VIRGIN ISLANDS NATIONAL PARK

DRAFT
ENVIRONMENTAL ASSESSMENT

Sustained Reduction Plan
For
Non-native Wild Hogs
Within
Virgin Islands National Park

DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
SOUTHEAST REGION

OCTOBER 2002

This Draft Environmental Assessment (EA) evaluates impacts, alternatives and associated effects for control of non-native wild hogs within Virgin Islands National Park.

Comments and Availability

Comments on this Draft Sustained Reduction Plan for Non-native Wild Hogs Within Virgin Islands National Park Environmental Assessment should be postmarked by DECEMBER 2, 2002 and addressed to:

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The Draft EA is available for public review at the following locations:

Elaine I. Sprauve Public Library
St. John, VI

Enid M. Baa Public Library
St. Thomas, VI

VINP Visitor Center
Cruz Bay; St. John, VI

National Park Service Headquarters
Christiansted NHS; St. Croix, VI

The Draft EA may also be viewed at www.nps.gov/viis or www.friendsvinp.org. Printed copies of the Draft EA can be requested from the National Park Service at the address above; electronic copies can be requested by contacting Rafe_Boulon@nps.gov.

Important Notice. Reviewers should provide the National Park Service (NPS) with their comments during the review period for the Draft EA. This would allow NPS to analyze and respond to the comments at one time and to use information acquired in the preparation of a Final EA, thus avoiding undue delay in the decision-making process. Reviewers have an obligation to structure their participation in the National Environmental Policy Act process so that it is meaningful and alerts the agency to the reviewer's position and contentions. Vermont Yankee Nuclear Power Corp. vs. NRDC 435 U.S. 519.533 (1978). Environmental objections that could have been raised at the draft stage may be waived if not raised until after completion of the Final EA. City of Angoon vs. Hodel (9th Circuit, 1966) and Wisconsin Heritages, Inc. vs. Harris 490f. Supp. 1334, 1338 (E.D. Wis. 1980). Comments on the Draft EA should be specific and should address the adequacy of the analysis and the merits of the alternatives discussed (40 CFR 1503.3).

As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural and cultural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historic places, and providing for enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to assure that their development is in the best interests of all. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

SUMMARY OF THE
DRAFT ENVIRONMENTAL ASSESSMENT

Introduction

St. John Island, the smallest of the three U. S. Virgin Islands is located near the Tropic of Cancer in a group of islands known as the Lesser Antilles that separate the Caribbean Sea from the Atlantic Ocean, and lies 70 miles to the east of Puerto Rico. Virgin Islands National Park is located on the island of St. John. Within the Park, three plants and five animals are listed as endangered or threatened under the Endangered Species Act. Twenty-five of its plants and one of its animals are listed as threatened or endangered under the Virgin Islands Endangered and Indigenous Species Act of 1990. It is this uniqueness that makes St. John a bastion of biological diversity. To date, 22 recorded archeological sites associated with the Taino cultures have been located on St. John. A systematic and thorough archeological survey of the entire island, however, would result in the discovery of hundreds of additional sites. An estimated twenty- percent of the island is listed in the National Register of Historic Places for its archeological significance. Virgin Islands National Park was established in 1956 to protect and preserve these nationally significant resources.

Non-native, exotic species introduced to St. John Island throughout the last 500 years have caused extensive damage to the rich resources of the island. Without aggressive management actions to reverse the tide of degradation caused by introduced exotic animals and plants, the rare biological and archeological resources of St. John are in peril of being lost forever.

This primary restoration plan proposes actions to:

1) Substantially reduce non-native wild hogs within VINP;
2) Sustain a population near-zero through fencing, monitoring and periodic removal;
3) Promote the conservation and recovery of plant and animal species and habitat; and
4) Reduce disturbance of archeological resources.

Description of the Alternatives

Alternative 2 – Proposed Action: Reduce Wild Hogs Within VINP and Sustain a Near-zero Population

The program goals for the Proposed Action include:

1) Substantially decrease the wild hog population throughout the Park to a near-zero level; and
2) Monitor and remove hogs periodically, and maintain fences indefinitely.

Under this Alternative, the reduction program would occur in three phases:

1) Administration, infrastructure acquisition and fencing;
2) Collection using baits, traps, dogs and contract hunters; and
3) Monitor for and removal of immigrant wild hogs, education, record keeping and fence maintenance.

The proposed action would reduce ecosystem and archeological site disturbance and promote native species recovery. A population reduction effort by professional wildlife reduction experts through standard baiting, trapping and collection techniques would remove non-native wild hogs from Virgin Islands National Park. Long-term monitoring and maintenance would sustain a near zero population in watershed areas where eradication is unfeasible.

Alternative 1 – No Action: Maintain Current Level of Management.

Under this alternative, no reduction efforts would be used on the non-native wild hogs within the boundaries of Virgin Islands National Park. Their population numbers would continue to rise and fall with the seasonal and long-term availability of food resources. Hogs would continue to impact island vegetation and wildlife including endemic and Federally and Territorially listed plant and animal species.

If left unchecked, hog populations would be expected to increase throughout the Park. In 1998, hogs were found in two VINP watersheds, Reef and Lameshur. During the next three years they immigrated into the Cinnamon and Maho watersheds of the Park. By August 2002, hogs were found in Hawksnest, Caneel watersheds. From these new locations, hogs would readily move into adjacent watersheds, causing irreparable damage to sensitive natural and cultural resources. Hogs also pose serious threats to public health and safety. This alternative is inconsistent with Federal mandates to protect water, plant, animal and cultural resources, visitor safety, as well as similar Territorial regulations.

	Alternative 1 **A.1**	**Alternative 2** **A.2**
Alternative Features	**Wild Hogs Control** No Action	**Wild Hogs Control** Proposed Action: Trapping, Shooting and Fencing
Wild Hogs Reduction Goals	No reduction strategy would be implemented.	Substantially reduce hogs in Reef, Lameshur, Maho and Cinnamon watersheds. Monitor and remove immigrant hogs periodically.
Fence Construction	0 mile.	2 – 3 miles.
Duration of Program	0	1 year - planning, 2 – 3 years removal, monitor for and remove immigrant hogs; indefinitely.

Summary of Environmental Impacts

For each alternative action, the Park analyzed the potential environmental impacts that would likely occur. Environmental impacts were divided into the following categories: Native Plant Communities, Rare and Listed Plants and Animals, Non-native Plants, Native Island Fauna, Non-native Island Fauna, Soil and Water Resources, Cultural Resources, and Human Uses.

The Proposed Action is Alternative 2: Reduce Wild Hogs Within VINP and Sustain a Near-zero Population. This action would be accomplished through fencing, baiting, trapping, shooting and periodic hog removal. Under this alternative, there would possibly be minor short-term impacts to native flora, fauna, soils, waters, cultural resources, and human uses due to the activities associated with feral wild hog reduction. However, following initial reduction of non-native hogs, protection of irreplaceable Park resources would be immediate.

Native Plant Communities

Alternative 1 - Hogs would continue impacts on vegetation through rooting, accelerated soil erosion, seed dissemination, understory removal, exotic plant proliferation, and trail creation.

Alternative 2 - The reduction of hogs would have substantial positive effects on native plant communities.

Rare and Listed Plants and Animals

Alternative 1 - Non-native hogs would continue to impact all known populations of listed plant and animal species.

Alternative 2 - The three listed plant species and five listed animal species and numerous rare plants would all benefit from the reduction of hogs.

Non-native Plants

Alternative 1 - Non-native plants would continue to benefit from the ground disturbance activities of non-native hogs.

Alternative 2 – A large reduction of the hog population and their disturbances would substantially reduce long-term establishment and spread of non-native plants.

Native Island Fauna

Alternative 1 - Non-native hogs would continue to directly and indirectly impact native wildlife through destruction of habitat, predation, competition for food, and supporting enhanced populations of predators.

Alternative 2 - Hog reduction would remove direct competition and predation on many island animal species.

Non-native Island Fauna

Alternative 1 - Without reducing non-native hogs, their populations would continue to increase in the Park.

Alternative 2 – Within three years, hog populations would be reduced within the Park.

Soil and Water Resources

Alternative 1 - Non-native hog rooting and herbivory would continue to reduce plant cover and greatly increase soil erosion and sedimentation of ephemeral streams, saltponds and ocean runoff.

Alternative 2 - Reduction of hogs would greatly reduce soil disturbance, destruction of cryptobiotic crusts, and lessen soil erosion, ephemeral streams, saltponds and ocean sedimentation. Cyano-bacteria make up the majority of the micro-biotic crusts but lichens, mosses, green algae, micro-fungi and bacteria are present ad well.

Cultural Resources

Alternative 1 - Non-native hogs would continue to destroy irreplaceable archeological sites, historical resources and would very greatly degrade and destroy the scientific values of these sites.

Alternative 2 - A primary cause of impacts to archeological sites, hog populations would be greatly reduced in approximately three years.

Human Uses

Alternative 1 – All NPS areas prohibit hunting unless it is specifically authorized in the enabling legislation. Human uses would be unchanged under this alternative. The aesthetics of visits to the Park would be lessened due to reduction of native wildlife, reduction of plant cover, and destruction of archeological and historical sites. The scientific value of the natural and cultural resources of the Park would decrease. Hogs may occasionally be dangerous to people when using Park trails.

Alternative 2 - Visitor use and access would be limited in some areas while hog reduction occurs in selected areas. Reduction of hogs would improve Park aesthetics, scientific values of natural and cultural resources, and recreational opportunities. A small number of persons would have the opportunity to register as NPS Volunteers (VIP's) and participate on a restricted basis with the reduction program.

TABLE OF CONTENTS

SUMMARY 3

I. **CHAPTER I. PURPOSE AND NEED** 10

A. Introduction 10

B. Purpose and Need 10
1. Program Objectives: Park-wide Sustained Reduction 15

C. Park Location and Setting 15

II. CHAPTER II. DESCRIPTION OF THE ALTERNATIVES 18

A. Non-native Wild Hogs Control Alternatives 18

1. Non-native Wild Hogs Implementation Plan 18
   a. Fence Research Enclosures 18
   b. Fence Selected Areas of the Boundary 19
   c. Use of Local Field Volunteers 19
   d. Baiting 19
   e. Traps and Snares 20
   f. Animal Control Agents 20
   g. Tracking Dogs 21
   h. Chemical Restraint and Radio-telemetry 21
   i. Handling Captured Hogs 22
   j. Capture and Disposition of Non-native Wildlife 22
   k. Final Disposition 22
   l. Use of By-products 22
   m. Information and Education Actions 22
   n. Ecological Research and Monitoring 23

2. Alternatives Considered but Eliminated from Detailed Analysis 23
   a. Sequential Park-wide Reduction by Fenced-Zone Removal 23
   b. Live Capture of Non-native Hogs and Relocation to Another Island 25
   c. Use of Poison 25
   d. Use of Contraceptives or Sterilization 25
   e. Public Hunting on NPS Property 25
   f. Biological Controls 25

3. Alternative 1. No Action, Continue Current Level of Management 25
4. Alternative 2. Reduce Wild Hogs Within VINP and Sustain a Near-zero Population, Proposed Action 26

B. Environmentally Preferred Alternative 28

III. **CHAPTER III. AFFECTED ENVIRONMENT** 30

A. Natural Resources 30
Wetlands and Floodplains 30
Terrestrial Vegetation 31
Native Animals 32
Endangered and Threatened Animal Species 33
Threatened and Endangered Plant Species 34
Introduced Animals and Plants 35

B. Natural Resource Threats 37
Land Use and Boundary Issues 38
Visitation Issues 38
Threats to Endangered and Threatened Species 39
Non-native/Exotic Animal Impacts 40
Non-native Wild Hogs Impacts and Introductions 41
Biological Pollution (Exotic Plants) 46
Forest Recovery and Fragmentation 47
Garbage Disposal and Recycling 47

C. Cultural Resources 47
History 48
Archeological Sites 49
Historic Structures 50
Ethnographic Resources 52

IV. CHAPTER IV. ENVIRONMENTAL CONSEQUENCES 53

A. Non-native Wild Hogs Control Environmental Consequences 53

1. Alternative 1. No Action, Continue Current Level of Management 53
   a. Air Quality Impacts 53
   b. Scenic Values 53
   c. Cultural Resource Impacts 53
   d. Socioeconomic/Visitor Use Impacts 53
   e. Soil Impacts 54
   f. Threatened & Endangered Species Impacts 54
   g. Vegetation Impacts 55
   h. Wildlife Impacts 55
   i. Water Quality Impacts 56
   j. Wetland, Saltpond & Floodplain Impacts 56
   k. Park Operations Impacts 56
   l. Cumulative Impacts and Conclusions 56

2. Alternative 2. Reduce Wild Hogs Within VINP and Sustain a Near-zero Population, Proposed Action 57
   a. Air Quality Impacts 57
   b. Scenic Values 57
   c. Cultural Resource Impacts 58

d. Socioeconomic/Visitor Use Impacts 58
e. Soil Impacts 58
f. Threatened & Endangered Species Impacts 59
g. Vegetation Impacts 59
h. Wildlife Impacts 60
i. Water Quality Impacts 60
j. Wetland, Saltpond & Floodplain Impacts 60
k. Park Operations Impacts 61
l. Cumulative Impacts and Conclusions 61

B. Summary Table of Environmental Consequences 63

V. CHAPTER V. COMPLIANCE WITH ENVIRONMENTAL LAWS AND REGULATIONS 69

VI. CHAPTER VI. CONSULTATION AND COORDINATION 71

VII. CHAPTER VII. PLANNING TEAM / PREPARERS 73

IIIV. CHAPTER IIIV. REFERENCES CITED 74

IX. CHAPTER IX. APPENDICES 82

A. List of Endangered Plants and Animals of the U.S. Virgin Islands 83
B. List of Introduced Animals to St. John Island, U.S. Virgin Islands 86
C. Consultation Letter from U.S. Fish and Wildlife Service 87

LIST OF FIGURES

1. Location of St. John, U. S. Virgin Islands 17

LIST OF TABLES

1. Summary Table of Environmental Consequences 63

I. CHAPTER I. PURPOSE AND NEED

I.A. INTRODUCTION

The purpose of this document is to evaluate the short-and long-term environmental consequences of a control program for non-native Wild Hogs (*Sus scrofa*) within Virgin Islands National Park (VINP), St. John, U. S. Virgin Islands. NPS would also be implementing a non-native goat and sheep sustained reduction program (Sustained Reduction Plan for Non-native Goats and Sheep Within VINP EA, in preparation, NPS 2003) during the same time period.

Animals, which are introduced or released by humans, either wild (e.g. deer), or domestic (e.g. cats), are considered non-native by conservation biologists throughout the world. Exotics (e.g. deer) are generally more frightened of humans, while feral animals (e.g. burros) can be very friendly to people. Each of these species disrupts complex native ecological communities, jeopardize endangered and native plants and animals, and degrade natural habitats.

Seventy-five percent of St. John is within the authorized boundary of VINP; however, the Federal land comprises only 52 percent of the island. Therefore, approximately 25 percent of the land is privately owned within the Park boundary. Because fencing and gating the entire Park is financially and logistically unfeasible, complete removal of <u>any</u> of the 12 introduced mammals from the Park is unrealistic. The next-best alternative is to substantially reduce the populations of the most detrimental species and take ongoing actions to sustain the near zero or minimal populations.

As described in Section II.B, the National Park Service and the USDA APHIS Wildlife Services (WS) Division, as lead agencies would conduct the reduction of non-native hogs from VINP (Alternative 2). Each agency would have a Program Coordinator and this team would manage and supervise the program. The Virgin Islands Department of Planning and Natural Resources, Division of Fish and Wildlife (VIDPNR); and Virgin Islands Department of Economic Development and Agriculture (VIDEDA); would play an advisory role to plan and implement the reduction, mitigation and monitoring portions of the program.

All personnel involved with this program would follow the mitigation measures described in this document for the protection of resources. These actions have been determined to be the most successful actions available to abate on-going resource degradation and recover unique island resources.

The sustained population reduction effort would require the use of standard wildlife capture and removal methods including the possible use of fencing, baits, traps, snares, rifles, dogs and Judas hogs. The program goals include the reduction of hogs throughout the Park to zero or near zero, monitoring and periodic removal to sustain this reduction. National Park Service guidelines for compliance with the National Environmental Policy Act (NEPA) require an analysis of potential effects of this proposed activity on the affected environment. This Environmental Assessment reviews these potential impacts and the actions that would be taken to prevent or mitigate any adverse effects.

I.B. PURPOSE AND NEED

The purpose of the proposed action is to undertake a control program for non-native wild hogs within Virgin Islands National Park (the Park). By reducing their populations inside the Park, adverse impacts to

visitors, residents, natural, cultural and aquatic resources would decrease. Collectively, wild hog populations pose a very large threat to the native natural resources, long-term resource management programs of the Park, cultural resources, and visitor health and safety.

People have accidentally or intentionally introduced hundreds of non-native species into natural communities worldwide, and while many die out, some persist and become pests (Stone and Loope 1996). It is now widely accepted that the current rates of native species extinctions are dramatically higher than background rates; most current extinctions can be directly attributed to human activity. Human-caused extinctions can be roughly divided into four broad categories: non-sustainable use of resources, habitat destruction, pollution, and introduced non-native species (Soule 1990).

But, it is the introduced species that are responsible for 39% of all recorded animal extinctions since 1600 for which a cause could be attributed (Treshy and Croll 1994). Thus, some impacts of introduced species are irreversible and at least as devastating as the other categories. Once established, introduced species often become permanent unless intentionally removed (Treshy and Croll 1994).

Native wildlife, however, in island ecosystems are particularly vulnerable the impacts of introduced species. Of the 484 recorded animal extinctions since 1600, 75% have been island endemics. Introduced species were completely or partially responsible for 67% of these extinctions (based on the 147 island species for which the cause of extinction is known, calculated from the World Conservation Monitoring Centre 1992).

Islands are important for the conservation of biodiversity for four reasons: 1) a large percentage of their biota are endemic species and subspecies; 2) they are important breeding areas for seabirds, pinnipeds, and sea turtles, which forage over thousands of square kilometers of ocean but are dependent on relatively small amounts of protected land on islands for breeding and nesting; 3) many islands are sparsely inhabited or uninhabited by humans, keeping socioeconomic costs of protection low; 4) the species and ecological communities on islands have evolved in natural fragments, making them less susceptible than continental species to the problems of habitat fragmentation caused by small reserve size. Therefore, by restoring and protecting islands, functioning unmanaged ecosystems can be maintained without large expenditures or significant conflict with local human populations (Treshy and Croll 1994).

Because the Park boundary is entirely inter-mixed with private or territorial lands, both small and medium-sized mammals readily enter from adjacent lands and establish breeding populations. Also, dozens of private inholdings exist within the boundary throughout the Park. For these reasons, the permanent elimination (eradication) of non-native wild hogs from the Park would be very difficult.

