A. Crane  
 1997 "Comparative Efficacy of Two Immunocontraceptive Vaccines." *Vaccine*. 15:1858-1862.
- Miller, L. A., B. E. Johns, and G. J. Killian  
 2000a "Immunocontraception of White-tailed Deer using Native and Recombinant Zona Pellucida Vaccines." *Animal Reproduction Science* 63:187-195.
- 2000b "Long-term Effects of PZP Immunization on Reproduction in White-tailed Deer." *Vaccine* 18:568-574.
- 2000c "Immunocontraception of White-tailed Deer with GnRH Vaccine." *American Journal of Reproductive Immunology* 44:266-274.
- Miller, L. A., K. Crane, S. Gaddis, and G. J. Killian  
 2001 "Porcine Zona Pellucida Immunocontraception: Long-term Health Effects on White-tailed Deer." *Journal of Wildlife Management* 65 (4): 941-5.
- Miller, L. A., and G. J. Killian  
 2002 "In Search of the Active PZP Epitope in White-tailed Deer Immunocontraception." *Vaccine* 20:2735-2742.
- Miller, L. A., J. C. Rhyan, and M. Drew  
 2004 "Contraception of bison by GnRH vaccine: a possible means of decreasing transmission of brucellosis in bison." *Journal of Wildlife Diseases* 40:725-730.
- Miller, L. A., J. C. Rhyan, and G. Killian  
 2003 Evaluation of GnRH contraceptive vaccine using domestic swine as a model for feral hogs. Proceedings of the Wildlife Damage Management Conference 10:120-127.
- Miller, L. A., J. P. Gionfriddo, K. A. Fagerstone, J. C. Rhyan, and G. J. Killian  
 2008 "The single-shot GnRH immunocontraceptive vaccine (GonaCon™) in white-tailed deer: comparison of several GnRH preparations." *American Journal of Reproductive Immunology* 60: 214-223.

- Miller, L. A., K. A. Fagerstone, D. C. Wagner, and G. J. Killian  
2009 "Factors contributing to the success of a single-shot, multiyear PZP immunocontraceptive vaccine for white-tailed deer." *Human-Wildlife Conflicts* 3(1): 103-115.
- Molenaar, G. J., C. Lugard-Kok, R. H. Meloen, R. B. Oonk, J. de Koning, and C. J. G. Wensing  
1993 "Lesions in the hypothalamus after active immunization against GnRH in the pig." *Journal of Neuroimmunology* 48:1-12.
- Moore, H. D. M., N. M. Jenkins and C. Wong  
1997 "Immunocontraception in rodents: a review of the development of a sperm based immunocontraceptive vaccine for the grey squirrel (*Sciurus carolinensis*)." *Reproduction Fertility and Development* 9:125-129.
- Morell, V.  
1993 "Australian Pest Control by Virus Causes Concern." *Science* 261:683-684.
- Muller, L. I., R. J. Warrnen, and D. L. Evans  
1997 "Theory and Practice of Immunocontraception in Wild Animals." *Journal of Wildlife Management* 25 (2): 504-14.
- Munson, L.  
2006 "Contraception in Felids." *Theriogenology* 66:126-134.
- Munson, L., J. E. Bauman, C. S. Asa, W. Jöchle, and T. E. Trigg  
2001 "Efficacy of the GnRH analogue deslorelin for suppression of oestrous cycles in cats." *Journal of Reproduction and Fertility* 57 Supplement:269-273.
- Munson, L., A. Gardner, R. J. Mason, L. M. Chassy, and U. S. Seal  
2002 "Endometrial hyperplasia and mineralization in zoo felids treated with melengestrol acetate contraceptives." *Veterinary Pathology* 39: 419-427.
- Murty, T.S. and G.A. Sastry  
1978 "Effect of cadmium chloride (CdCl<sub>2</sub>) injection on the histopathology of the testis and the prostate in dogs. I. Intratesticular procedure." *Indian Veterinary Journal* 55:368-371.
- Nash, P. B., J. K. James, L. T. Hui, and L. A. Miller  
2004 Fertility control of California ground squirrels using GnRH immunocontraception. Proceedings of the 21<sup>st</sup> Vertebrate Pest Conference.
- Naugle, R. E., A. T. Rutberg, H. B. Underwood, J. W. Turner, Jr., and I. K. M. Liu  
2002 "Field testing of immunocontraception on white-tailed deer (*Odocoileus virginianus*) on Fire Island National Seashore, New York, USA." *Reproduction Supplement* 60:143-153.
- Nett, T. M., M. C. Allen, M. Wiczorek, and L. M. Glode  
1999 A gonadotropin-releasing hormone agonist (GnRH-A) linked to pokeweed antiviral protein (PAP) decreases the ability of the pituitary gland to secrete LH. 32<sup>nd</sup> Annual Meeting of the Society for the study of Reproduction, Pullman, WA; 29 July – 3 August, 1999.