The National Park Service Organic Act (16 U.S.C. 1 *et seq* [1988], August 25, 1916, sc. 408, 39 Stat. 535) mandates the parks to "conserve the scenery and the natural and historic objects and the wildlife therein…{to} leave them unimpaired for the enjoyment of future generations." Changes to the natural communities from human actions in the parks, including the continuous and unabated invasion of exotic and feral species, are contrary to the intentions of the Act. The Redwoods Act of 1978 (16 U.S.C. 1a-1) reaffirms this principle. In general, these two statutes confer upon the Secretary of the Interior the discretion to determine how best to protect and preserve park resources. Additionally, the NPS Organic Act, especially 16 U.S.C. 3, authorizes the Secretary of the Interior to destroy animals that may be detrimental to parks; therefore comprehensive control of exotics and their effects in the NPS is therefore incumbent on the agency.

NPS Natural Resources Management Guidelines (1991, Chapter 2, Page 286) require that for each exotic or non-native species present within a National Park Service unit, an individual management and

monitoring program be tailored to the particular park setting. This program includes a species evaluation, development of an information base, monitoring, initiation of management action, and establishment of an institutionalized follow-up program.

NPS is mandated to control/remove animals that are determined to be injurious to native flora and fauna. Management of populations of exotic plant and animal species, up to and including eradication, would be undertaken whenever such species threaten Park resources or public health. High priority would be given to the management of exotic species that have a substantial impact on Park resources and that can be expected to be successfully controlled (NPS Natural Resources Management Guideline 1991, Chapter 2, Page 286).

National Park Service is required to identify and promote the conservation of all Federally listed threatened, endangered, or candidate species within park boundaries and their critical habitats. The National Park Service is also required to protect all state and locally listed threatened, endangered, rare, declining, sensitive, or candidate species that are native to and present in the parks, and their critical habitats. All management actions for protection and perpetuation of special status species would be determined through the Park's Resource Management Plan (NPS Management Policies 2001, Chapter 4, and Page 11; and NPS 1999). Management and monitoring programs should be coordinated with other state and Federal agencies.

Guidelines for management of species Federally listed as threatened, endangered or candidates for listing are found in NPS Management Policies and Natural Resources Management Guidelines, National Park Service Management Policies (NPS 2001) and guidelines for natural resources management (NPS 1991) establish the affirmative responsibility of NPS, and the individual Park, for managing both listed and candidate species. They also stress that management actions should emphasize removal of threats, but also active recovery efforts and that management should be done in an ecosystem context.

The Endangered Species Act (ESA) requires that actions authorized, funded or carried out by Federal agencies not jeopardize the continued existence of listed species. Under section 7(a)(2) of the ESA (16 USC section 1536), Federal agencies are required to consult with the U. S. Fish and Wildlife Service (USFWS) on actions which may affect listed species or critical habitat. Because this primary restoration plan proposes actions that may affect the 2 Federally listed plant species and 5 Federally listed wildlife species on St. John Island, NPS would consult with USFWS on likely effects to those species (Appendices A and C). The St. Thomas Lidflower and Prickly-ash Recovery Plans stipulate that rooting and grazing by non-native wild hogs were a factor in the decline of each of these species and should be removed from the island to prevent continuing habitat degradation on St. John (USFWS 1988). Hogs also depredate one Territorially Endangered animal species, the Slipperyback Skink, an endemic to the Park. Other Territorial Endangered species include ground-nesting species such as Bridled Quail Dove, Bahama Pintail Duck and West Indian Nighthawk, all of which suffer egg and chick depredation due to hogs.

National Park Service management also seeks to preserve and foster appreciation of cultural resources in NPS's custody through appropriate programs of research, treatment, protection, and interpretation (NPS 2001). Guidance for cultural resources management in NPS units is found in National Park Service Management Policies (NPS 2001) and Cultural Resources Management Guidelines (NPS-28). Management of cultural resources in NPS units is subject to the provisions of the National Historic Preservation Act (16 USC 470 *et seq*.), the National Environmental Policy Act (42 USC 4371 *et seq*.), the American Indian Religious Freedom Act (42 USC 1996), the Advisory Council on Historic Preservation's regulation regarding "Protection of Historic Properties" (36 CFR 800), the Secretary of the Interior's "Standards and Guidelines for Archeology and Historic Preservation (FR 48:44716-40) and "Federal Agency Responsibilities under Section 110 of the National Historic Preservation Act" (FR 53:4727-460.

With the exception of bats, the Virgin Islands National Park is presently inhabited by numerous species of non-native mammals that have produced severe impacts on many indigenous species of plants and animals and threats to visitor safety (Appendix B). Feral or wild mammals include the whitetail deer, burro, wild hog, domestic goat, domestic cow, domestic sheep, European boar, West Indian mongoose, tree rat, Norway rat and domestic cat, domestic dog and house mouse. Some of these species also threaten visitor experience and safety. With the possible exception of deer, increasing populations of these species are seriously affecting native species of plants and animals. Additionally, introduced species of birds, amphibians, reptiles, insects and plants are impacting the fragile environment (see Appendix B, List of Introduced Animals to St. John Island).

Non-native domestic hogs (Sus *scrofa)* are an ungulate species not native to North America or South America. The term "non-native hog" refers to domestic hogs that escape to survive in the wild, as well as their progeny. Christopher Columbus first introduced European hogs into the West Indies in 1493. The Danes brought wild hogs to St. John in 1718 when they colonized the island. Wild hogs have established breeding populations in many areas and all habitat types of the Virgin Islands National Park. Currently in St. John, hogs are predominately owned by one landowner adjacent to Centerline Road near Cruz Bay. These hogs are not fenced off, so animals periodically wander into surrounding areas, including National Park lands, and became feral.

The total non-native wild hog population on St, John is known to oscillate widely between climatic episodes. During drought years, hog numbers have been estimated to be between 200 and 300. Under normal rainfall years, numbers have been estimated to be as high as 800 animals; which impact approximately 55% of Virgin Islands National Park. The proposed action is intended to address the potential for hogs spreading into new areas, especially now that several populations are established on the northern portion of the Park, mitigating current impacts, and sustaining a near-zero population to limit future impacts.

Wild hogs have thrived in Reef and to a smaller degree in Lameshur watersheds since the Park was established. The suspected origin into the Park was the Susannaberg area near the Public Works facility, where even now hogs wander up Centerline Road and migrate down the L'Esperance Trail into Reef Bay. While wild hogs have established breeding populations in these areas, none occurred elsewhere in the Park.

Currently, wild hogs inhabit four Park watersheds. The success of the wild hogs in populating the Park can be attributed to the lack of natural predators, the prolific reproductive nature of the species, and the fact that they are opportunistic omnivores. There are no practical methods to census wild hogs and the population can fluctuate drastically with available food resources.

The effects of wild hogs on park resources are multifaceted and result from their movements, habitat utilization and food habits. Of greatest concern are the destructive effects hogs have on natural ecosystems and native components of those ecosystems. Hog rooting behavior profoundly disrupts natural communities, individual species populations, forest successional patterns and forest nutrient cycles. Rooting adjacent to small streams and springs often results in high rates of soil erosion, which severely affects aquatic habitats. Rooting and wallowing by hogs detrimentally affect the aesthetic and wilderness values of the Park.

Wild hogs have both direct and indirect effects on the flora of the Park. A variety of plant species, including some that are rare, threatened, endangered or endemic to St. John Island are eaten, trampled or uprooted by hogs. Hog rooting in dry evergreen woodlands, dry evergreen scrub, thorn and cactus scrub, moist forest formations, early successional vegetation, and coastal wetlands may reduce understory cover

by as much as 95 percent of normal ground density, resulting in changes in forest structure and composition.

Wild hogs negatively affect the fauna of the Park through predation, habitat alteration and competition for food. Hogs may prey upon one Territorially endangered and threatened animal species, the Slipperyback Skink (*Mabuya mabouia*). Areas uprooted by hogs undergo notable declines in small mammal and reptile populations (Singer *et. al*. 1982). Wild hogs are in direct competition with other animals for insects, earthworms and other invertebrates and compete with native species for other available food resources. Hogs may consume the eggs, chicks and adults of such Territorially endangered species as the Bridled Quail Dove, Bahama Pintail Duck, and the West Indian Nighthawk.

All Federally and territorially listed species require some level of protection and monitoring (see Appendix A, List of Endangered Plants and Animals of the U.S. Virgin Islands). Wild hogs and European boar are seriously threatening the sole, small remaining populations of the Endangered St. Thomas Lidflower (*Calyptranthes thomasianum*) and Marron Bacora (*Solanum conocarpum)*, which has been proposed for listing. Rooting and grazing by hogs was a factor in the decline of these species. Non-native hogs potentially impact twenty-five territorially threatened and endangered listed plant species.

Wild hogs also serve as co-hosts with native wildlife and livestock for infectious and parasitic diseases. Hog cholera, swine brucellosis, trichinosis, foot and mouth disease, African swine fever, and pseudo-rabies are all diseases that may be transmitted from wild hogs to livestock. A variety of arthropod, protozoans, helmith parasites also have been found from the Park, including, ticks, lice, protozoa, kidney worms, esophageal worms, stomach worms, intestinal worms, and lungworms which are common parasites for both wild and domestic swine.

St. John Island contains a rich archeological record of the Taino Indian culture contained in 22 recorded sites, with the earliest human occupations dating nearly 4,000 years ago. A systematic and thorough archeological survey of the entire island, however, would result in the discovery of hundreds of additional sites. Sites range from isolated artifacts to huge, stratified sites spanning a period of 4,000 years. The large number, diversity and relatively undisturbed nature of the island sites provide excellent research opportunities for archeological investigations into human adaptation in a context of changing environments and cultural conditions. Wild hog rooting has damaged a number of island sites, such as Cinnamon and Reef bays. Hog rooting to a depth of three feet has been noted in a number of sites.

Hog rooting in the upper layers of deeper, more complex stratified sites profoundly disturbs time and spatial relationships and destroys the context of the information contained in these sites. Continued hog rooting of archeological sites on the island would result in the loss of integrity, and ultimately loss of the values which make the St. John Island archeological sites eligible for inclusion in the National Register of Historic Places.

The long history of grazing by non-native ungulates has greatly accelerated erosion of soils on St. John. Large areas have been denuded of vegetation and are eroded down to bedrock. Rooting by hogs exposes substantial sections of land to erosion by water and wind. Erosion and rooting cause disturbance to archeological sites that have long been protected by vegetation.

The NPS officially curtailed illegal hog hunting in the late 1980's. Within about 3 years, interpreters and visitors began to complain about "hog harassment" along the popular Reef Bay Trail. By 1995, extensive damage from hog rooting had occurred along much of the 1.5-mile trail. Also by this time, many animals were observed at the Virgin Islands Environmental Resource Station facility, where hogs used to be very rare.

The Virgin Islands National Park General Management Plan (1983) and Resources Management Plan (1999) identified the need to remove non-native animals and exotic pests from St. John Island. The objectives for management of non-native wild hogs within Virgin Islands National Park, include:

1. Protect the native species and natural processes of the Park ecosystem by reducing the impacts of wild hogs on these species and processes.

2. Protect critical habitat of rare, endangered, and endemic species, and reduce wild hog impacts on identified areas that are particularly vulnerable to grazing and rooting.

3. Protect rare, endangered and endemic species, which are presently or potentially impacted by activities of wild hogs.

4. Ensure the opportunity for visitor experience of undisturbed natural processes by reducing the effects of wild hog activity upon aesthetic and wilderness values of the Park.

5. Protect public health by monitoring wild hog populations and individual animals for possible diseases communicable to humans, livestock or wildlife.

6. Minimize adverse effects of wild hogs, and control methods upon resources adjacent to the Park.

7. Conserve archeological sites threatened by accelerated erosion by wild hog rooting.

8. Initiate conservation and restoration of soil resources damaged by the activities of wild hogs.

9. Control and reduce the spread of invasive, non-native weeds caused by the activities of wild hogs.

I.C. PARK LOCATION AND SETTING

Virgin Islands National Park is located near the Tropic of Cancer in a group of small islands known as the Lesser Antilles that separate the Caribbean Sea from the Atlantic Ocean. The most northwesterly of this clustered island chain are the Virgin Islands of the United States and Great Britain, and approximately 113 kilometers (70 miles) to the west, the U. S. Commonwealth of Puerto Rico. The U.S. Virgin Islands, made up of three main islands and 57 smaller, mostly uninhabited islands and cays, are found near the crossing of 18 degrees north latitude and 64.5 degrees west longitude. The island of St. John (52 square kilometers or 20 square miles) is the smallest and least developed of the three main U.S. owned Virgin Islands. St. Croix (218 square kilometers or 84 square miles) lies approximately 64 kilometers (40 miles) to the south of St. John, and St. Thomas (83 square kilometers or 32 square miles), lies about 4 kilometers (2.5 miles) to the west.

Virgin Islands National Park comprises over half (2,816 hectares or approximately 10 square miles) of the island of St. John. Established in 1956, the park was expanded in 1962 to encompass 2, 287 hectares (8.7 square miles) of the surrounding waters. Of the NPS land on St. John, either private interests or the Virgin Islands government owns three square miles. In 1978, Congress authorized the addition of approximately 135 acres on Hassel Island in the Charlotte Amalie harbor, St. Thomas to the Park. The NPS has acquired most of the land on Hassel Island and has limited first right to match any offers on most

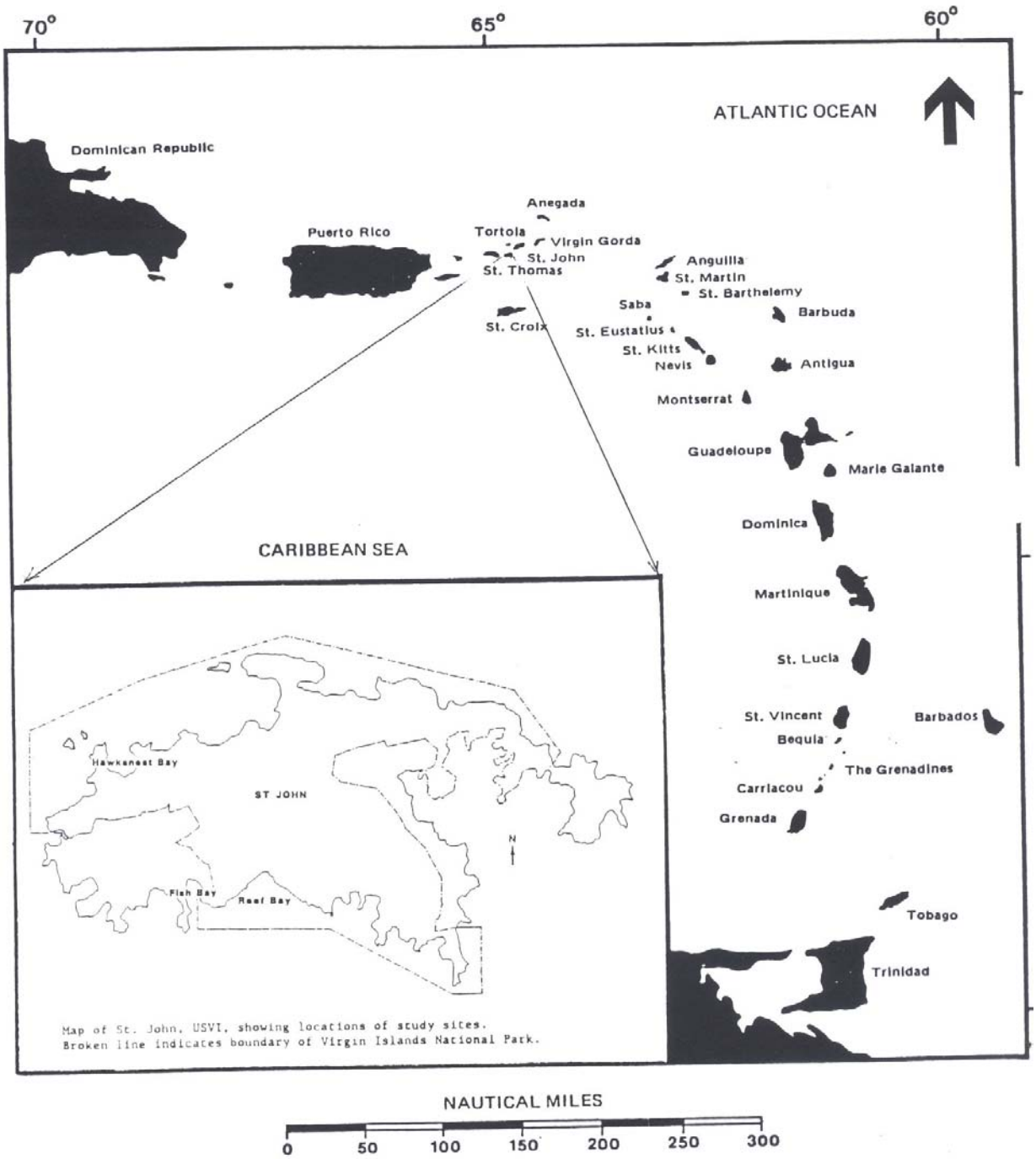
of the remaining private properties. The Virgin Islands government also owns lands on Hassel Island. Also, on St. Thomas, approximately 15 acres in the Red Hook area are under park jurisdiction and, until recently, served as the Park's administrative headquarters; and approximately five acres at Wintberg for administrative purposes.

Because of its internationally significant natural resources, Virgin Islands National Park was designated an international biosphere reserve in 1976 and is one of the few biosphere reserves that has both marine and terrestrial resources. The Park was included in the United Nation's Biosphere Reserve System as a representative example of Lesser Antillean cultural and natural ecosystems.

Virgin Islands National Park contains examples of most tropical Atlantic terrestrial, coastal and marine ecosystems. These include various examples of subtropical dry to moist forest, salt ponds, beaches, mangroves, seagrass beds, corral reefs and algal plains. Terrestrial topography is quite dramatic with average slopes being 30 percent. The highest mountain peak plunges sharply to the sea over a distance of three-quarters of a mile. Rock petroglyphs, middens and three settlements are several of the remains of prehistoric cultures found to date. European settlement patterns and plantations systems significantly altered St. John's biology and ecology by removing native forests, building structures, terraces, rock walls and roads, and importing vegetation and mammals. The plantation settlements took advantage of the labor of enslaved Africans. The last four decades have brought considerable change on St. John through the development of vehicular transportation and roads, resorts, and other tourist facilities.

In terms of visitor attractions, scenery, spectacular marine gardens and beaches are probably the most significant features of Virgin Islands National Park. However, there are an estimated 250 historic structures within the Park, most of them remnants of the Danish sugar plantation era, which are increasingly popular with visitors. Over the past ten years, visitation to the Park has averaged approximately 942,800 persons annually.

Figure 1. Location of St. John, U. S. Virgin Islands



II. CHAPTER II. DESCRIPTION OF THE ALTERNATIVES

The National Environmental Policy Act (NEPA) requires that a reasonable range of alternatives be developed to provide decision-makers and the public with a clear basis for choice (*40 CFR 1502.14*). Case law has determined that reasonable alternatives include those that are technically and economically practicable and feasible, using common sense, rather than those that are simply desirable (*46 CFR 18027*, *Forty Most Asked Questions Concerning CEQ's NEPA Regulations*).

The alternatives detailed below were developed to focus on issues identified by resource specialists with the NPS, wild hog eradication experts and other control experts, government regulatory agencies, and the public.

This chapter describes the alternatives that were analyzed in this environmental assessment for reduction of non-native wild hogs within Virgin Islands National Park. Following a brief description of control techniques, the alternatives for wild hogs are (1) no action, and (2) reduce wild hogs within VINP and sustain a near-zero population, proposed action. The action would be accomplished through fencing, baiting, trapping, shooting and periodic hog removal. The description of the environmentally preferred alternative is located in the document after Alternative 2.

As required by NEPA, Alternative 1 is included as a "No Action" alternative, serving as benchmarks against which other action alternatives can be compared. This alternative represents the state of the management of these non-native wildlife populations within Virgin Islands NP now.

II.A. Non-native Wild Hogs Control Alternatives

II.A.1. Non-native Wild Hogs Implementation Plan

This section describes available control and related techniques and methodologies for non-native wild hog control in the Park, including fencing, shooting, baiting, trapping, snaring, dogs, chemical restraint and radio-telemetry. Limited use of field volunteers for hog collection is addressed. Final disposition of collected animals including land burial and charitable meat donation are included. The section concludes with a section describing public outreach, information and education. The term collect as used in this document refers to a captured or dispatched animal.

Fence Research Enclosures

Fencing is economical for small areas and, therefore, is directed toward fragile or unique habitats within the Park. Currently, 26 special protection areas in VINP have been identified and remain unfenced. A network of long-term ecological monitoring plots, representing a range of stand ages and land-use histories, has now been established in each of the following forest types on the island: upland moist, gallery moist, dry evergreen woodland and dry evergreen scrubland. Peter Weaver has established 16 plots in the dry evergreen and moist forest of the Cinnamon Bay watershed; the New York Botanical Garden has three plots covering upland moist, gallery moist and dry evergreen woodland; and the Smithsonian has two plots covering dry evergreen woodland and dry evergreen scrubland. In addition, the USDA-NRCS has five long-term plots in the Lameshur and Cinnamon Bay watersheds to measure soil temperature and moisture. Information on forest regeneration, tree seedling growth, changes of

species composition and forest structure are gathered by researchers through Memorandums of Understanding, Cooperative Agreements and direct National Park Service funding.

Fencing of these areas would provide an immediate protection solution and must be maintained to prevent hog encroachments. Other endangered, rare or unique concentrations of plants or animals would be identified for protection as warranted. The need for special protection fencing is dependent upon:

1. accurate identification and location of resources requiring protection
2. installation damage must be less than hog damage,
3. non-target wildlife movement must be unimpeded, and
4. maintenance must be guaranteed.

Fencing would be constructed from vinyl-coated galvanized chain-link fence with 7-foot metal spade posts manually driven 2 – 3 feet into the substrate and appropriately spaced. Diagonals near gates would provide stability and the use of cement would be none to minimal.

Fence Selected Areas of the Boundary

Ungulate-proof fences would be considered for installation to restrict their access to parklands immediately adjacent to Herman Farm, L' Esperance and Catherineberg. Where necessary restricted-access, ungulate-proof gates would be installed and maintained. The opportunity would be used to collect subsurface archeological information on a relatively systematic basis by mapping and shovel-testing the post holes as they are dug and before the posts have been inserted. Access to VINP gates are controlled through the Law Enforcement Division.

Use of Local Field Volunteers

The Volunteers-In Parks (VIP) program would possibly be used to involve a limited number of residents to share their knowledge and hunting skills and labor to assist with specific hog collection activities. Local knowledge would be gathered from island residents regarding trap design and manufacture and placement, seasonality, timing and bait choice. This program responds to a cultural tradition that includes a long history of hogs on the island and what is known archaeologically about enslaved Afro-Americans, and others, supplementing their diets (at least in some areas of the Americas) through hunting, fishing, and trapping.

VIP's authorized by VINP would participate under the exclusive direction and authority of the Park Superintendent (or his designee); such VIP's would be prohibited from using firearms and must participate within the strict guidelines established by the NPS and USDA Program Coordinators.

Baiting

Baiting would take place with careful monitoring to ensure consumption by target species. Various small bait stations would be established in each of the four watersheds: Maho, Reef, Lameshur and Cinnamon. They may or may not operate concurrently depending on available personnel and climatic conditions. Temporary bait stations would be initially established within or near areas of high hog concentrations as determined by track and scat data. No specific bait is considered ideal for wild hogs; therefore, traps would be initially baited with shelled corn, although other baits may be tested. Water may be considered for use as part of the bait scheme. As animal concentrations change and move within a watershed, bait station locations would also change. Because hogs are very mobile between wet and dry seasons we anticipate the use of relatively mobile bait stations. Hogs would not bait into an area but with bait, they may become concentrated in an area.

During the bait station acclimation period, scat and track analysis would allow field personnel to estimate the population size using the bait station. As animals are removed from the surrounding area, those numbers could be compared with the initial population estimate to determine and approximate reduction percentage for the general area. Careful data gathering and record keeping would be supplemented with photography.

Traps and Snares

Initially, traps and snares represent the highest number of animals collected for the least amount of human effort. Therefore, a few different models or techniques would be employed to collect hogs, including single and multiple (corral) live traps, drop nets, and snares. Trap success is a function of natural food availability, environmental conditions, hog densities and distribution, trap placement, trap design, age and previous trapping activity (Fox and Pelton 1977). Portable, chain-link single-catch traps have been the most practical and efficient traps for capturing wild hogs in many areas. These may be constructed for remote use in this program, in addition to the multiple-catch corral trap envisioned to capture the majority of trapped hogs in this program. Live-capture traps may be assembled in the field and dismantled for movement to a new site. While live capture traps are more expensive to obtain and use, they are preferred over kill traps.

Guidelines for trapping wild hogs include:

1. Trap inspection within 12 hours minimum,
2. Trap placement remote from visitors (when possible),
3. Plot trap locations on topographic maps using global positioning system (GPS),
4. Carcass disposition away from visitor access areas, and
5. Coordinate trapping efforts through the Resource Management office.

Rigid, heavy gauge welded wire panels measuring 4 x 8 feet would be wired together and fastened to an independent, one-way door. Three panels form a triangular corral trap capable of holding several animals.

Although trapping is an effective method of control and can account for the majority of hogs removed from a Park, it has some limitations. For example, some animals may be "trap shy" and may not enter traps regardless of bait type or trap location. In addition, it is difficult to transport traps to some areas of the Park due to the remote and rugged terrain or without causing serious impacts to designated natural areas. Finally, in terms of man-hours, trapping is very labor-intensive. Therefore, the most cost-effective method for controlling wild hogs in the Park is a combination of trapping and shooting.

Live traps and snares would be used in conjunction with as well as independent of bait stations. Traps and snares would be inspected at maximum 12-hour intervals. Initial trapping typically yield the highest ratio of animals collected over time, and this drops over time until the program is no longer cost effective.

Neck snares would be constructed using slip-wire and secured close to the ground along established corridors frequented by hogs and remote from human activity. Wildlife conservationists consider these to be live traps for virtually all targeted wildlife captured. However, white-tailed deer sometimes behave erratically and may readily suffocate and quickly (and humanely) die. Capture and disposition of nontarget wildlife is addressed in a separate section below.

Animal Control Agents

Wild hogs would be collected from lands within or immediately adjacent to four Park watersheds: Maho, Reef, Lameshur and Cinnamon. However, hogs would possibly be collected from any Federally owned land within the authorized Park boundary.

Trained and certified animal control agents would collect wild hogs on the ground or from temporary tree stands, with the possible use of the techniques and technologies described below. USDA APHIS and NPS personnel would be qualified and certified for the centerfire rifle used to dispatch hogs. Firearms used for this program would be equipped with telescopic scopes and silenced muzzles; their use would be restricted to NPS property. Transportation of field personnel may include trucks, jeeps, horses, all terrain vehicles and boats. Temporary tent camps may be established in remote areas

All wildlife collection operations would be closely coordinated with Law Enforcement, Interpretation Rangers, and Maintenance personnel to ensure maximum safety to residents and visitors. Direct reduction activities would be well organized by NPS and USDA Program Coordinators. NPS law enforcement personnel and others would ensure proper closure and visitor clearance from each area. Personnel safety would be of greatest concern at all times. Each team would be equipped with both a two-way radio and cellular telephone linked through the newly renovated VINP radio system. A full-time NPS dispatcher would ensure smooth communication between all field personnel.

Tracking Dogs

Use of well-trained and experienced tracking dogs can be extremely cost effective when seeking to remove a small number of remaining, trap-shy individuals. Use of dogs would be considered for humanely collecting individuals where other alternatives have failed. The removal of every possible hog from remote densely vegetated locations would possibly require the use of trained tracking dogs. These specialized animals would be brought in from the U.S. mainland and maintained under strict control at all times. Dogs would be under the control and guidance of USDA Program Coordinators and visitor safety would be foremost in all operations.

Chemical Restraint and Radio-telemetry

Because hogs are highly social animals, an animal equipped with a radio transmitter can lead field personnel to remote locations where hogs congregate (White and Garrott 1990). This method of locating animal concentrations in steep slopes and dense underbrush can be an effective means to collect exotic hogs. Hogs used in this fashion are called Judas hogs. Before fitting an adult hog with a radio transmitter, the animal must first be captured and restrained through injection of chemical sedatives. The fastest, safest and most humane method to restrain hogs for attaching a radio collar is through chemical restraint. Standard large-animal restraint drugs would be used to temporarily sedate trapped wild hogs USDA APHIS personnel have extensive training in the preparation and use of chemical restraint and immobilization drugs for large (and small) animals throughout North America (Kreeger 1997). Their experience includes many successful wild hog reduction programs.

Telazol is a combination of tiletamine and zolazepam and would be used in conjunction with rompun to reduce nausea (Kreeger 1997). Swine are particularly susceptible to overheating and would be kept in the shade with provisions for wetting them down as necessary (IWVS, 1991) Intramuscular Telazol injections would be administered by either a jab stick, blow gun or CO2 pistol to captive individuals in corral or box traps. Fewer than five hogs would be collared in each watershed. Immobilization drugs and drug delivery equipment would be restricted to employees responsible for hog management under the direct field supervision of the Program Coordinators. These employees must have completed a Wildlife Immobilization Practitioner Course as required by NPS-77. Immobilization drugs would be stored in a locked safe and records would be maintained to include the date, amount used, purpose, and signature of the user. Since Telazol and Ketamine are listed as a Class II substances, all guidelines for use and storage specified by the Drug Enforcement Administration would be followed (Fowler 1978). Radio-collared animals would be monitored at least twice a year to detect and remove ingress animals into the control units (Hegdal and Colvin 1986; Kurz and Marchinton 1972; Kreeger 1997). At the very end of the control program, the Judas hogs may be neutralized.

Handling Captured Hogs
The principle weapon of the hog is teeth. Immature hogs have sharp, needle-like deciduous teeth that inflict nasty wounds that are septic and serious. Adult swine tear flesh easily. They have extremely strong jaws capable of crushing bones. Boars also develop elongated canine teeth called tusks, which are fearsome weapons capable of disemboweling a horse and certainly a person. The sow with a litter is a formidable, menacing animal and should be approached with caution (Fowler 1978).

It is impossible to safely and humanely handle an unrestrained hog in a large enclosure, whether adult or immature, without a squeeze chute or chemical sedatives. The hog is moved into a small pen by driving, or enticing it into the small enclosure with feed, either individually or as a group (Birmingham 1983).

Capture and Disposition of Non-target Wildlife
The live capture and snare traps proposed for use in this program are relatively species specific. Moreover, they are widely considered live traps, which means the majority of trapped animals and especially the targeted species, are found alive. These methods are more expensive to obtain and use, but are preferred over leg snares or kill traps, because they are more humane when used properly. The nontarget wildlife that might become incidental targets includes the following non-native species: white-tailed deer, goats, sheep and burros. These four exotic species have been selected for extensive population reduction programs, albeit their NEPA compliance documentation has only recently began. Nevertheless, few if any of these species are expected to be found in the traps or snares. Capture of burros would be extremely rare and those would be released. Other non-native species would be humanely collected.

Final Disposition
Biological data would be collected on all captured hogs. Collected hogs would be humanely euthanized and disposed of by burying in a shallow grave or donated to a public agency. Burial would occur in a shallow grave at least 50 yards from streams, visitor access areas, trails, roads, or buildings, and may include a small portion of lime. Lime accelerates the rate of decomposition in the warm, moist subtropical weather. A 300-pound carcass often completely decomposes within 10 days. These opportunities would be permitted, scheduled and controlled through the Program Coordinators.

Use of By-products
Financially and logistically, neither the Park nor Territorial wildlife agencies have sufficient resources to transport live or dead hogs across rough terrain or through dense vegetation for any large distance. Therefore, hogs trapped in backcountry areas would be humanely euthanized and expeditiously buried on land. Persons participating as Volunteer-In Park's would possibly have an opportunity to keep a collected animal for consumption.

Information and Education Actions
Public awareness regarding the wild hog reduction program would be promoted whenever possible. NPS and USDA personnel would work with community leaders in an effort to maintain communication avenues and resolve any problems.

There is also a need to convey information regarding wild hog management to Park visitors. Many visitors are unaware that wild hogs occur in the Park, nor do they realize the devastating impact hogs have on the ecosystems of the Park. Information and presentations in the form of posters, articles in the Park newspaper, bulletin board fliers, exhibits, signs, brochures, and slide and video programs would be used to address wild hog biology and management.

Need to continually work with hog owners to keep hogs at home; perhaps assist with the control program implementation.

Ecological Research and Monitoring

Monitoring and assessment of key ecosystem components is an action that is included in Alternative 2. Pre-reduction surveys for baseline data of hog damage would be conducted. Post-reduction surveys of affected areas would be conducted in order to measure reduction in damage due to the control of non-native hogs.

During the bait station acclimation period, scat and track analysis would allow field personnel to estimate the population size using the bait station. As animals are removed from the surrounding area, those numbers could be compared with the initial population estimate to determine and approximate reduction percentage for the general area. Careful data gathering and record keeping would be supplemented with photography.

Research efforts would concentrate on the natural history, population dynamics, and impacts of wild hogs on the Park ecosystem. Some disease and parasitism investigations would also be carried out. Research relating to wild hogs would provide information useful in refining control techniques, population censusing, and habitat utilization modeling (Brisbin and Mayer 2001).

II.A.2. Alternatives Considered but Eliminated from Detailed Analysis

Sequential Park-wide Reduction by Fenced-Zone-Removal (Install Ungulate-proof Fences on Parklands and Reduce Wild Hogs within the Fenced Areas). One method used to prevent re-colonization of Parklands by wild hogs is to construct permanent barriers to their dispersal. This method is practiced where eradication is the objective. The method requires fencing small areas and eliminating animals from within the fenced enclosure. Exclosures without hogs are joined to create larger hog-free areas. This measure, although effective, would be impractical and unfeasible to implement on St. John for many reasons. The primary reasons why this method is entirely impractical are cost, boundary surveys, cultural impact mitigation, archaeology inventories and data recovery, resident and visitor access, maintenance, and delay of available funds. Finally, the method would take over ten years to implement and could be entirely compromised by the introduction of a single pregnant sow. The method would be most effective in areas with few inholdings, a clear boundary, limited access and substantial financial and maintenance resources.

Initially, the Park would be required to request funds by line item, which is a ten-year cycle. Next, several hundred thousand dollars would be required for an updated boundary survey. Then, extensive archaeological surveys and data collection would need to be conducted. The terrain on St. John is very rugged, which greatly increases the expense and difficulty associated with construction and maintenance of fences. Several hundred inholdings within the authorized boundary would substantially increase the amount of fencing, and gates required to guard against private livestock escaping into Park lands from within or adjacent areas. The aquatic boundary alone is approximately 75 miles. Maintenance and financial costs and access considerations negate this option from consideration.

Once the fences and gates were erected, however, and adequately maintained and the animals removed, this alternative is the most effective in assuring that the Park remains protected from large non-native animals. This is important if the public fails to restrain their livestock to their private lands. Fences would be constructed to exclude non-native animals from all long-term monitoring plots, some

campgrounds, and limited selective areas of the boundary where new animals can easily reenter the Park (Herman Farm and L' Esperance).

Boundary fencing has been an important management tool for controlling wild hogs at Hawaii Volcanoes National Park (Barrett 1984). Over 100 miles of boundary and interior fences, which cost over $2 million to construct, are the key asset in the ungulate control program of this national park. Seventy miles of hog-proof fences are inspected monthly and 30 miles of goat-proof fences are inspected every two to six months. Minor repair work is need on small sections of fence following inspections, particularly after tree falls and washouts. Fences need to be replaced every 5 to 35 years depending on their location and exposure. Fences in high rain fall areas or directly exposed to volcanic fumes on the east and southwest rift zones or to salt spray near the coast require replacement more frequently than others (Resources Management Plan, Hawaii Volcanoes National Park 1999). A systematic effort is underway to replace the most deteriorated fences in this national park. Essentially all fences built in the 1970s and 1980s need to be replaced. Approximately 19 miles of the most deteriorated fences were replaced in 1995-1999. An additional 28 miles of older fences needs to be replaced in the near future.

A hog-proof fence has been proposed at the boundary of Great Smoky Mountains National Park, where hogs have historically entered the park. It has been proposed that such a fence would impede wild hog immigration into areas where hog control has been effective.

Fencing the boundary has merit, but is distasteful, particularly if visitors frequently encounter it. Fencing the Park boundary would also be prohibitively expensive. For example, Goatcher (1989) estimated it would cost $2,160,000 to fence 60 miles on Santa Rosa Island, Channel Islands National Park in California. Fence maintenance, also, would be a major concern since falling trees, vandalism and the corrosive moist ocean salty environment are expected to increase maintenance costs. Fence design must also be considered in order to prohibit hog entry but minimally impede the natural ebb and flow of native animals into and out of the Park. Finally, the fencing effort could be neutralized if people physically reintroduced hogs back into controlled areas. Based on the Channel Islands estimate we conservatively estimate the cost of installation and gate access to be $ 7.5 million dollars in 2003. Unfortunately, these monies would not be available for several years, while impacts continue to increase. Moreover, the impacts to vegetation, cultural and historical resources, visitor mobility and user degradation, tremendous ongoing maintenance costs and ineffective method to permanently restrict hog encroachment.

Because hogs aggressively root, fencing designed to prevent hog encroachment would be especially expensive to install on St. John, and the buried portion would require frequent replacement. Aside from the high cost to fence, one major drawback is that a single pregnant sow can soon repopulate a watershed if inadvertently reintroduced.