- Nielsen, C. K., W. F. Porter, and H. B. Underwood  
1997 "An Adaptive Management Approach to Controlling Suburban Deer." *Wildlife Society Bulletin* 25:470-477.
- Nshimura, N., N. Kawate, T. Sawada, and J. Mori  
1992 "Chemical castration by a single intratesticular injection of lactic acid in rats and dogs." *Journal of Reproduction and Development* 38:263-266.
- Onclin, K., and J. P. Verstegen  
1996 "Practical use of a combination of a dopamine agonist and a synthetic prostaglandin analogue to terminate unwanted pregnancy in dogs." *Journal of Small Animal Practice* 37:211-216.
- Oonk, H. B., J. A. Turkstra, W. M. M. Schaaper, J. H. F. Erkens, M. H. Schuitemaker-de Weerd, A. van Nes, J. H. M. Verheijden, and R. H. Meloen  
1998 "New GnRH-like peptide construct to optimize efficient immunocastration of male pigs by immunoneutralization of GnRH." *Vaccine* 16:1074-1082.
- Pineda, M. H. and D. I. Hepler  
1981 "Chemical Vasectomy in Dogs: Long-term Study." *Theriogenology* 16:1-12.
- Plotka, E. D., and U. S. Seal  
1989 "Fertility Control in Female White-tailed Deer." *Journal of Wildlife Diseases* 25:643-646.
- Plotka, E. D., D. N. Vevea, T. C. Eagle, D. B. Siniff, and J. R. Tester  
1989 "Ovarian Function in Captive Feral Mares." *Journal of Wildlife Diseases* 25:574-579.
- Porter, W. F., H. B. Underwood, and J. L. Woodward  
2004 "Movement behavior, dispersal, and the potential for localized management of deer in a suburban environment." *Journal of Wildlife Management* 68:247-256.
- Powell, D. M.  
1999 "Preliminary evaluation of porcine zona pellucida (PZP) immunocontraception for behavioral effects in feral horses (*Equus caballus*)." *Journal of Applied Animal Welfare Science* 2:321-335.
- Rabb, M. H., D. L. Thompson, Jr., B. E. Barry, D. R. Colborn, K. E. Hehnke, and F. Garza, Jr.  
1990 "Effects of active immunization against GnRH on LH, FSH, and prolactin storage, secretion, and response to their secretagogues in pony geldings." *Journal of Animal Science* 68:3322-3329.
- Raphael, B. L., P. Kalk, P. Tomas, P. P. Calle, J. G. Doherty, and R. A. Cook  
2003 "Use of melengesterol acetate in feed for contraception in herds of captive ungulates." *Zoo Biology* 22:455-463.
- Ringleb, J., M. Rohleder, and K. Jewgenow  
2004 "Impact of feline zona pellucida glycoprotein B-derived synthetic peptides on *in vitro* fertilization of cat oocytes." *Reproduction* 127:179-186.