Hog removal would occur in each of these management units on a sequential basis. Complete reduction would be achieved in each of the units in a coordinated effort lasting approximately three years using trained, professional direct reduction experts. Areas experiencing reductions would be closed to the public temporarily. It is the goal of this program to complete this effort in a speedy, humane fashion to reduce prolonged impacts to the island during the reduction campaign. The establishment of fenced zones would allow greater flexibility in the duration of the overall program, however the risk of failure is increased substantially when the program is projected over many years.

Fences would be constructed of either triple-galvanized steel or special alloy metals to resist corrosion in the warm moist saline environment of St. John. This fence type has been demonstrated to be effective in Channel Islands National Park and Hawaii Volcanoes National Park's for several years.

Live Capture of Non-native Hogs and Relocation to Another Island. Non-native hogs, like all animals wild or domestic, are susceptible to a wide range of infectious and parasitic diseases. While some of these diseases are specific only to hogs, others are shared with other animals, including some that are shared with humans. Millions of dollars have been spent in an effort to rid the United States of these wildlife and human plaguing diseases. Agencies considering actions that could increase the potential for transmission of these diseases are highly discouraged from doing so. Therefore, this alternative has been rejected.

Use of Poison. There are a number of toxicants which can be effective as part of a reduction program. However, each of the potential poisons could negatively affect non-target species. It would be very difficult to protect non-targets from incidental poisoning. Additionally, there are rare, threatened and endangered species which would be threatened by increased mortality from poisons. For these reasons, poisons would not be used as a tool in the reduction of non-native hogs. Bait stations for hogs are too big to restrict access for smaller animals or dogs, etc.

Use of Contraceptives or Sterilization. Contraception or sterilization could be relatively benign methods to reduce non-native hogs from an area. Unfortunately, birth control technology is presently inadequate to achieve reduction, or even control, of non-native hog populations. Currently, there are no effective sterilization methods or contraceptives for non-native hogs. Most contraceptives are short-term and require annual re-treatment. The methods are used in conjunction with eradication efforts. Where the goal is not to remove every animal, the few sexually active animals readily repopulate an area and thwart the expensive operation.

Public Hunting on NPS Property. Allow hunting by members of the public, similar to hunting in National Forests or on Territorial lands. VINP enabling legislation prohibits the Superintendent from authorizing public hunting within the Park.

Recreational hunting can achieve control or reduction of animals that have a relatively low reproductive potential. However, animals with high reproductive potentials, such as hogs and rabbits, are much more difficult to control and require a well-focused, comprehensive and sustained effort by wildlife reduction professionals.

Biological Controls. The use of biological controls, such as introduced hog predators, is incompatible with NPS management policies.

II.A.3. Alternative 1. No Action, Continue Current Level of Management

Under this alternative, no reduction efforts would be used on the non-native wild hogs within the boundaries of Virgin Islands National Park. Their population numbers would continue to rise and fall with the seasonal and long-term availability of food resources. Hogs would continue to impact island vegetation and wildlife including endemic and Federally and Territorially listed plant and animal species. Impacts to native plants and animals, and native plant and animal communities from hogs have been well documented in the literature (Barrett and Stone 1983, Bratton 1974b, Griffin 1978, Singer and Ackerman 1981, Singer et. Al. 1982 and 1984, and Tate 1984).

If left unchecked, hog populations would be expected to increase throughout the Park. In 1998, hogs were found in only two watersheds, Reef and Lameshur. During the next three years, they immigrated into the Cinnamon and Maho watersheds. From these new locations, hogs would readily move into adjacent watersheds, causing irreparable damage to sensitive natural and cultural resources. Hogs also

pose serious threats to public health and safety and pose severe environmental damage to cultural and natural resources.

Under the No Action alternative, NPS would continue to animal-proof trash receptacles, dumpsters and buildings at campgrounds, day use sites, concession areas, Park overlooks, and employee housing areas and collect trash on a regular basis. Last year, Virgin Islands NP installed about 100 animal-proof trash containers (at a cost of about $75,000) at all Park sites except the major concession operations at Trunk Bay and Cinnamon Bay to collect both refuse and recyclables. In fiscal year 2002, the NPS requested $30,000 in funding to purchase and install an additional 20 animal-proof trash containers at major concession locations (eight at Trunk Bay and twelve at Cinnamon Bay) to collect both refuse and recyclables. Also in 2002, NPS has contracted for the construction of a one-mile long burro exclusion fence with four barbed-wire strands around the perimeter of the Cinnamon Bay Campground at an estimated cost of $67,000 that is not designed to also exclude hogs.

II.A.4. Alternative 2. Reduce Wild Hogs within VINP and Sustain a Near-zero Population, Proposed Action

The program goals for the Proposed Action include:

1) Substantially decrease the wild hog population throughout the Park to a near-zero level; and
2) Monitor and remove hogs periodically, and maintain fences indefinitely.

Under this alternative, the non-native wild hogs would be controlled from within the boundaries of Virgin Islands National Park. The goal would be to humanely and substantially reduce their population throughout the Park and sustain the reduction through monitoring, periodic removals and fence maintenance.

The National Park Service and the USDA APHIS Wildlife Services (WS) Division as lead cooperating agencies would conduct the initial reduction of non-native hogs (Alternative 2). Each agency would have a Program Coordinator and this team would manage and supervise the program. The Virgin Islands Department of Planning and Natural Resources, Division of Fish and Wildlife (VIDPNR); and Virgin Islands Department of Economic Development and Agriculture (VIDEDA); would play an advisory role with various portions of the planning and implementation of the reduction, mitigation and monitoring portions of the program. All personnel involved with this program would follow the mitigation measures described in this document for the protection of resources.

The primary tools for hog collection would be live traps, shooting and snares. During the peak period of the hog reduction program, it is estimated that an increase in personnel and vehicles on St. John Island. They would be housed, to the extent possible, in government housing on NPS owned property. Temporary tent camps may be established to facilitate operations in remote areas. Horses or all terrain vehicles may be used for transportation.

The techniques and tools for achieving the reduction goal would be similar to those described under Alternative 2, and are consistent with other models of reduction such as were used on Santa Rosa Island and Santa Cruz Island (NPS 2001) in Channel Islands National Park and Hawaii Volcanoes National Park.

Steps Required for Park-wide Wild Hog Sustained Reduction

Under this Alternative, the reduction program would occur in three phases**:**

1) Administration, infrastructure acquisition, and fencing;
2) Collection using baits, traps, dogs and contract hunters; and
3) Monitoring for remnant wild hogs, periodic hog removal, education, record keeping and fence maintenance.

Phase I – Administration, Infrastructure Acquisition and Fencing *(Approximately 1 year)*

This phase would require approximately one year to complete once funding is received and environmental compliance is met. This year would be used to hire or contract with personnel, purchase supplies and equipment, establish adequate communications, construct live-traps, and fence especially vulnerable long-term monitoring plots. and begin selective fencing near targeted areas.

Consensus building would be established during the NEPA process, continued into Phase I and sustained indefinitely. A strong bridge would be established and strengthened between the NPS, USDA-Wildlife Services and VI Department Economic Development and Agriculture (DEDA). Key groups or officials may facilitate this crucial bridge, including Friends of VINP, the St. John Community Foundation, VI Department of Planning and Natural Resources, the Rotary Club, and the Island Administrator.

Fences would be constructed to exclude non-native animals from all long-term monitoring plots and limited selective areas of the boundary where hogs can easily reenter the Park (Herman Farm, L' Esperance and Catherineberg). Because the origin of hogs into the four impacted watersheds is well established from hogs constantly roaming portions of Centerline Road **(see page 19)**, selective fencing and possible gating would prevent future encroachments from this area.

Local non-government organizations (NGO's) with the guidance and assistance from the NPS and USDA would develop a comprehensive community outreach strategy. This outreach serves to inform, advise and educate the St. John community and island visitors about hogs and the ecological damage a small group of hogs can inflict on a small, remote subtropical island. The community would be advised of the global problems germane to introduced hogs as well as the potential economic loss to the U. S. Virgin Islands if no action is taken to reduce their population.

Phase II – Collection Using Baits, Traps, Dogs and Contract Hunters *(2 - 3 years)*

Initial scoping and observation conducted in Phase I would allow Program Coordinators to determine where to concentrate their resources. Several methods or techniques may occur simultaneously, but new methods would be used later in Phase II as more hogs become trap-shy. At that point, radio-telemetry and dogs may be employed to collect additional hogs. Fence installation would be completed in areas designated for selective fencing while minimizing any damage to cultural sites and structures.

A relatively fast hog population reduction campaign is envisioned for each watershed. Due to logistical factors, watersheds may be paired and worked simultaneously, e.g. Maho -- Cinnamon and Reef -- Lameshur. Phase II would possible take approximately 2--3 years. Baiting in conjunction with snares, single-capture and corral traps would be employed systematically throughout each watershed. Areas of high hog concentrations would be targeted first. Hog movements would determine where the collection efforts must then be focused. Biological and ecological data would be recorded from each collected animal. These data, field observation records and scat and track analysis would help determine relative

abundance for workers to establish a baseline from which to estimate and measure group population dynamics.

Phase III – Monitoring for Remnant Wild Hogs, Periodic Hog Removal, Education, Record Keeping, and Fence Maintenance *(Ongoing, Indefinitely)*

This phase would be an indefinite period of searching the Park for hog sign. If hog sign was detected, NPS law enforcement rangers or certified resources management personnel would either trap and/or humanely dispatch the animals as described in Phase II. As hogs immigrate into the Park from private lands, they would be tracked and reduced. Long-term ecological monitoring to assess ecosystem change due to hog reduction would continue indefinitely.

Monitoring for hog sign would continue throughout the life of the program. The primary purpose of the monitoring is to determine the presence or absence of hogs. Water sources, which are preferred habitat for hogs, would be a focus of the monitoring efforts, in addition to historical locations of high population densities.

The partnerships established during the NEPA process in Phase I would be supported, maintained and revived as key personnel change. VINP Biological Technicians would monitor both the "containment"(selective fencing) and "research exclosures" every 6 months. These technicians would also monitor the four watersheds annually using transects and quadrats for hog sign. Monitoring would be particularly intensive in areas that previously had the highest hog concentration, as well as the bait station areas. Detailed records would be documented from these areas and extend into an Excel exotic mammal database.

NPS personnel using one or more of the previously described techniques would accomplish periodic removal of hogs. NPS law enforcement and interpretation rangers, maintenance and resources management personnel performing routine fieldwork would be provided with general "Exotic Species Observation Sheets." These people would be instructed on the animals of particular concern and importance of reporting any suspected siting, sign or activity, and be routinely notified by resources management personnel to submit any documented sighting as soon as possible. Resources management would develop and maintain an exotic mammal database to maintain and analyze the data.

II.B. Environmentally Preferred Alternative

In accordance with Council on Environmental Quality (CEQ) regulations, Alternative 2 is identified as the environmentally preferred alternative. The environmentally preferred alternative is defined by CEQ as the alternative " that would promote the national environmental policy as expressed in NEPA's Section 101. Generally, this means the alternative that causes the least damage or most benefit to the biological and physical environment and best protects, preserves and enhances historic, cultural and natural resources" (*46 CFR 18027*, *Forty Most Asked Questions Concerning CEQ's NEPA Regulations*).

As considered in this EA, Alternative 2: **Reduce wild hogs within VINP and sustain a near-zero population**, is the environmentally preferred alternative due to its restoration of natural conditions throughout the Park over Alternative 1. Of the alternatives analyzed, Alternative 2 best responds to NPS mandate to preserve and protect unimpaired the significant resources for which VINP was established and allows for appropriate use and enjoyment by the public. Potential adverse effects on natural and cultural resources would be reduced over those in the no action alternative. By reducing the population of non-

native hogs inside the Park, adverse impacts to visitors, residents and natural and cultural resources would decrease. The proposed reduction programs would produce minimal or no damage to Park resources or threats to visitor and employee safety. Collectively, hog populations pose a very large threat to the native natural resources, long-term resource management programs of the Park, and visitor health and safety.

The Proposed Action would cause the least damage to the biological and physical environment and best protect, preserve and enhance the Park's historic, cultural and natural resources. Consequently, Alternative 2 would best fulfill NPS's statutory mission and responsibilities; best meet the purpose and need for a Sustained Reduction Plan for Non-native Wild Hogs; best respond to the issues identified through public and agency scoping; and achieve the best balance of environmental, visitor experience, economic, and other factors.

III. CHAPTER III. AFFECTED ENVIRONMENT

III.A. NATURAL RESOURCES

This section of the Environmental Assessment describes the status of baseline information from inventories, monitoring and research projects. NPS-77, "Standards for Natural Resource Inventory and Monitoring", and the *1997 Inventory and Monitoring Implementation Plan* by the Biological Resources Division, USGS were also used as sources of information. The discussion of the affected environment is not a complete description of the program area. The section portrays the significant conditions and trends of the resources that may be affected by the proposed program or the no action alternative.

Wetlands and Floodplains

Several guts or gullies have been known to have permanent pools of freshwater, some of which still contain small populations of several species of shrimp and fish that were once a delicacy among local residents. Guinea and Fish Bay guts still have populations of shrimp (*Macrobrachyum* sp., *Atya* sp. and *Xiphocaris* sp.). In addition, one or two species of gobies and Mountain Mullet *(Agonostomus monticola*). Little is known about these populations or their dynamics. Populations are undoubtedly greatly reduced due to upstream discharges from commercial activities in the Susannaberg area (e.g. Moses' Laundromat, Majestic Construction, etc.).

The pattern of rainfall and soil type is critical to recharge streams or aquifers. Brief showers do not significantly add to recharge. To create stream flow, 13 to 25 millimeters (2 to 4 inches) in a single rainfall are necessary with a resultant 20-75% surface runoff flow.

Two intermittent streams, Guinea Gut and Fish Bay/Battery Gut, are both outside the park on the south shore. Other smaller intermittent streams and many watercourses carry storm runoff for a short time after heavy rainstorms transporting sediment to the sea. In most cases, the streambed and adjacent floodplain re-stabilize over the years. If changes are made to the cross section, grade, plane or profile of the stream or adjacent flood plain, sediment loss occurs and restabilization must take place. In most cases, construction and changes in land use can be a major disruptive event increasing erosion and sediment transport.

Mangrove habitats are the equivalent of salt marshes. They mostly occur as a coastal fringe of red mangroves seaward of terrestrial uplands but can also be found as basin forests at the base of large watersheds. Mangrove shorelines make up a little more than 2% of the shoreline and are found in protected bays: Cruz Bay, Mary's Creek, Haulover Bay, Newfound Bay, Hurricane Hole, Coral Harbor and Fish Bay. Hurricane Hole may be the most pristine of the remnant mangrove habitats remaining in the USVI (over 50 percent of all mangroves in the USVI have been destroyed during the past 50 years). Mangroves are an important interface between terrestrial processes and marine habitats. They filter sediment from upland runoff, thus maintaining water quality. They produce and export nutrients used by other marine ecosystems. They provide a vitally important nursery habitat in their submerged prop roots for many species of coral reef fish. Many species of birds nest or roost in mangroves where they are safe from predators. The mudflats that form behind mangroves support populations of the large gray land crab (*Cardisoma guanhumii)*.

Salt ponds are shallow, saline ponds usually found at the base of valley drainage systems. They form as reefs grow from two rocky points of a bay, eventually meeting in the middle and forming a berm created by storm wave tossed coral rubble. This berm isolates the pond from the sea and usually becomes

colonized by mangroves and other salt tolerant species. Salt ponds are very effective upland sediment traps, thus maintaining water quality in adjacent marine waters. Ponds are important habitat for many species of shorebirds, bats and waterfowl where they feed on insects and invertebrates living in the pond and nest in the fringing mangrove vegetation. Drastic fluctuations in salinity, temperature turbidity and levels of oxygen and hydrogen sulfide make life in a salt pond a challenge for all but a few adaptable species. Salt ponds also have many traditional uses such as soaking for medicinal purposes and collecting salt for cooking. The salt deposits as the pond dries up during the dry season. The animal and plant life associated with this ecosystem have not been well studied and the ecology of salt ponds is only partly understood. There are five salt ponds larger than 2 acres in size on St. John. The largest is on the south shore behind Salt Pond Bay.

Rooting by non-native hogs adjacent to small streams and springs often results in high rates of soil erosion, which severely affects aquatic habitats. Rooting and wallowing by hogs detrimentally affect the aesthetic and wilderness values of the Park. In searching for food and shelter, hogs create winding trails through all plant communities. These paths compact the soil and contribute to increased water run-off and erosion. These paths can also serve as routes for the spread of invasive, non-native plant species.

Terrestrial Vegetation

The destruction of the natural vegetation on St. John has been extensive, spreading over nearly 90 percent of the island. Large portions of the original forests of St. John were cleared for plantations during the late 1700s and early 1800s. Many, if not most, of the tropical hardwood trees found here were harvested and sent to Europe for furniture, boat and mast construction. This intensive modification of the forest distribution and structure changed the hydrologic regime that was present on St. John. The island became drier as vegetative cover was removed or modified. Evidence from relict streambeds indicates that St. John may have had perennial streams that are no longer in existence. Ultimately, forest destruction has affected over 90% of the island. Therefore, some of the native and endemic plant species have become extinct, or nearly extinct, with their populations reduced to a few individuals (Acevedo-Rodriquez 1996).

The present vegetation exhibits differing degrees of revegetation, ranging from recently disturbed to late-secondary successional forests, which may be as old as 100 years. Eleven vegetation types have been mapped, including: mangroves, salt flats, pasture, upland moist forest, gallery moist forest, basin moist forest, dry evergreen forest, dry thicket and scrub, thorn and cactus, disturbed vegetation, and rock and coastal hedge. About 63% of the island is in the dry evergreen forest category and 17% in the combined moist forest category. The upland moist forest contains some virgin stands with minimal exotic floral species. The tallest trees on the island grow along the banks of the intermittent streambeds.

Presently, the greatest threats to forest regeneration are human development and growing populations of non-native hogs, goats and burros. Goats and burros alter forest composition by selectively feeding on palatable species and distributing the seeds of exotic species through their feces. Hogs destroy vegetation through rooting up of plants. Despite disturbance by non-native animals and construction, Parklands continue to be a valuable refuge for native plant species. To date, 747 species of vascular plants have been identified from St. John, of which 642 (86%) are native to the island. The species are found in 117 families, of which 12 are introduced. Almost all species (99.7%) on St. John are found on other islands within the Virgin Islands. Two species are endemic to St. John (*Eugenia earhartii* and *Machaonia woodburyana*) and six others are endemic to the Virgin Islands. Another 25 species are endemic to the Puerto Rico platform. Many voucher specimens and representatives of common plants have been collected by premier botanists and placed in the Park herbarium collection, creating an extensive collection of most species on the island. As they conduct monitoring and inventories, botanists continue to identify new species. Pedro Acevedo-Rodriguez of the Smithsonian Institute discovered three species new to St. John in 1992.

A network of long-term monitoring plots, representing a range of stand ages and land-use histories, has now been established in each of the following forest types on the island: upland moist, gallery moist, dry evergreen woodland and dry evergreen scrubland. Peter Weaver has established 16 plots in the dry evergreen and moist forest of the Cinnamon Bay watershed; the New York Botanical Garden has three plots covering upland moist, gallery moist and dry evergreen woodland; and the Smithsonian has two plots covering dry evergreen woodland and dry evergreen scrubland. In addition, the USDA Natural Resources Conservation Service has five long-term plots in the Lameshur and Cinnamon Bay watersheds to measure soil temperature and moisture. Information on forest regeneration, tree seedling growth, changes of species composition and forest structure are gathered by researchers through Memorandums of Understanding, Cooperative Agreements and direct National Park Service funding.

Native Animals

The only mammals native to St. John are bats. Three of the six native species of bats are protected under the V.I. Endangered and Indigenous Species Act of 1990 (Act No. 5665). Some bat species are important pollinators of many floral species on the island as well as important seed dispersal agents for many species of fruit bearing trees and shrubs. Other species of bats consume vast quantities of insects, including mosquitoes. Fish-eating bats are also present. Bat abundance at night on St. John may exceed bird abundance during the day. Except for a short study using ultrasonic surveys to detect bats, virtually no data exist for bat abundance, locations of roosting or maternity colonies or threats to bats on St. John.

Recent museum analysis of materials excavated from the Cinnamon Bay archeological dig during 1998 has yielded some startling discoveries. The remains of at least four extinct animals have been identified, including the Caribbean Monk Seal (*Monachus tropicalis*), Puerto Rican Shrew (*Nesophontes*, sp.), a flightless rail and others. At least six other species have been identified which have been extirpated from the Virgin Islands. It is becoming apparent that this dig is revealing considerable information about faunal assemblages on St. John before European colonization and demonstrating that the Taino Indians lived a very different natural world from what we find today. These animals were apparently important food sources for these Native American Indians. These Indians may have brought some species such as the Green Iguana (*Iguana iguana*) and the Red-Foot Tortoise (*Geochelone carbonaria*) to the Virgin Islands from South America as food sources.

Avifaunas are abundant and varied. The latest National Park Checklist of Birds on St. John includes 170 species in 17 families. St. John is an overwintering area for migratory warblers using the eastern flyway. Fragmentation of habitat has been suggested for reducing populations of over-wintering warblers. More recent research from 62 permanently marked survey points in moist forest and dry woodland on St. John suggests that the reduction in numbers of overwintering warblers is due primarily to reduced numbers of one species (Northern Parula) and possible reductions in breeding populations along the southeastern United States from North Carolina to northern Florida. Birds are probably the best-studied group of terrestrial animals in the Park. Continued surveys are necessary to determine trends in populations of resident and migratory species.

The terrestrial reptiles and amphibians on St. John are quite varied. There are three native species of tree frogs (*Eleutherodactylus lentus, E. antillensis and E. cochranae*) and one introduced species, the Cuban Tree Frog (*Osteopilus septrionalis*), one introduced Marine Toad (*Bufo marinus*), two geckos (*Hemidactylus mabouia* and *Sphaerodactylus macrolepis*), three species of Anolis Lizards (*Anolis stratulus*, *A. cristatellus* and *A. pulchellus*), the Red-foot Tortoise (introduced), Green Iguana (introduced), Ground Lizard (*Ameiva exsul*), Legless Lizard (*Amphisbaena fenestrata*), Worm or Blind Snake (*Typhlops richardii*), a type of Garter Snake (*Arrhyton exiguus*), the Puerto Rican Racer (*Alsophis portoricensis*) and the Slipperyback Skink (*Mabuya mabouya*). Herpetological populations on St. John

have not been adequately inventoried or monitored. Species that occur on nearby islands may also occur here but have not been observed and documented.

Catherine Curry made a checklist from insect species in the Park museum collection in 1970 when ten families were represented and 52 species identified (Curry 1970). William Muchmore (1987) studied terrestrial invertebrates in 1987 and made a collection of common representative insects for the Park. Two hundred and thirty-two species representing 124 families were identified. Arachnida (scorpions, pseudoscorpions, harvestmen, and spiders) made up the largest order. Jeremiah Trimble has identified thirteen species of dragonflies and damselflies (Order Odonata) in VIIS (Trimble J., IAR, 1997). Michael Ivie (1983 and 1984) has been studying beetles (Coleoptera) in the Virgin Islands for several years. Before he started, approximately 75 species of beetles had been described for the VI. He has now documented over 1500 species (several new species) and expects to find over 2000. Most of these species may be found in VINP, but would only be documented through further studies. Additional inventories covering a greater number of families are needed to more fully document the species and distributions of insects within VINP.

Non-native hogs continue to have very large and adverse effects on island wildlife and fauna. Because herptofauna and invertebrates are small, often slow and readily available, they are particularly susceptible to local extirpation from hog depredation. Of particular concern are the varied native reptile and amphibian populations in the Park and their associated links in the food and ecological web of the island. Wild hogs prey upon three species of tree frogs, two species of sea turtles, two geckos, three Anolis lizards, the Ground Lizard, Legless Lizard, Blind Snake, the Puerto Rican Racer, and the Slipperyback Skink. The Park has listed over 232 common insect species, including 13 species of dragonflies and damselflies and over 1500 beetle species, many of which are consumed by non-native hogs. Many invertebrate species may be lost before researchers have catalogued them.

Endangered and Threatened Animal Species

The Endangered Species Act (PL 93-205) requires that Federal agencies protect all listed species and habitats. Twelve Federally listed endangered and threatened species have been observed in the Park (see Appendix A, List of Endangered Plants and Animals of the U. S. Virgin Islands). Five species of whales, as well as several dolphin species, may migrate through the Park. The endangered West Indian Manatee had been recorded as being very rare around St. John, although it has been recently recorded (ca. 1990) from West End, Tortola. These listed species, which include six marine mammals, five birds, three reptiles (sea turtles) and two plants.

Five Federally listed threatened or endangered bird species have been identified. The Federally endangered Brown Pelican nests, feeds and roosts both adjacent to and within National Park boundaries. The U.S. Fish and Wildlife Service is evaluating nesting success in considering this species for delisting. The Federally Endangered Peregrine Falcon is a rare winter migrant. The Federally Threatened Roseate Tern and Endangered Least Tern are summer residents that have both been observed nesting within the Park in recent years (1997 and 1999, respectively). Piping Plover are a very rare summer migrant.

Two of the federally listed sea turtles are commonly found in Park waters. The Hawksbill Sea Turtle requires coral reefs for food and refuge. Peak nesting season on Park beaches is from July through November, although nesting activity may take place any month of the year. While Green Sea Turtles feed in seagrass beds in Park waters, they are infrequent nesters on St. John beaches. Sea turtles are frequently struck and killed by boats speeding through Park waters. Nesting frequencies have decreased on many beaches due to adjacent upland development that results in people, lights and dogs, all of which deter turtles from using particular beaches. Direct impacts on Federal endangered species by exotic species include the predation of sea turtle nests and eggs by the small Indian mongoose (*Herpestes*

auropunctatus) and non-native wild hogs. While considerable information exists on seasonality of nesting for sea turtles using VIIS beaches, no rigorous studies of nesting numbers and frequencies on all VINP beaches has been carried out since the early 1980's.

The Federally Endangered Virgin Islands Tree Boa (*Epicrates monensis granti*) has never been observed on St. John although it occurs on the East End of St. Thomas and on Tortola, BVI. This species could conceivably exist on St. John.

Wild hogs negatively affect the fauna of the Park through predation, habitat alteration and competition for food. One Territorially endangered and threatened animal species, the Slipperyback Skink (*Mabuya mabouia*), is endemic to the Park. Other Territorial Endangered species include ground-nesting species such as Bridled Quail Dove, Bahama Pintail Duck and West Indian Nighthawk, all of which suffer egg and chick depredation due to hogs. Areas uprooted by hogs undergo notable declines in small mammal populations (Singer *et. al.* 1982). Wild hogs are in direct competition with small mammals for insects, earthworms and other invertebrates and also compete with native species for other available food resources, especially hard mast.

Threatened and Endangered Plant Species

As of March 31, 2001, 736 native plant species were nationally listed as endangered or threatened under the Endangered Species Act. According to the Center for Plant Conservation, over 4,000 species of U.S. plants, roughly 25 percent of our country's entire known native plant species, are at some degree of risk. Of these, many hundreds could vanish in the next few decades. Faced with the expanding development of natural areas, competition from invasive non-native species, loss of pollinators, and over-collection for ornamental and other uses, many of our native plants face an uncertain future. Hawaii, California, Texas, Florida and the Puerto Rican platform have the greatest number of rare, imperiled and federally listed plant species (Harrelson 2001).

There are two plant species Federally listed as endangered on St. John Island: Prickly Ash (*Zanthoxyllum thomasianum*) and St. Thomas Lidflower (*Calyptranthes thomasiana*) and one species Marron Bacora (*Solanum conocarpum)*, which has been proposed for listing (USFWS 1988) are potentially impacted by non-native hogs. There are also twenty-five plant species territorially listed as threatened and endangered on St. John potentially impacted by non-native hogs include: *Cyposelia humifusa*, Urban's Holly (*Ilex urbanii*), Central American Oak (*Ilex sideroxyloides*), Pinion (*Tillandsia lineatispica*), Wooly Nipple (*Mammilaria nivosa*), *Croton fishlockii,* Egger's Cockspur (*Erythrina eggersii*), Egger's Galactia (*Galacteria eggersii*), Cowage Cherry (*Malpighia woodburyana*), *Malpighia linearis*, *Byrsonima sp.Psidium sp*., *Eugenia sp*., *Schoepfia schreberi*, Christmas Orchid *(Encyclia ciliare*), Yellow Dancing Lady (*Tolumnia prionochila*), White Dancing Lady (*Tolumnia variegatum*), *Ponthieva racemosa, Prescottia oligantha*, *Prescottia stachyoides*, *Tetramicra canaliculata,* Myrtle-leaved Peperomia (*Peperomia myrtifolia*), *Machaonia woodburyana*, Bulletwood (*Manilkara bidentata*), and *Solanum mucronatum*. The non-native hogs, goats and burros on the island variously threaten each of these. The federal listing proposal for these species identified non-native hogs, goats and burros as the major cause of decline for each of these plant species. The primary causes of impact to these rare species by non-native hogs, goats and burros are rooting, direct feeding and soil erosion.

All of the Federally and Territorially listed species require NPS to provide some level of protection and monitoring. Direct impacts on Federal endangered species by exotic species include the rooting of *Z. thomasianum, C. thomasiana* and S. *conocarpum* by non-native hogs. Non-native goats and burros may be having an impact on many Territorial endangered species of plants. While the distribution of endangered plants is relatively well known, the extent of threats to the species is speculative.

Introduced Animals and Plants

With the exception of bats, the Virgin Islands National Park is presently inhabited by numerous species of non-native mammals that have produced severe impacts on many indigenous species of plants and animals and threats to visitor safety (Appendix B, List of Introduced Animals to St. John, U.S. Virgin Islands). Feral or wild mammals include the whitetail deer, burro, wild hog, domestic goat, domestic cow, domestic sheep, European boar, West Indian mongoose, tree rat, Norway rat and domestic cat, domestic dog and house mouse. Some of these species also threaten visitor experience and safety. With the possible exception of deer, increasing populations of these species are seriously affecting native species of plants and animals. Additionally, introduced species of birds, amphibians, reptiles, insects and plants are impacting the fragile environment (see Appendix B, List of List of Introduced Animals to St. John Island).

For a more thorough description of the effects of these introduced animals, see Sustained Reduction of Non-native Rats, Cats and Mongooses from Virgin Islands Environmental Assessment (NPS 2002). Norway Rats or Brown Rats (*Rattus norvegicus)* existed on St. John from the 1700's and were introduced by European explorers. Black or Tree Rats (*Rattus rattus)* existed on St. John from the earliest records and were also introduced by Europeans. Both species occur in Virgin Islands National Park and range throughout St. John, but the tree rat is considerably more common. Most problems arise from the nocturnal black rats, which reside in trees and generally forage at night. Tree rats are associated largely with people and human establishments and are known as commensal rodents.

As commensal rodents, Norway and tree rats are habituated to living near humans and except for an occasional predation by red-tailed hawks, they have no biological predators. Rats are omnivorous; they eat nearly every kind of grain, fruit, fish, fowl, carrion, milk products, and vegetables. Several rodents can destroy hundreds of chicks in just one night. They are behaviorally plastic, have high reproduction rates, and can survive in a variety of habitats. These traits make them ideally suited to survive on a variety of predator free islands. Even if extinctions do not occur, rats can have ecosystem wide effects on the distribution and abundance of native species through direct and indirect effects. For example, comparisons of rat-infested and rat-free islands, or pre and post rat eradication experiments, have shown that rats depressed the population size and recruitment of birds, reptiles, plants and terrestrial invertebrates. Rats have also been shown to affect the abundance and age structure of intertidal invertebrates. The introduction of new *Rattus* species should be avoided, even to islands that already have introduced rats.

Domestic cats originated from an ancestral wild species, the European and African Wild Cat (*Felis silvestris*). The domestic cat (*Felis catus*) is now considered a separate species. The estimated numbers of pet cats in urban and rural regions of the United States have grown from 30 million in 1970 to nearly 65 million in 2000. Reliable estimates of the present total cat population are not available. Nationwide, approximately 30% of households have cats. In rural areas, approximately 60% of households have cats. Populations of birds on oceanic islands have evolved in circumstances in which predation from mammalian predators was negligible and they, and any other island vertebrates and invertebrates, are therefore particularly vulnerable to predation when non-native cats have been introduced.

The impacts of domestic cats on wildlife are difficult to quantify. However, a growing body of literature strongly suggests that domestic cats are a very large factor in the mortality of small mammals, birds, reptiles and amphibians. Because free-ranging cats often receive food from humans, they can reach population levels that may create areas of abnormally high predation rates on wildlife. When the wildlife prey is a threatened or endangered species, the results may be extirpation or extinction. Effects of cat predation are most pronounced in island settings (both actual and islands of habitat), where prey

populations are already low or stressed by other factors, or in natural areas where cat colonies are established.

Domestic cats have and continue to threaten populations of reptiles and ground and shrub nesting birds as well as providing vectors for transmission of parasites and diseases to humans. Cats carry many diseases, some which may be passed to humans (cat scratch fever, various bacterial skin diseases) and others that are transmissible to domestic cats. Certainly, their feet and fur carry germs, which they invariably disperse in their wanderings. Cats also apparently like to defecate in the bathrooms and showers at Trunk Bay, producing very unsanitary conditions and additional work for Park employees. Several visitors have contracted "creeping eruption"(*Tinea corporis*, also known as hookworm), a fungal infection, while on the beach at Trunk Bay. This is transmitted via cat feces, probably deposited on the beach where conditions are favorable for parasitic survival.

Cats hunt for both fun and food. Unlike wild predators, domestic cats hunt whether they are hungry or not. These cats are called "subsidized predators" because they sometimes receive a steady supply of food at home. Pet cats can hunt longer and are less susceptible to disease than many wild predators. Because non-native cats routinely kill insects and other small animals for "sport" to practice their hunting skills, in addition to using them as a food source, great numbers of wildlife are lost each year to a small non-native cat population. A recent university study in Wisconsin ((Fish and Wildlife Today 1998) estimated that " 1 to 2 million free ranging rural cats in Wisconsin kill roughly as many as 217 million birds each year." Researchers noted that birds make up only 20 percent of the cats' diet. Seventy percent of the diet was small mammals and 10 percent reptiles and amphibians (Patronek 1997; Coleman and Temple 1995). Thus, great numbers of wildlife can be lost each year to a small non-native cat population.

In the 1880's, European planters introduced the West Indian Mongoose (*Herpestes auropunctatus)* to the Caribbean and to St. John as a biological control to suppress the tree rat populations that decimated sugar cane fields (Nellis and Everard 1983). It was thought to be the salvation for the large sugar cane plantations on the islands that were being ravaged by tree rats. At first, the statistics indicated that a very large decline in the rat population had occurred and the decline was attributed to mongoose predation. As a result, in the next 30 years (1872 to 1900), even more mongooses were brought to the islands and distributed throughout the Caribbean as a biological control.

Soon it was discovered rats seeking meals at night do not depredate the daytime foraging mongooses. Rats are nocturnal and sleep in trees during the day. They were therefore able to eat as much sugar as they wanted by night, while the mongooses were sleeping. The rats were safe, during the day, from the mongooses, which cannot climb trees. They coexist well and now exaggerated populations of both non-native opportunistic omnivore species must be controlled. Mongoose populations are scattered throughout St. John, with the highest concentrations near human populations, due to increased food availability. Mongooses have no biological predators and populations rise sharply when sufficient food quantities become available (Nellis and Small 1983).

Problems compounded as the rats continued to enjoy sugar cane and mongooses feasted instead on bird and sea turtle eggs, as well as, insects, papaya and guava. Public health concerns increased when the mongoose was discovered to be a carrier of rabies. Since mongooses have no natural predators here, the checks and balances of natural population control are missing. Non-native mongoose have devastated reptile populations, some bird populations and continue to depredate the nests of the endangered Hawksbill Sea Turtle (Coblentz, 1983).

Because reptiles, amphibians and invertebrates, such as insects, are small, often slow and readily available on St. John, they are particularly susceptible to local extinction from non-native rat, cat and mongoose

depredation. Of particular concern are the varied native reptile and amphibian populations in the Virgin Islands National Park and their links to the ecological web of the island. Non-native rats, cats and mongooses prey upon three species of tree frogs, two geckos, three Anolis lizards, the Ground Lizard, Legless Lizard, Blind Snake, the Puerto Rican Racer, and the Slipperyback Skink. The Park has listed over 232 common insect species, including 13 species of dragonflies and damselflies and over 1,500 beetle species; all of which may be eaten by rats, cats and mongooses.

Great numbers of wildlife, therefore, are lost each year to relatively small non-native rat, cat and mongoose populations. The cumulative impacts associated with these increasing wildlife loses are very large. Small islands typically have both smaller resident wildlife populations and lower species diversity. This is particularly true on very small and highly fragmented islands such as St. John, because most negative impacts are concentrated and accelerated when compared with similar impacts to a larger landmass.

Non-native rats, cats and mongooses prey upon endangered hawksbill and leatherback sea turtles, which nest on St. John. Norway and roof rats, cats and mongoose kill emergent hatchlings as they crawl from the nest to the ocean at night, when the rats are most active. Non-native rats, cats and mongoose would also prey upon sea turtle nests soon after being laid when the odor is still present, eating many eggs and spoiling the remaining ones. The Sea Turtle Recovery Plans stipulate that predators should be removed from turtle nesting beaches in order to protect species listed under the authority of the Endangered Species Act.

Non-native rats, cats and mongooses prey upon chicks, juveniles and adults of most bird species that nest on St. John. Of particular concern are endangered Brown Pelicans, Least Terns and threatened Roseate Terns. Territorial endangered species preyed upon by non-native rats, cats and mongoose include ground and tree nesting species such as Bridled Quail Dove, Bahama Pintail Duck, and the Antillean Mango Hummingbird, all of which suffer egg and chick death due to rats. Non-native rats, cats and mongoose also prey upon four (of the five) native bat species, three of which are territorially endangered, and the only indigenous mammals on the island.