- Robbins, S. C., J. M. Jelinski, and R. L. Stotish  
2004 "Assessment of the immunological and biological efficacy of two different doses of a recombinant GnRH vaccine in domestic male and female cats (*Felis catus*).” *Journal of Reproductive Immunology* 64:107-119.
- Rudolph, B. A., W. F. Porter, and H. B. Underwood  
2000 "Evaluating immunocontraception for managing suburban white-tailed deer in Irondequoit, New York.” *Journal of Wildlife Management* 64:463-473.
- Rutberg, A.  
2009 Email communication to Kristina Heister, Natural Resource Manager, Valley Forge National Historical Park regarding updated results of research being conducted on one-shot, multi-year PZP vaccine on Fripp Island, SC. March 25, 2009.
- Rutberg, A. T., and R. E. Naugle  
2009 Testing the effectiveness of one-shot immunocontraceptives on white-tailed deer at Fripp Island, South Carolina. 2008 Progress Report. South Carolina Department of Natural Resources. Unpubl.
- Rutberg, A. T., and R. E. Naugle  
2008a "Population-level effects of immunocontraception in white-tailed deer (*Odocoileus virginianus*).” *Wildlife Research* 35: 494-501.  
2008b "Deer-vehicle collision trends at a suburban immunocontraception site.” *Human-Wildlife Conflicts* 2(1): 60-67.
- Rutberg, A. T., R. E. Naugle, L. A. Thiele, and I. K. M. Liu  
2004 "Effects of immunocontraception on a suburban population of white-tailed deer *Odocoileus virginianus*.” *Biological Conservation* 116:243-250.
- Rutberg, A. T., R. E. Naugle, J. W. Turner Jr., M. A. Fraker, and D. R. Flanagan  
2013 "Field testing of single-administration procine zona pellucida contraceptive vaccines in white-tailed deer (*Odocoileus virginianus*).” *Wildlife Research* 40:281-288.
- Sabeur, K., B. A. Ball, T. M. Nett, H. H. Ball, and I. K. M. Liu  
2003 "Effect of GnRH conjugated to pokeweed antiviral protein on reproductive function in adult male dogs.” *Reproduction* 125:801-806.
- Safir, J. M., R. G. Loy, and B. P. Fitzgerald  
1987 "Inhibition of ovulation in the mare by active immunization against LHRH.” *Journal of Reproduction and Fertility* 35:229-237.
- Sankai, T., T. Endo, K. Kanayama, Y. Sakuma, M. Umezu, and J. Masaki  
1991 "Antiprogesterone compound, RU486 administration to terminate pregnancy in dogs and cats.” *Journal of Veterinary Medical Science* 53:1069-1070.
- Seagle, S. W., and J. D. Close  
1996 "Modeling white-tailed deer *Odocoileus virginianus* population control by contraception.” *Biological Conservation* 76:87-91.

- Shideler, S. E., M. A. Stoops, N. A. Gee, J. A. Howell, and B. L. Lasley  
2002 "Use of procine zona pellucida (PZP) vaccine as a contraceptive agent in free-ranging tule elk (*Cervus elaphus nannodes*).” *Reproduction Supplement* 60:169-176.
- Skinner, S. M., G. J. Killian, L. A. Miller, and B. S. Dunbar  
1994 "Characteristics of antigenicity and immunogenicity patterns of native and recombinant zona pellucida proteins in the white-tailed deer.” *Journal of Reproduction and Fertility* 101:295-303.
- Skinner, S., T. Mills, H. J. Kirchick, and B. S. Dunbar  
1984 "Immunization with zona pellucida proteins in abnormal ovarian follicular differentiation and inhibition of gonadotropin-induced steroid secretion.” *Endocrinology* 115:2418-2432.
- Stith, C., and M. D. Hussain  
2003 "Determination of mifepristone levels in wild canid serum using liquid chromatography.” *Journal of Chromatography B* 794:9-15.
- Stout, T. A. E., and B. Colenbrander  
2004 "Suppressing reproductive activity in horses using GnRH vaccines, antagonists or agonists.” *Animal Reproduction Science* 82-83:633-643.
- Suri, A.  
2004 "Sperm specific proteins- potential candidate molecules for fertility control.” *Reproductive Biology and Endocrinology* 2:6.  
  
2005 "Contraceptive vaccines targeting sperm.” *Expert Opinion on Biological Therapy* 5:381-392.
- Tast, A., R. J. Love, I. J. Clarke, and G. Evans  
2000 "Effects of active and passive gonadotropin-releasing hormone immunization on recognition and establishment of pregnancy in pigs.” *Reproduction Fertility and Development* 12:277-282.
- Trigg, T. E., P. J. Wright, A. F. Armour, P. E. Williamson, A. Junaidi, G. B. Martin, A. G. Doyle, and J. Walsh  
2001 "Use of a GnRH analogue implant to produce reversible long-term suppression of reproductive function in male and female domestic dogs.” *Journal of Reproduction and Fertility Supplement* 57:255-261.
- Tshewang, U., K. F. Dowsett, L. M. Knott, and T. E. Trigg  
1997 "Preliminary study of ovarian activity in fillies treated with a GnRH vaccine.” *Australian Veterinary Journal* 75:663-667.
- Tung, K. S. K., P. Primakoff, L. Woolman-Gamer, and D. G. Myles  
1997 "Mechanism of infertility in male guinea pigs immunized with sperm PH-20.” *Biology of Reproduction* 56:1133-1141.