Burros destabilize steep slopes through maintenance of trails and these results in erosion and impact to coral reefs and seagrass beds. They also affect plant community composition, distribution and succession through selective feeding and dispersal of exotic plant species. Burros continue to enter campsites and destroy tents and camping equipment in their efforts to locate food items. Resident and other visitors have been bitten, threatened or chased by burros. Traffic safety becomes an issue when visitors stop to look at or photograph burros on the road, thus impeding traffic and causing accidents.

Wild hog are seriously threatening the sole, small remaining populations of the endangered St. Thomas Lidflower (*Calyptranthes thomasianum*) and *Solanum conocarpum*, which has been proposed for listing. Domestic goatherds are capable of denuding large areas of land of all vegetation, including trees (through bark stripping) and cactus. The VINP represents possibly the largest and best example of dry tropical forest remaining in the Caribbean and many of these exotic species are having a serious impact on its health and sustainability.

III.B. NATURAL RESOURCE THREATS

This section of the Environmental Assessment summarizes the condition of the natural resources. It addresses the nature and severity of major threats to the natural resources and impacts that have the potential to degrade or impair those resources.

Land Use and Boundary Issues

Approximately 53% of the island is Federal land. The Park owns 2939 hectares (7,259 acres) of the 3840 hectares (9,485 acres) authorized by the enabling legislation. Within the Park boundary, 26.5% (901 hectares or 2,226 acres) of the land is owned by either private interests or the Virgin Islands government. These separate parcels of non-federal land or "inholdings" are dispersed throughout the federal land within the authorized boundaries. The trend has been to further sub-divide the parcels and develop them. There were 261 parcels of non-federal land in 1991 and approximately 322 in 1992.

The NPS is unable to restriction development on private adjacent lands, as our Authorizing legislation does not provide for condemnation. Local zoning or Coastal Zone Management Act (CZM) protection has often been inadequate because enforcement is inadequate. Virgin Islands National Park participates in CZM or any permit review for construction or modification of land within or adjacent to Park boundaries. The Resource Management Division has established mechanisms for the Park to be contacted on adjacent development issues and to participate in the review/permitting process. There is also a need to upgrade the Park's land status maps (1986) to show changes in ownership and watch for potential development. Due to lack of eminent domain authority, the Park has to compete for NPS acquisition funds and/or must work closely with groups like the Friends of Virgin Islands National Park and Trust for Public Lands who can either purchase land and hold it until Park funds are available or purchase and donate land to the Park.

Development of private inholdings and land adjacent to the Park boundary and pressure to re-open and/or pave old Danish cart roads within the Park represents a serious threat to marine and terrestrial ecosystems in the Park. Clearing of St. John's steep hillsides on slopes approaching and exceeding 30 degrees, has resulted in elimination of native species, spread of exotic plants, increased soil erosion, loss of sparse topsoil, and fragmentation of the forest and "viewsheds". These impacts need to be minimized or at least mitigated. Because development cannot be prevented, eco-sensitive development must be encouraged to require use of recycled and low energy products as well as forested scenic easements. Agreements with landowners could be developed to achieve energy savings, and to minimize loss of biological diversity, introduction of exotic species, degradation of Park resources and scenic values.

Intact forests are important habitat for migratory birds. Development of private lands within the Park and construction of roads through watersheds which are now largely undisturbed could have drastic consequences for the birds which winter in the Virgin Islands.

Visitation Issues

Visitation to the Park by individuals is usually of a short-term nature. The annual number of visitors has increased from around 120,000 in the early 1970's to 1.2 million in 2001. Heaviest visitor use occurs between November and May and reflects cruise ship arrivals. Most visitors spend their time on, in or near the water. Beach use and boating are the most popular activities. The beaches along the northwest shore between Cruz Bay and Cinnamon Bay receive the highest concentration of use. Many tours are also taken to the cultural site, Annaberg Sugar Plantation.

It is desirable to provide a variety of appropriate opportunities for visitors, from concession operated/heavy use to primitive surroundings/light use. Tourist influx to the Park continues to increase. Human carrying capacities were established in the 1983 GMP for Park facilities, anchorages, recreational beaches, Biosphere Reserve core areas, and human impacts to resources were reduced in creative ways. These carrying capacities need to be reevaluated in light of the trends in visitation since 1983. Congestion and potential crowding threaten to impact or possibly impair not only the quality of the visitor experience but also the integrity of scenic, natural and cultural resources. The Final Commercial Services Plan/EA (2001) identifies desired future conditions that represents commercial use capacities which best

balances resource protection with a quality visitor experience. Trails, roads and facilities must be maintained and upgraded, but not at the expense of the environment.

Starting in 1998, the Fee Demo Program instituted a fee collection program for Trunk Bay and Annaberg Sugar Plantation. Visitors now pay $4.00 per person to visit both sites, whether by land or water. Of fees collected, the Park retains 80%, less costs to operate collection, and can submit proposals to compete for the remaining 20%. In the three years of this program, substantial funds have been collected for use in upgrading visitor facilities and providing enhanced services, such as animal-proofing many trash receptacles, dumpsters and new comfort stations.

The NPS officially curtailed illegal hog hunting in the late 1980's. Within about 3 years, interpreters and visitors began to complain about "hog harassment" along the popular Reef Bay Trail. By 1995, extensive damage from hog rooting had occurred along much of the 1.5-mile trail. Also by this time, many animals were observed at the Virgin Islands Environmental Resource Station facility, where hogs used to be very rare. This facility is in the lower portion of the Lameshur watershed; the northern ridge forms the southern ridge of the Reef bay watershed. The two watersheds are joined by a restricted-access jeep trail. Both watersheds form the south-central portion of St. John.

Threats to Endangered and Threatened Species

Protection of threatened and endangered species and their habitat is imperative, as is reduction or control of exotic and non-native species. Threatened and endangered species of plants are threatened by development of inholdings and damage caused by non-native animals. Rooting activities of wild hogs is damaging the *Calyptranthes* population on Bordeaux Mountain. Non-native goats and burros graze on seedlings and saplings of rare plants and disperse the seeds of non-native species that compete with the rare species for light, water, space and nutrients.

Law Enforcement Rangers strictly enforce the pet leash and restriction laws, especially during turtle nesting season. Dogs must be kept on a leash or physically restrained while in the Park (36 CFR 2.15). Dogs are restricted from all NPS beaches, not only sea turtle nesting beaches. Dogs dig in the sand, sometimes scenting a sea turtle nest, then predating and destroying the entire nest.

The major threat to the reproductive success of threatened and endangered sea turtles is predation of eggs and hatchlings by mongooses and rats. Predation of sea turtle eggs by mongooses is a learned response. Mongooses see a dog or other mongoose digging a nest or find a recently dug nest and discover a high protein source of food. Although sea turtles attempt to disguise the scent by dispersing sand with their flippers, mongooses often detect it and dig to find the eggs. Mongoose predation accounted for up to a 23% loss of sea turtle eggs (Nellie & Small, 1983). Some beaches on St. Thomas experience 100% predation of eggs and nests. Since they are the major predators and threat to nesting success, trapping mongooses each season is necessary adjacent to nesting beaches.

Human poaching of threatened and endangered sea turtles and taking of eggs may be a problem in remote areas of the Park. Sea turtle products, mostly hawksbill shells, are the most commonly confiscated products by the U.S. Customs at United States borders. These confiscations are on the increase. Legal harvesting of adult green turtles is seasonally permitted in adjacent waters of the British Virgin Islands. Public education, involvement of volunteers with beach patrol programs and encouraging protection of the endangered and threatened sea turtles in British waters, can raise community awareness about these ancient animals while reducing the incidence of taking and poaching.

Turtle mortality due to boat strikes has greatly increased over the last fifteen years (Boulon, 1997). In some years, over half of all reported turtle strandings involved damage to the carapace from boat

propellers or hulls. Increasing populations of juvenile green turtles and increasing numbers of high speed powerboats results in increased numbers of incidental mortalities. The numbers of high speed boats travelling along the north shore of St. John en route to the BVI continues to increase.

While other parts of the world (Southeastern U.S., Hawaii) have been reporting large numbers of green turtles affected with fibropapillomas, the USVI has only had a few reports of individuals having this disease. However, reports of infected turtles are on the increase and sizes of reported tumors are also increasing. This may become a great concern if this disease starts to affect a large segment of our turtle population. Monitoring of in-water sightings and strandings must be formalized and continued.

Endangered and threatened seabirds (Brown Pelican, Roseate and Least Terns) are most commonly affected by predation on eggs and young by rats, cats and mongooses. Humans are also potential poachers of eggs in remote areas. Disturbance by human visitation to offshore cays results in low egg production, death of chicks to sun exposure or even abandonment of the whole nesting colony. Decreases in baitfish populations may limit nesting populations and affect the breeding and fledging success of these birds.

Non-native/Exotic Animal Impacts

Indian mongooses are one of many problem exotic and non-native animals on St. John. Mongoose predation has contributed to the reduction of many reptiles and ground nesting birds as well as sea turtles. Because of its high fecundity and large population, it is unrealistic to eliminate this predator from the island. Attempts to eliminate mongoose from uninhabited islands considerably smaller than St. John (e.g. Buck Island Reef National Monument, near St. Croix USVI) have been successful but expensive. Eradications from small and uninhabited islands are more feasible than those a single pregnant female would reestablish the population in just a few years. The only realistic management measure is to control this species through intensive poison/removal at specific nesting beaches before the peak turtle nesting season.

Non-native cats prey on birds, frogs and lizards, having very large effects on their populations. The populations of non-native cats at certain beaches (Trunk Bay, Cinnamon Bay, and Francis Bay) have increased dramatically in recent years. Two local veterinarians, in conjunction with the St. John Animal Care Center (ACC), have offered to sterilize cats and release them into feeding stations outside the Park. The goal is to eliminate stray cats from the Park and reduce them to “a manageable” level elsewhere on St. John. Stray cats are placed for adoption through the ACC. This has resulted in greatly reduced non-native cat populations in the Park. This effort must be maintained, as the populations would expand again as cats’ reproduce and others wander into or are released in the Park.

Burros, hogs and goats graze and browse on vegetation both inside and out of the Park. Impacts to vegetation have been identified and recorded (Coblentz 1983; Nellis *et. al.* 1985, and Ray 1990). Plants on St. John did not evolve with grazers and browsers so have not developed defenses and survival tactics. Forest structure and species composition is changing due to introduction of exotic plants in fecal matter and disappearance of favorite non-native animal foods. Goats are predominantly concentrated along the east and southeast boundary of the Park, and Reef and Fish bays. In the mid-1990’s they began using Ram's Head, Annaberg and Brown Bay extensively and the Park is currently preparing a goat reduction plan EA. Hogs are centered around the Susannaberg landfill and have spread from there to Bordeaux Mountain, Cinnamon and Maho watersheds and Annaberg Sugar Plantation. Burros wander the entire island. Young black mangrove saplings (a protected species) are one of their favorite foods.

Recent introductions include two species of frogs from Puerto Rico and a bird. The Cuban Tree Frog is thought to prey on species of smaller frogs such as our indigenous tree frogs. The "coqui" has been heard around Caneel Bay. The House Sparrow flew across the narrow 3-mile wide channel separating St.

Thomas and St. John and has been seen around Cruz Bay. Audubon Society members are monitoring this species and have attempted some reduction.

Non-native Wild Hogs Impacts and Introductions

Non-native Domestic Hogs (Sus *scrofa)* are an ungulate species not native to North America or South America (Barrett 1984). Christopher Columbus first brought domestic hogs or European hogs into the West Indies in 1493. The term "non-native hog" refers to a wild hog that comes from domestic genetic stock, such as domestic livestock that escape to survive in the wild, as well as their progeny. Wild and non-native hogs can harbor various diseases, including pseudo-rabies, hog cholera, brucellosis, vesicular exanthema of swine, trichinosis, and leptospirosis.

Non-native wild hogs are generalist omnivores with a diet that changes seasonally according to abundance of foods. Mast foods, such as acorns and berries, are important food items in the fall. Winter diets typically comprise roots, bulbs and invertebrates that hogs find by rooting in seasonally moistened soil. As soil dries during spring and summer, hog diets shift to green plants.

Hogs have high reproductive potential, and are considered the most prolific ungulate in the United States. Sows can breed six or seven months of age, and can produce up to two litters per year with as many as 10 piglets in each litter. Hog populations can double annually if not limited by food or water availability. Hog populations respond to changes in food availability and weather. Drought years can cause very large declines in population numbers due to starvation and reduced reproduction, whereas heavy mast crops following winters of high precipitation can allow hog populations to increase greatly (Coblentz 1978 and 1980, Sterner 1990). Hogs generally require access to permanent water, and abundant cover.

Wild hog numbers on St, John Island are known to oscillate widely between climatic episodes. During drought years, hog numbers have been estimated to be between 200 and 300. Under normal rainfall years, numbers have been estimated to be as high as 800 animals; which impact approximately 55% of Virgin Islands National Park. The hog population would vary of the course of a year. Numbers normally rise in the spring and summer when food is widely available and then fall dramatically in the fall and winter when food becomes scarce and starvation becomes common place. These numbers are not surprising given that hogs have an extremely high reproductive potential. Conservatively, with plentiful food, hogs can be expected to double their numbers at least twice a year.

The very large concerns are the potential for spreading into new areas, especially now that a population is established on the northern portion of the Park, and the speed and thoroughness with which wild hogs degrade the sensitive natural and cultural environments. The amount of disturbance caused by hogs varies by plant community depending upon access, shelter, water sources, and food availability. Plant communities providing adequate water, abundant food sources and shelter would incur the most use.

The Danes brought wild hogs, to St. John in the early 1700's. Wild hogs have established breeding populations in many areas and all habitat types of the Virgin Islands National Park. Currently in St. John, hogs are predominately owned by one landowner adjacent to Centerline Road near Cruz Bay. These hogs are not fenced off, so individual animals periodically wander into surrounding areas, including National Park lands, and became feral.

Wild hogs have thrived in Reef and to a smaller degree in Lameshur watersheds since the Park was established in 1959. The suspected origin into the Park was the Susannaberg area near the Public Works facility, where even now hogs wander up Centerline Road and migrate down the L'Esperance Trail into Reef Bay. Popular and well-publicized hunts occurred during specific times of the year for a specific hog

roast celebration. These hunts were allowed by default by the Park until mid-1980. While wild hogs have established breeding populations in these areas, none occurred elsewhere in the Park.

The NPS officially curtailed illegal hog hunting in the late 1980's. Within about 3 years, interpreters and visitors began to complain about "hog harassment" along the popular Reef Bay Trail. By 1995, extensive damage from hog rooting had occurred along much of the 1.5-mile trail. Also by this time, many animals were observed at the Virgin Islands Environmental Resource Station facility, where hogs used to be very rare. This facility is in the lower portion of the Lameshur watershed; the northern ridge forms the southern ridge of the Reef bay watershed. The two watersheds are joined by a restricted-access jeep trail. Both watersheds form the south-central portion of St. John.

By 1998, visitors reported seeing hogs in the Cinnamon Bay watershed, a suspicion that was confirmed later in the year. In 2001, a hog group was documented in the Maho watershed and the evidence indicates they have been there for over two years. These two watersheds are located on the central portions of the island's northern shore, and a large hill separates them. Centerline Road is a two-lane paved highway separating the north and south portions of the island.

The Susanaberg area was probably where the hogs entered Reef Bay and eventually spread from there into Lameshur. About 1 mile northeast of Susanaberg, in a depression between two hills along Centerline Road, an NPS sign marks a public trail that winds one mile into the Cinnamon watershed and terminates at the public campground. This trail is undoubtedly the origin of hogs into Cinnamon watershed. About one-half mile east of the Cinnamon trailhead, Centerline road passes a steep embankment to the north. This area basically connects with the upper portion of the Maho watershed and is probably where hogs entered this watershed.

Documented direct effects on plant communities by alien herbivores including hogs include reduction in native species cover, density and biomass. Alien herbivores and hogs have also caused the elimination of the soil litter layer and loss of seed banks, increased soil disturbance, and soil compaction, and lowered or altered rates and patterns of nutrient cycling.

In searching for food and shelter, hogs create winding trails through all plant communities. These paths compact the soil and contribute to increased water run-off and erosion. These paths can also serve as routes for the spread of invasive, non-native plant species. Where they intersect Park trails, these hog trails can also lead visitors astray by creating their own trails. Hogs rooting on Park trails have caused very large damage to trails, exacerbated erosion and affected visitor safety. They are presently affecting $50,000 worth of repairs made to the Reef Bay Trail.

Documented indirect effects of alien herbivores and non-native hogs to plant communities include the increase of cover, frequency, and biomass of non-native plant species, increased water run-off and soil erosion, and degradation of soil structure. Hogs have also contributed to changes in soil micro-flora and micro-fauna, and the potential loss of fire-induced successional communities due to inadequate fuels and lack of seed banks in North American forests.

In Tennessee, indirect effects associated with hogs included setting back or speeding up plant succession, consumption of natural seed crops to the point of impeding reproduction, limiting species composition and quantity of vegetation, encouraging erosion and physical damage to trees.

Disturbances caused by hog rooting and movement through island vegetation may facilitate the spread of non-native, invasive plant species. Once established, these species have demonstrated the ability to expand at the expense of native plant species. Additionally, many of the naturalized non-native plant

species found on St. John Island have not co-evolved with the grazing pressures exerted by large herbivores. They have adaptive mechanisms, which allow them to avoid being grazed or to better survive the impacts of grazing. These non-native plant species have expanded in the presence of goats and hogs on St. John at the expense of the island's native flora. The presence of hogs would only likely benefit these undesirable species because exotic plants are widely dispersed through their feces.

Micro-biotic flora or crusts are a critical component of many of the arid and semi-arid rangelands throughout the Northern American West, Midwest and East. These crusts are found throughout the world and are known to occur on St. John. Cyano-bacteria make up the majority of the micro-biotic crusts, but lichens, mosses, green algae, micro-fungi, and bacteria are present as well. These soil crusts significantly modify the surfaces on which they occur and can represent 70-80 percent of the living ground cover. Soil crusts are known to be important in nitrogen fixation, enhancing vascular seedling establishment, and reducing soil erosion.

Several studies have shown that soil crusts are severely impacted by the trampling associated with grazing. Researchers have noted that soil lichen cover is negatively correlated with livestock grazing and that soil mobility and erosion increased with reduced lichen cover. It is likely that hog rooting would be equally or more damaging. Recovery of soil crusts following the cessation of grazing and trampling has also been noted.

Much of the ecological concern about hogs arises because they are opportunistic omnivores, eating anything from grain to carrion. They kill and eat small vertebrates, but also feed on roots for much of the year. They eat any plant species and do so by uprooting and denuding large areas. After eating most of the uprooted vegetation, the hog often continues to dig with their large and powerful snout. After wallowing in the newly exposed and cool earth and trampling in any water that may have collected in the established wallow, the hog and her family move on. The associated digging activities in search of roots causes disturbance to the soil. This can result in increased soil erosion and changes in forest understory layer by killing tree seedlings and trampling herbaceous plants. Longer-term changes could include changes in the overstory layer if tree recruitment is affected by killing young trees.

The soil disturbance can also result in invasion by exotic plant species that possess ecological advantage in disturbed habitats. In addition, the Reef Bay watershed contains long-term forest monitoring plots established by the New York Botanical Garden in 1985. As of this time, by 1999 rooting activities of hogs had greatly impacted approximately 14 percent of the subplots in the study site. Leaving the environment in this way can make it impossible for new plants of the original species to grow. When food is plentiful, as is roughly 80 percent of the island, breeding females compensate with an increased litter size, as many as 10 young, and breed twice per year. Thus, a single gravid sow may easily establish a breeding population in a new area.

The ecological impacts from introductions of non-native herbivores can be both drastic and immediate. Hoofed herbivores impact native vegetation communities through their grazing and browsing activities, which change plant species composition and distribution. These changes typically result from the selection and avoidance by herbivores of certain plant species, thereby modifying plant succession processes in the impacted area, and eventually leading to a completely different and unnatural plant community than existed before. For example, the most palatable and nutritious plants would be preferentially eaten, leaving the thornier, less desirable species (from the herbivores' perspective). If this continues at a high enough level over a period of time, the plant community would be changed towards one containing more thorny species with less total plant cover. The exact impact to a plant community would depend on the feeding habits and habitat preferences of the herbivores, the herbivore population size, and the length of time they occupy an area.

Currently, wild hogs inhabit most areas of the Park, but only a few areas have high concentrations of animals. The success of the wild hogs in populating the Park can be attributed to the lack of natural predators, the prolific reproductive nature of the species, and the fact that they are habitat generalists. The number of wild hogs inhabiting the Park may be as high as 800 animals. There are no practical methods to census wild hogs and the population can fluctuate drastically with available food resources.

The effects of wild hogs have on park resources are multifaceted and result from their movements, habitat utilization and food habits. Of greatest concern to Park management are the destructive effects hogs have on natural ecosystems and native components of those ecosystems. Rooting by wild hogs profoundly disrupts natural communities, individual species populations, forest successional patterns and forest nutrient cycles. Rooting adjacent to small streams and springs often results in high rates of soil erosion, which severely affects aquatic habitats. Rooting and wallowing by hogs detrimentally affect the aesthetic and wilderness values of the Park.

Direct impacts to listed plant species would include herbivory of T&E plant species by non-native hogs and the trampling, crushing and uprooting of listed plant species should non-native hogs walk, root or bed down within listed plant occurrences. Depending on the number of individual hogs within an area, one to many T&E plants may be grazed trampled or uprooted. Those occurrences that are found in areas of high hog use would likely incur the most damage. Because the rarity of these listed plant species is defined by their limited numbers; even relatively small impacts can have a large detrimental effect. Individual plants lost through predation, trampling or uprooting cannot contribute offspring to the succeeding generation. This results in a loss to the next generation of both absolute numbers and potential genetic diversity. A decrease in genetic diversity can lead to an overall decrease in evolutionary fitness for a species. Decreased population numbers lead to increased potential for extinction from continued predation, or from large random disturbance events such as fire, hurricanes or drought.

Indirect effects to listed T&E plant species by non-native hogs include alterations in listed plant micro-habitats, soil erosion, and facilitation of the spreading of invasive, non-native plants into the habitats of listed plant species.

Wild hogs have both direct and indirect effects on the flora of the Park. A variety of plant species, including many rare, threatened, endangered or endemic to St. John are eaten, trampled or uprooted by hogs. Hog rooting in dry evergreen woodlands, dry evergreen scrub, thorn and cactus scrub, moist forest formations, early successional vegetation, and coastal wetlands may reduce understory cover by as much as 95 percent of normal ground density, resulting in changes in forest structure and composition. Hogs and European boar are seriously threatening the sole, small remaining populations of the endangered St. Thomas Lidflower (*Calyptranthes thomasianum*), Prickly Ash (*Zanthroxyllum thomasianum*) and Marron Bacora (*Solanum conocarpum)*, which has been proposed for listing. Resource managers are particularly worried about the protection of the St. Thomas Lidflower, because the largest population of 216 individuals lives near the top of Bordeaux Mountain.

Twenty-five territorially threatened and endangered listed plant species potentially impacted by non-native hogs include: *Cyposelia humifusa*, Urban's Holly (*Ilex urbanii*), Central American Oak (*Ilex sideroxyloides*), Pinion (*Tillandsia lineatispica*), Wooly Nipple (*Mammilaria nivosa*), *Croton fishlockii,* Egger's Cockspur (*Erythrina eggersii*), Egger's Galactia (*Galacteria eggersii*), Cowage Cherry (*Malpighia woodburyana*), *Malpighia linearis*, *Byrsonima sp*. *Psidium sp*., *Eugenia sp*., *Schoepfia schreberi*, Christmas Orchid *(Encyclia ciliare*), Yellow Dancing Lady (*Tolumnia prionochila*), White Dancing Lady (*Tolumnia variegatum*), *Ponthieva racemosa, Prescottia oligantha*, *Prescottia stachyoides*, *Tetramicra canaliculata,* Myrtle-leaved Peperomia (*Peperomia myrtifolia*), *Machaonia woodburyana*,

Bulletwood (*Manilkara bidentata*), and *Solanum mucronatum*. Local extirpation of certain plants is possible whenever hog damage is occurring (Bratton 1974a, 1974b, 1975, and 1977).

Wild hogs negatively affect the fauna of the Park through predation, habitat alteration and competition for food. One territorially endangered and threatened animal species, the Slipperyback Skink (*Mabuya mabouia*), an endemic to the Park. Other Territorial Endangered species include ground-nesting species such as Bridled Quail Dove, Bahama Pintail Duck and West Indian Nighthawk, all of which would no longer suffer egg and chick depredation due to hogs. Areas uprooted by hogs undergo notable declines in small mammal populations (Singer *et. al.* 1982). Wild hogs are in direct competition with small mammals for insects, earthworms and other invertebrates and also compete with native species for other available food resources, especially hard mast.

Non-native hogs continue to have very large and adverse effects on island wildlife and fauna. Because herptofauna and invertebrates are small, often slow and readily available, they are particularly susceptible to local extirpation from hog depredation. Of particular concern are the varied native reptile and amphibian populations in the Park and their associated links in the food and ecological web of the island. Wild hogs prey upon three species of tree frogs, two geckos, three Anolis lizards, the Ground Lizard, Legless Lizard, Blind Snake, the Puerto Rican Racer, and the Slipperyback Skink. The Park has listed over 232 common insect species, including 13 species of dragonflies and damselflies and over 1500 beetle species, many of which are consumed by non-native hogs. Many invertebrate species may be lost before researchers have catalogued them.

Presently, the greatest threats to forest regeneration are development and growing populations of non-native hogs, goats and burros. Goats burros alter forest composition by selectively feeding on palatable species and distributing the seeds of exotic species through their feces. Hogs destroy vegetation through rooting up of plants. Despite disturbance by non-native animals and construction, Park lands continue to be a valuable refuge for native plant species. To date, 747 species of vascular plants have been identified from St. John, of which 642 (86%) are native to the island. The species are found in 117 families, of which 12 are introduced. Almost all species (99.7%) on St. John are found on other islands within the Virgin Islands. Two species are endemic to St. John (*Eugenia earhartii* and *Machaonia woodburyana*) and six others are endemic to the Virgin Islands. Another 25 species are endemic to the Puerto Rico platform. Many voucher specimens and representatives of common plants have been collected by premier botanists and placed in the Park herbarium collection, creating an extensive collection of most species on the island. As they conduct monitoring and inventories, botanists continue to identify new species.

A network of long-term monitoring plots, representing a range of stand ages and land-use histories, has now been established in each of the following forest types on the island: upland moist, gallery moist, dry evergreen woodland and dry evergreen scrubland. Peter Weaver has established 16 plots in the dry evergreen and moist forest of the Cinnamon Bay watershed; the New York Botanical Garden has three plots covering upland moist, gallery moist and dry evergreen woodland; and the Smithsonian has two plots covering dry evergreen woodland and dry evergreen scrubland. In addition, the USDA-NRCS has five long-term plots in the Lameshur and Cinnamon Bay watersheds to measure soil temperature and moisture. Information on forest regeneration, tree seedling growth, changes of species composition and forest structure are gathered by researchers through Memorandums of Understanding, Cooperative Agreements and direct National Park Service funding.

The Virgin Islands National Park has probably the best baseline set of data for dry tropical forest in the Caribbean. The numerous studies and long-term monitoring plots, coupled with the inventories and

published works on St. John vegetation, make this the most comprehensively studied habitat type in VINP. All of the federally and territorially listed species require some level of protection and monitoring.

Altered and degraded forest systems are recovering from the clear-cutting done in plantation days. Most species are still present, but composition and forest structure do not yet resemble pre-plantation descriptions of the forests. Ecological succession to dominant communities is being monitored. Grazing and browsing by non-native livestock and development pressures are the greatest threats. The few remaining mangrove forests have been considerably stressed by recent hurricanes: Hugo (1989), Luis (1995), Marilyn (1995), Bertha (1996) and Georges (1998) and development pressures. Fragmentation of small natural areas into even smaller parcels is a threat to natural systems and processes.

Wild Hog Disease Issues. Wild hogs also serve as co-hosts with native wildlife and livestock for infectious and parasitic diseases (New, Barton, Morris and Potgieter 1994). Hog cholera, swine brucellosis, trichinosis, foot and mouth disease, African swine fever, and pseudo-rabies are all diseases that may be transmitted from domestic goats to livestock. A variety of arthropod, protozoans, helmith parasites also have been found from the Park, including, ticks, lice, protozoa, kidney worms, esophageal worms, stomach worms, intestinal worms, and lungworms. These are common parasites for both wild and domestic swine.

Non-native swine can be carriers of some diseases that humans can contract, including trichinosis and brucellosis. Trichinosis is generally only a problem in confined livestock areas where hogs are fed the remains of dead hogs, since the tapeworm cysts are found in muscle tissue and must be ingested to be transmitted to a different host. The only way non-native hogs would contract trichinosis would be through consumption of dead hogs in that area.

Swine brucellosis is caused by a bacterium (*Brucella suis)*, and is transmitted through oral contact with aborted fetuses or the reproductive tracts of female hogs. It results in the abortion of a female's first litter or two, after which time the animal ceases to exhibit any obvious symptoms. According to local experts, there is no evidence for the presence of brucellosis in livestock in the Virgin Islands, cattle are certified "brucellosis free", and blood sera is collected from livestock periodically for testing brucellosis (Rollo and Nellis, pers. comm.).

Any efforts by the NPS to reduce hog populations must take into consideration disease issues. It appears that no serious public health hazards would occur if the public were allowed to butcher hogs. Brucellosis is unlikely to be found in St. John hogs, and locals have already been hunting hogs in Park areas for almost forty years. Suggested cautions would be to inform people that during butchering activities, gloves should be used and that contact with the reproductive tracts and fetuses of female hogs should be avoided.

Biological Pollution (Exotic Plants)

Harmful exotic plants can have profound environmental consequences ranging from wholesale ecosystem changes and extinction of indigenous or native species, especially on islands, to more subtle ecological changes and increased biological sameness (monospecific forests). Both intentional and accidental introductions of harmful non-indigenous plants occur. Intentional introductions take the form of ornamental plants to enhance perceived beauty or of crops, fruit trees and medicinal plants to generate a new source of food or income. Accidental introductions arrive as contaminants or hitchhikers on bulk commodities, packing material, in ship ballast, seed shipments and soil. Agricultural inspections of plants entering the Virgin Islands through customs are cursory at best. No inspections are done on cargo transported between the Virgin Islands. An inventory of exotic species and determination of their status in the Park are needed. If the species interferes with Park objectives, has the ability to alter ecosystems,

can spread to natural communities, can out-compete native species or is allellopathic, management actions need to be evaluated and implemented.

Disturbances caused by hog rooting and movement through island vegetation may facilitate the spread of non-native, invasive plant species. Once established, these species have demonstrated the ability to expand at the expense of native plant species. Additionally, many of the naturalized non-native plant species found on St. John Island have not co-evolved with the grazing pressures exerted by large herbivores. They have adaptive mechanisms, which allow them to avoid being grazed or to better survive the impacts of grazing. These non-native plant species have expanded in the presence of goats and hogs on St. John at the expense of the island's native flora. The presence of hogs would only likely benefit these species due to the fact that exotic plants are currently widely dispersed through their feces.

Forest Recovery and Fragmentation

Altered and degraded forest systems are recovering from the clear-cutting done in plantation days. Most species are still present, but composition and forest structure do not yet resemble pre-plantation descriptions of the forests. Ecological succession to dominant communities is being monitored. Grazing and browsing by non-native livestock (hogs, goats, sheep and burros) and development pressures are the worst threats. The few remaining mangrove forests have been considerably stressed by recent hurricanes: Hugo (1989), Luis (1995), Marilyn (1995), Bertha (1996) and Georges (1998) and development pressures. Fragmentation of small natural areas into even smaller parcels is a threat to natural systems and processes.

Garbage Disposal and Recycling

Until 1994 the St. John solid waste disposal site was an open landfill located at Susannaberg, 2.4 kilometers (1.5 miles) east of Cruz Bay, south of Centerline Road. The Territorial Department of Public Works manages the facility. This landfill served the needs of the entire island, including the Park until it was closed after a large fire erupted and eventually was put out in 1992. The landfill has been capped and closed according to the Environmental Protection Agency's standards, however, leachates carrying contaminants may wash down Guinea Ghut or seep into the groundwater during heavy rainstorms. Garbage generated on St. John is taken to the landfill site, loaded onto trucks, barged to St. Thomas and deposited in the Bovoni Landfill. This landfill has exceeds capacity, and resource recovery alternatives are being explored by the VI Government.

Twelve percent of the contents of the landfill are metal, 40% is paper and 5% is glass. If just these materials were recycled, the volume of garbage going to the landfill would be decreased by over 50%. If composting household garbage, grass and leaves were done; another 23% in volume would be reduced. The Park, the VI Anti Litter and Beautification Commission (VIALBC) and a few key local citizens has initiated recycling programs for aluminum. Recycling would decrease the volume of garbage sent to the landfill as well as save energy. Ninety percent of the energy it takes to manufacture aluminum from virgin materials can be saved if aluminum is recycled. Hog access to human garbage at all NPS visitor and concession facilities and structures are one of the reasons why the Park is animal-proofing all of food containers.

III.C. CULTURAL RESOURCES

This section of the Environmental Assessment describes the current status of baseline information from inventories, monitoring and research projects. Major Park planning documents have been completed. Some are in the process of being updated; the Land Use Plan, General Management Plan, and the

Resource Management Plan. Virgin Islands National Park needs an update to major inventories and documentation of cultural resources in addition to special studies and an administrative history.

History

Non-native Domestic Hogs (*Sus scrofa)* are an ungulate species not native to North America or South America (Barrett 1984). Christopher Columbus first brought domestic hogs or European hogs into the West Indies in 1493. The Danes brought wild hogs, to St. John in 1718 when they colonized the island. Wild hogs have established breeding populations in many areas and all habitat types of the Virgin Islands National Park. Currently in St. John, hogs are predominately owned by one landowner adjacent to Centerline Road near Cruz Bay. These hogs are not fenced off, so individual animals periodically wander into surrounding areas, including National Park lands, and became feral.

Three waves of migrations brought Native Americans north from the Orinoco River valley of Venezuela. By the time of European discovery of the New World, two prehistoric Indian groups inhabited or visited the Virgin Islands, the Arawaks or Tainos and the more aggressive Caribs. On November 4, 1493, Christopher Columbus and a fleet of 17 ships made land fall in the Lesser Antilles beginning two centuries of international wars for supremacy of the West Indies, disrupting native customs and deforesting the land. The Columbus expedition did land on St. Croix, probably at Salt River.

Beginning in 1718, St. Thomas and St. John were colonized by the Danish West India and Guinea Company. Landholdings were cleared and cultivated. These "plantages" or "plantations" relied on slave labor and sizable capital investment. On St. John in 1733-4, development was slowed and nearly stopped by an almost successful slave uprising. The Danish West Indies became a crown colony in 1755 and development accelerated. By 1780, the greater part of St. John was under cultivation. Early crops included cotton, tobacco and dye woods such as indigo, but shifted predominantly to sugar. The rugged terrain, the thin rocky soil and labor-intensive economies created problems. As long as sugar prices remained high and African slaves were easily available, agricultural development was financially viable.

Denmark abolished trade in slaves in 1792. By the 1800s, sugar prices dropped. Plantation economy became marginal. By the mid-1800s, competition with areas where mechanical cultivation of both sugar and cotton and the increased production of the European sugar beet was too much and some plantations folded. In 1848 slavery was abolished in the Danish West Indies. The plantation systems succumbed. Only a few plantations lasted into the 20th century. They introduced crops that produced bay and lime oil, mechanically crushed sugar, or they attempted to raise and sell livestock.

The breaking point for most remaining plantations occurred in 1867. Following a major hurricane and earthquake, tracts of cultivated land were abandoned or allowed to shrink. The population declined. Land reverted to natural vegetation that buried the collapsing remains of the once flourishing agricultural buildings. In 1917, the Danish West Indies was ceded to the United States. The territory of the Virgin Islands was created in 1931 and is currently administered by an elected governor and legislature. Oversight authority for the territory rests in the U.S. Department of Interior.

Now the islands are based on a tourist economy. After World War II, with rising wages and improved large-scale commercial air travel, mass tourism became reality. The over one million tourists per year originate predominantly from the United States (64%), Europe (10%) and Canada (7%). Beginning in the 1950s, St. Thomas became a popular destination for Caribbean cruise ships that send passengers to St. John for day trips. The island, which once harbored fewer than 800 people living mostly in two-room wooden cottages without indoor plumbing, electricity or telephones and their only means of transportation a burro or a horse, has undergone a dramatic transformation. A population of over 4,500 persons is now sustained by wage employment that allows many to live in modern housing and own cars.

The Virgin Islands National Park was welcomed when it was established in 1956 on St. John. It was thought that the Park would provide economic opportunities for local Virgin Islanders. But, the Park has been developed as a "natural area", following an U.S. concept of nature foreign to St. Johnians. The general policy adopted by the Park dictated that land be "managed 'back' toward pristine condition" that had prevailed "when the area was first visited by the white man" (Administrative Policies 2001). Access to economic resources in the Park has been restricted, severely limiting traditional use of the environment. The tourist industry created only limited economic opportunities for St. Johnians.