- Turkstra, J. A., H. B. Oonk, W. M. M. Schaaper, and R. H. Meloen  
2002 "The Role of the Individual Amino Acids of a GnRH-tandem-dimer Peptide used as an Antigen for Immunocastration of Male Piglets Determined with Systematic Alanine Replacements." *Vaccine* 20:406-412.
- Turkstra, J. A., F. J. U. M. van der Meer, J. Knaap, P. J. M. Rottier, K. J. Teerds, B. Colenbrander, and R. H. Meloen  
2005 "Effects of GnRH immunization in sexually mature pony stallions." *Animal Reproduction Science* 86:247-259.
- Turner, J. W., J. F. Kirkpatrick, and I. K. M. Liu  
1996 "Effectiveness, reversibility and serum antibody titers associated with immunocontraception in captive white-tailed deer." *Journal of Wildlife Management* 60:45-51.
- Turner, J. W., and J. F. Kirkpatrick  
2002 "Effects of immunocontraception on population longevity and body condition in wild mares (*Equus caballus*)." *Reproduction Supplement* 60:187-195.
- Turner, J. W., K. M. Liu, and J. F. Kirkpatrick  
1992 "Remotely delivered immunocontraception in captive white-tailed deer." *Journal of Wildlife Management* 56:154-157.
- Turner, J. W., K. M. Liu, D. R. Flanagan, K. S. Bynum, and A. T. Rutberg  
2002 "Porcine zona pellucida (PZP) immunocontraception of wild horses (*Equus caballus*) in Nevada: a 10 year study." *Reproduction Supplement* 60:177-186.
- Turner, J. W., Jr., I. K. M. Liu, D. R. Flanagan, A. T. Rutberg, and J. F. Kirkpatrick  
2007 "Immunocontraception in Wild Horses: One Inoculation Provides Two Years of Infertility." *The Journal of Wildlife Management* 71:662-7.
- Turner, J. W., Jr., I. K. M. Liu, A. T. Rutberg, and J. F. Kirkpatrick  
1997 "Immunocontraception limits foal production in free-ranging feral horses in Nevada." *Journal of Wildlife Management* 61:873-880.
- Turner, J. W., A. T. Rutberg, R. E. Naugle, M. A. Kaur, D. R. Flanagan, H. J. Bertschinger, and I. K. M. Liu  
2008 "Controlled-release components of PZP contraceptive vaccine extend duration of infertility." *Wildlife Research* 35: 555-562.
- Underwood, H. B.  
2005 *White-tailed Deer Ecology and Management on Fire Island National Seashore*. National Park Service Technical Report NPS/NER/NRTR-2005/022. National Park Service, Washington D.C.
- U.S. Department of Agriculture (USDA)  
2008 GonaCon™ Birth Control for Deer: Questions and Answers. Animal and Plant Health Inspection Service, Wildlife Services. Fact Sheet. Available on the Internet at [http://www.aphis.usda.gov/wildlife\\_damage/nwrc/research/reproductive\\_control/content/faq\\_gonacon\\_bc\\_deer\\_08.pdf](http://www.aphis.usda.gov/wildlife_damage/nwrc/research/reproductive_control/content/faq_gonacon_bc_deer_08.pdf).

- Verdier, Y., G. Farre, N. Rouet, Z. Kele, T. Janaky, and F. Boue  
2005 "Identification of a new, testis-specific sperm antigen localized on the principal piece of the spermatozoa tail in the fox (*Vulpes vulpes*).” *Biology of Reproduction* 72:502-508.
- Vickery, B. H.  
1986 "Comparison of the potential for therapeutic utilities with gonadotropin-releasing hormone agonists and antagonists.” *Endocrine Review* 7:115-124.
- Vickery, B. H., G. I. McRae, W. Briones, A. Worden, R. Seidenberg, B. D. Schanbacher, and R. Falvo  
1984 "Effects of LHRH agonist analog upon sexual function in male dogs.” *Journal of Andrology* 5:28-42.
- Vickery, B. H., G. I. McRae, J. C. Goodpasture, and L. M. Sanders  
1989 "Use of potent LHRH analogues for chronic contraception and pregnancy termination in dogs.” *Journal of Reproduction and Fertility* 39:175-187.
- Von Berky, A. G., and W. L. Townsend  
1993 "The relationship between the prevalence of uterine lesions and the use of medroxyprogesterone acetate for canine population control.” *Australian Veterinary Journal* 70:449-250.
- Waddell, R. B., D. A. Osborn, R. J. Warren, J. C. Griffin, and D. J. Kesler  
2001 "Prostaglandin F<sub>2α</sub>-mediated fertility control in captive white-tailed deer.” *Wildlife Society Bulletin* 29:1067-1074.
- Walter, W. D., H. J. Kilpatrick, and M. A. Gregonis  
2003 "Does immunocontraception improve condition of free-ranging female white-tailed deer?” *Journal of Wildlife Management* 67:762-766.
- Walter, W. D., P. J. Perkins, A. T. Rutberg, and H. J. Kilpatrick  
2002a "Evaluation of immunocontraception in a free-ranging suburban white-tailed deer herd.” *Wildlife Society Bulletin* 30:186-192.
- 2002b "Evaluation of immunocontraceptive adjuvants, titers, and fecal pregnancy indicators in free-ranging white-tailed deer.” *Wildlife Society Bulletin* 30:908-914.
- Wang, M.  
no date Neutersol: intratesticular injection induces sterility in dogs. At:  
<http://www.neutersol.com/Study.htm> (accessed on June 22, 2005).
- Warren, R. J.  
2000 "Overview of Fertility Control in Urban Deer Management.” In Proceedings of the 2000 Annual Conference for the Society of Theriogenology, 2 December 2000, San Antonio, Texas, 237-46. Nashville, TN: Society for Theriogenology.
- Weikel Jr., J.H., and L.W. Nelson  
1977 "Problems in evaluating chronic toxicity of contraceptive steroids in dogs.” *Journal of Toxicology and Environmental Health* 3:167-177.

- White, L. M., R. J. Warren, and R. A. Fayrer-Hosken  
1994 "Levonorgestrel implants as a contraceptive in captive white-tailed deer." *Journal of Wildlife Diseases* 30:241-246.
- Yang, W. H., M. Wieczorck, M. C. Allen, and T. M. Nett  
2003 "Cytotoxic activity of gonadotropin-releasing hormone (GnRH)-pokeweed antiviral protein conjugates in cell lines expressing GnRH receptors." *Endocrinology* 144:1456-1463.
- Yoder, C. A., W. F. Andelt, L. A. Miller, J. J. Johnston, and M. J. Goodall  
2004 "Effectiveness of twenty, twenty-five diazacholesterol, avian gonadotropin-releasing hormone, and chicken riboflavin carrier protein for inhibiting reproduction in coturnix quail." *Poultry Science* 83:234-244.
- Zeng, W., S. Ghosh, Y. F. Lau, L. E. Brown, and D. C. Jackson  
2002 "Highly immunogenic and totally synthetic pipopeptides as self-adjuvanting immunocontraceptive vaccines." *Journal of Immunology* 169:4905-4912.
- Zeng, X. Y., J. A. Turkstra, R. H. Meloen, X. Y. Liu, F. Q. Chen, W. M. M. Schaaper, H. B. R. Oonk, D. Z. Guo, and D. F. M. van de Wiel  
2002a "Active immunization against gonadotropin-releasing hormone in Chinese male pigs: effects of dose on antibody titer, hormone levels and sexual development." *Animal Reproduction Science* 70:223-233.
- Zeng, X. Y., J. A. Turkstra, A. Tsigos, R. H. Meloen, X. Y. Liu, F. Q. Chen, W. M. M. Schaaper, H. B. Oonk, D. Z. Guo, and D. F. M. van de Weil  
2002b "Effects of active immunization against GnRH on serum LH, inhibin A, sexual development and growth rate in Chinese female pigs." *Theriogenology* 58:1315-132.
- Zimmerman, C.  
2009 Personal communication between Carl Zimmerman, Chief of Natural Resources, ASIS and Kristina Heister, Natural Resource Manager, VAFO on 2/19/2009 regarding use of fertility control at ASIS.

## APPENDIXES

This page intentionally left blank.