After the Park was established, it undertook the task of undoing the effect of almost 250 years of cultivation. If a St. Johnian had a garden plot under cultivation on land acquired by the Park, the plot could continue to be cultivated but no new land could be cleared. Soil was depleted within several years and the traditional extensive swidden agriculture ceased. Cattle grazing on Parklands were forbidden. No longer permitted to turn their cattle loose on a nearby estate during periods of drought, farmers were forced to slaughter them. Even though hunting and trapping had never been a major part of the local economy, the Park set up large signs prohibiting it. There was a fine of $500 or six months in prison for any person violating Park rules.

Archeological Sites

The Virgin Islands prehistorically are part of a larger Caribbean Culture Area. This area consists of two distinct chains of islands. The Lesser Antilles are a line of small, mainly volcanic islands sweeping northward from Trinidad near the mouth of the Orinoco River in Venezuela. The Greater Antilles consists of a chain of four large islands: Puerto Rico, Hispaniola (Haiti and the Dominican Republic), Cuba and Jamaica. American Indians prior to discovery inhabited the Virgin Islands by the Spanish explorers. Prehistoric information and surveys are incomplete.

The earliest occupation of the Americas was detected around 10,000 BC. During the last glaciation when a land bridge formed between Asia and North America, small highly mobile bands of hunters and gatherers reached America. They hunted large megafauna such as the mastodon and mammoth. It is not thought that the Antilles were inhabited during this period (13,000 to 7,900 BC). The earliest recorded prehistoric site for the Caribbean Culture Area is the El Jobo Site in Venezuela. This culture was probably an offshoot of the North American big game hunting tradition.

During the next period of time, the hunter/gatherer groups became more organized and spread out. They developed storage pits, began collecting shellfish, developed habitations, prepared their dead for burials, traded with other groups and developed the atlatyl to increase hunting prowess. This period of time is called Archaic on the mainland (8,000 to 1,000 BC) and Meso-Indian in the Caribbean (5,000 BC to AD 0). The only known site representing this period of time in the Virgin Islands is the Krum Bay Site on St. Thomas although there may be a site as old as 700 AD at the west end of Cinnamon Bay beach.

The third broad period of pre-history is called the Neo-Indian in the Caribbean (AD 0 to contact with Europeans). During this period of time, there was an increase in horticulture, ceramic pottery use and there was a shift to a more sedentary lifestyle. Several waves of culture groups left the Orinoco valley in Venezuela and migrated northwards. Just a few hundred years prior to contact with Europeans, the Arawaks had begun to be displaced by this last migrant group. By European contact, the Caribs had occupied all of the Lesser Antilles including the U.S. Virgin Islands.

Twenty-two prehistoric sites have been recorded on St. John, thirteen of which are on National Park Service land. Only two of these sites are currently on the National Register, the Reef Bay petroglyphs and the Cinnamon Bay site. Nine additional sites may be eligible for National Register listing. The largest and best-known site on St. John is at Coral Bay outside the Park boundary.

The subsistence economy of these Archaic people was based on collecting plants, fishing and small game hunting with an emphasis on the exploitation of maritime resources. No large mammals were present on St. John. The Iguana (*Iguana iguana*), Hutia (*Isolobodan*), and several bird species provided land-based meats. The hutia, a small rodent-like animal, and the iguana are thought to have been introduced to St. John by Arawak settlers. Reef fish were the most important and easiest to exploit. The Manatee (*Trichechus manatus*) was known to have been used by aboriginal and historic settlers alike. Shellfish were abundant, with Conch (*Strombus* sp.) and the West Indian Topshell (*Cittarium pica*) being found the most often in the archeological record. Spiny lobster and crabs were also utilized for food. Recent evidence from Cinnamon Bay shows that the Caribbean Monk Seal as well as freshwater turtles, snakes and a number of rails were also consumed.

Wild hog rooting has damaged a number of island sites. Hog rooting to a depth of three feet has been noted in a number of sites. Hog rooting has destroyed the information potential of some shallow sites and surface scatters. Rooting in the upper layers of deeper, more complex stratified sites profoundly disturbs time and spatial relationships and destroys the context of the information contained in these sites.

Non-native wild hogs damage irreplaceable archeological sites and degrade the scientific importance of the sites located at Cinnamon and Reef bays. Damage to archeological sites by hogs would continue essentially unabated. Hog rooting of archeological sites on the island has resulted in a loss of integrity, and could ultimately result in a loss of the values that make these sites eligible for the National Register of Historic Places.

Historic Structures

The most conspicuous structures, both in volume and size, are the remains of sugar plantations. They are found predominantly along ridges of the north coast and valleys of the south coast of St. John, where drainages were good for growing sugar cane. On drier areas of the island, cotton and livestock were raised.

Consolidation of small landholdings to larger economically feasible ones occurred over time. From 1728 Danish tax records, 91 plantation lots were counted on St. John. Only half of these were under development. Seventy-two years later, in 1800, P.L. Oxholm mapped 68 plantations, 41 of which were within the current authorized Park boundaries. Currently there are 46 historic plantations within the authorized boundary, 31 of these are on federal land.

There are 236 historic structures on the 1989 List of Classified Structures for St. John. Seventeen of these are still roofed or with vestiges of roofing. Nine structures are in use. Sixteen historic districts are recorded on the National Register, all of which are on federal land. These contain 180 individual structures. Seven individual structures are recorded on the National Register, four of which are on federal land. Structures range in function from Danish plantation great house, cook house, slave village and sugar processing factory to colonial fort and battery, to a school and even a guard custom house. They date from 1718. Many of the structures have fallen to ruinous piles of rock not considered salvageable and should be removed from the List of Classified Structures (LCS) and added to the Cultural Sites Inventory (CSI) as historic archeological sites. Basic inventories are not complete. Portions of structures and new historic archeological sites hidden by years of vegetative growth are still being discovered. Historic structure reports have not been completed for most structures undergoing stabilization.

No National Landmarks are yet listed for the island of St. John, although there are six worthy of nomination (M. Barnes, 1990). Two sites were nominated in 1994: Fortsberg and the Reef Bay Great House Plantation manager or owner residences were usually with the area of production or on higher ground overlooking the factory. Slave quarters or "villages" were placed on the periphery of the

production center. Most plantations included an orchard and plot for raising vegetables. Terrain dictated the pattern, either grid or terracing with walls. Existing roads and trails generally follow original cart roads that should also be considered part of the cultural resource.

Architecture was rural in character and utilitarian of purpose. The most common construction was rubble masonry using locally available fieldstone set in lime mortar with liberal use of imported brick for framing doors, window openings, arches and quoining of corners. Much rubble and brick masonry has traces of a parged or plaster finish. Stucco inlays of colored plaster ornamentation was frequent in principal buildings. The Reef Bay Great House and Hammer Farm are excellent examples of the use of ornamentation. Characteristic, but not common, was the use of blocks of cut and fitted brain coral that was usually left exposed. Annaberg Sugar Plantation is an excellent example of this architectural style. Clay wing tile, both glazed and unglazed, was not an unusual roofing material. Flooring made of brick, clay tile or Gotland limestone flagging was widely used. The few remaining well-preserved structures indicate that workmanship was excellent.

The most significant and complete historic structures on St. John under Park jurisdiction have been cleared of vegetation and stabilized to provide a degree of protection against further deterioration. The work has been predominantly limited to masonry repair of standing walls. The Reef Bay Sugar Factory has been re-roofed with a lightweight modern galvanized-type roofing to protect the machinery and other features of the interior. Significant structures that have been stabilized include the Reef Bay Sugar Factory which is the best preserved example of technology used in mid-19th century sugar making, the Cinnamon Bay sugar plantation which was one of the first established on the island and site of significant events during the 1733 slave rebellion, the Annaberg Sugar Plantation illustrating an excellent example of a complete factory complex, and the Hammer Farm (also called Catherineburg) windmill tower with unique ramp and vaulted storage.

The Reef Bay Great House is considered one of the most important historic structures in the Park and illustrates West Indian formal architecture. It is on the National Register (H-15) and has been nominated for National Historic Landmark status. Fish plates and tie rods were installed in some walls of the Reef Bay Great House to increase structural strength, but have now been removed. Reconstruction of the walls of southwest corner was needed to stabilize it and keep it from imminent collapse. This was completed in 1993. The structure has also been re-roofed with sheets of galvanized aluminum. Plastering of the exterior is still needed.

Fourteen known historic districts and one individual building exist on inholdings within the authorized boundary on St. John. Nine of them may qualify for nomination to the National Register for their historical associations and their integrity. They include: Caneel Bay Plantation (H6); Susannaberg Plantation (H7); Adrian Plantation (H8); Oynes Point Custom Guard House (H9); Leinster Bay Plantation (H29); More Hill (H38); Frederiksdal and Mount Pleasant (H41). The State Preservation Office has nominated two of them to the National Register: Frederiksvaern, Fortsberg, Coral Bay (H44); and Whistling Cay Customs Guard House (H47).

The major environmental impact to the historic structures is growth of vegetation. Plant roots penetrate soft mortar and plaster surfaces working themselves deeper into the structure forming cracks through pressure against surfaces as they grow and providing avenues for moisture and rainfall to enter. Consistent, constant removal of vegetation continues to be one of the major efforts in stabilizing major Park structures.

Non-native wild hogs destroy irreplaceable historic sites and degrade the scientific importance of the sites located at Cinnamon and Reef bays. Damage to historic sites by hogs continues essentially unabated.

Hog rooting of historic sites on the island has resulted in a loss of integrity, and could ultimately result in a loss of the values that make these sites eligible for the National Register of Historic Places.

Ethnographic Resources

The culture of island residents is important to understand and maintain. No ethnographic program has been developed. Oral histories are needed before elderly island residents containing a wealth of information forget or pass away. Crafts such as basketmaking were not just conducted for additional income or trade, but as avenues to carry on community traditions and lifestyles. An expansion of craft demonstrations, displays and an outlet for their sale may be desirable.

There has been a local hog-hunting tradition on St. John for centuries. Such a cultural tradition reflects the long history of hogs on the island and what is known archaeologically about enslaved Afro-Americans, and others, supplementing their diets (at least in some areas of the Americas) through hunting, fishing, and trapping. Hog hunting in the Park in the mid-1990's before it was determined the enabling legislation for the Park did not allow it.

NPS would contact former St. Johnian hunters and ask them to participate under the Volunteers-In Parks (VIP) program in implementing this hog reduction program. We would be able to contact these individuals, as we have their previous hunting permits on record (also see page 21, Use of Local Field Volunteers; as well as page 22, Use of By-products).

IV. CHAPTER IV. ENVIRONMENTAL CONSEQUENCES

Chapter IV discusses the environmental consequences of implementing each of the two alternatives described in Chapter II. This analysis of environmental consequences is largely a qualitative assessment of the effects of the alternatives on twelve natural and cultural resources categories.

IV.A. Non-native Wild Hogs Control

IV.A.1. Alternative 1. No Action, Continue Current Level of Management

Wild hog populations have been increasing for the past several years as evidenced by the introduction of hogs in Maho and Cinnamon watersheds in 1998, which were historically free of hogs. Therefore, all impacts associated with the presence and proliferation of hogs would be expected to increase under this alternative.

Air Quality Impacts
No adverse air quality impacts would be expected under this alternative. Consequently, there would be no impairment of air quality as a result of the implementation of Alternative 1.

Scenic Values
Scenic values would decline under this alternative as non-native hogs eat, trample, crush and uproot native flora and increasingly depredate native fauna. The aesthetics of visits to the island would be lessened due to the reduction of native wildlife, reduction of plant cover, and damage to archeological and historical sites. Consequently, there would be no impairment of scenic values as a result of the implementation of Alternative 1.

Cultural Resource Impacts
Non-native hogs would continue to damage irreplaceable archeological resources and would degrade the scientific importance of the St. John archeological record. Under this alternative, damage to archeological and historic sites by hogs would continue essentially unabated. Continued hogs rooting of archeological sites on the island would result in their loss of integrity, and ultimately loss of the values that makes them eligible for listing on the National Register of Historic Places.

Cultural resource impacts would increase where hog burrowing, vegetation grazing and exotic seed dispersal continually impact the context of these resources, thereby compromising their scientific value. Consequently, there would be no impairment of cultural resources as a result of the implementation of Alternative 1.

Socioeconomic/Visitor Use Impacts
Under the no action alternative, existing socioeconomic conditions would continue on St. John Island, with Park visitation continuing to increase. In many areas of the Park, visitation levels would remain heavy except in remote backcountry areas. The quality of the visitor experience would be impacted by the presence of non-native hogs and by the effects of hogs, which include evidence of hog rooting, the occasional sighting of hogs, and continued impacts to native flora and fauna the public hopes to observe.

Hogs may occasionally be dangerous to people in certain situations. Park visitors and employees would continue to be charged by wild hogs periodically while hiking Park trails.

The continued presence of hogs along trails maintained for public use in several watersheds may necessitate temporarily closing the trails for public safety. This would result in fewer visitor services a reduced visitor experience, as well as an increase in law enforcement efforts to maintain the closure.

Health and sanitation impacts would continue to decline under this action. Increasing wild hog populations would continue to serve as co-hosts with native wildlife and livestock for infectious and parasitic diseases as when compared with the wild hog reduction alternative. Consequently, there would be no impairment of socio-economic/visitor use as a result of the implementation of Alternative 1.

Soil Impacts

Major soil impacts would continue and may readily increase under this alternative. Hog rooting and herbivory would continue to reduce plant cover and greatly increase soil erosion and sedimentation of streams and nearshore ocean water where it can affect coral reef, seagrass beds and associated marine communities.

Over 82% of land is greater than thirty degrees in slope. Therefore, uprooted soils, which are typically very thin, readily flow into the nearby valleys. Loss of this precious topsoil makes new or existing plant growth more challenging, and may eventually impact and smother marine reefs and sea grass bed communities. Slopes whose vegetation and soils have been upturned and tilled as a result of hogs rooting are susceptible to having rapid runoff during storm events. This rapid runoff would continue to deepen existing gullies, and possibly create new gullies. Rapid runoff causes high sedimentation to occur in low gradient valley bottom reaches. Consequently, there would be no impairment of soils as a result of the implementation of Alternative 1.

Threatened and Endangered Species Impacts

Non-native hogs are a potential threat to each of the Federally or Territorially listed Endangered and Threatened (ET) plant species found on St. John Island. Under this alternative, the threats to each of the listed species would remain or increase. Fluctuations in the severity of impacts would occur seasonally and yearly as hog numbers changed. However, the potential for recovery of rare plant species would be negligible even during those years when hog numbers are low. This is because the hog populations are related to food availability; therefore, animals continue to immigrate into new watersheds.

Direct impacts to listed plant species would include herbivory of T&E plant species by non-native hogs and the trampling, crushing and uprooting of listed plant species should hogs walk, root or bed down within listed plant occurrences. Depending on the number of individual hogs within an area, one to many (ET) plants may be grazed trampled or uprooted. Because the rarity of these listed plant species is defined by their limited numbers, even relatively small impacts can have a large detrimental effect. Individual plants lost through predation, trampling or uprooting cannot contribute offspring to the succeeding generation. This results in a loss to the next generation of both absolute numbers and potential genetic diversity. A decrease in genetic diversity can lead to an overall decrease in evolutionary fitness for a species. Decreased population numbers lead to increased potential for extinction from continued predation, or from large random disturbance events such as fire, hurricanes or drought.

Under this alternative, VINP would fail to actively remove (or eliminate) species known to predate listed (ET) species. In St. John, the listed species include the Endangered St. Thomas Lidflower (*Calyptranthes thomasiana*), Prickly Ash (*Zanthroxyllum thomasianum*) and Marron Bacora (*Solanum conocarpum)*,

which has been proposed for listing. Non-native hogs also potentially impact twenty-five territorially threatened and endangered listed plant species.

Non-native hogs may also depredate one Territorially Endangered and Threatened animal species, the Slipperyback Skink (*Mabuya mabouia*), an endemic to the Park. Other Territorial Endangered species include ground-nesting species such as Bridled Quail Dove, Bahama Pintail Duck and West Indian Nighthawk, all of which suffer egg and chick depredation due to hogs. Consequently, there would be no impairment of threatened and endangered species as a result of the implementation of Alternative 1.

Vegetation Impacts

Hogs are voracious browsers of vegetation and prefer native plants, which evolved in isolation from large herbivores and lack defenses against ungulates. Hogs would continue to impact the native island vegetation, including endemic and federally and territorially listed plant species. Hogs selectively root plants and consumes them entirely. This causes topsoil loss and slower revegetation, often by invasive species. When combined with indiscriminate seed dispersal, the entire floral species composition begins to change as ground cover, understory, brush and finally canopy levels react to varying light and shade patters, loss of selected species, and rapid introduction of invasives.

Impacts to native plants and associated floral communities by introduced alien herbivores have been well documented in the literature. Similar impacts have been noted with regards to hogs. Documented indirect effects of alien herbivores and hogs to plant communities include the increase of cover, frequency, and biomass of non-native plant species, increased water run-off and soil erosion, and degradation of soil structure. Hogs have also contributed to changes in soil micro-flora and micro-fauna, and the potential loss of fire-induced successional communities due to inadequate fuels and lack of seed banks.

Twenty-six long-term ecological monitoring sites would continue to be destroyed or potentially compromised by increasing hog populations and movement into new areas. Valuable ecological data would continue to be lost. Consequently, there would be no impairment of vegetation as a result of the implementation of Alternative 1.

Wildlife Impacts

The non-native hog population would continue to fluctuate due to annual differences in weather. In years with favorable precipitation, greater plant productivity would allow hog populations to expand to an estimated 800 animals. As the hog populations increase, they would immigrate into new areas. This occurred in the Maho and Cinnamon watersheds in 1998. If left unchecked, hogs would spread to all park areas and impact wildlife and other resources throughout the park. Native wildlife would continue to be adversely impacted by this action because hogs depredate very large numbers of native fauna, including several native bird, reptile and amphibian species and numerous insect and spider species.

Because herptofauna and invertebrates are small, often slow and readily available, they are particularly susceptible to hog depredation. Of particular concern are the varied native reptile and amphibian populations in the Park and their associated links in the food and ecological web of the island. There are three species of tree frogs, two geckos, three Anolis lizards, the ground lizard, legless lizard, blind snake, the Puerto Rican racer, and the slipperyback skink. The Park has listed over 232 common insect species, including 13 species of dragonflies and damselflies and over 1500 beetle species. Many invertebrate species may be lost before researchers have catalogued them. Consequently, there would be no impairment of wildlife as a result of the implementation of Alternative 1.

Water Quality Impacts
Major adverse water quality impacts would continue unabated or increase under this alternative. This alternative would not implement any very large reductions in the non-native hog population. Hog rooting and herbivory would continue to reduce plant cover and greatly increase soil erosion and sedimentation of streams and nearshore ocean water where it can affect coral reef, sea grass bed and associated fishery, nursery and related communities.

Slopes whose vegetation and soils have been upturned and tilled as a result of hogs rooting are susceptible to having rapid runoff during storm events. This rapid runoff would continue to deepen existing gullies, and possibly create new gullies. Rapid runoff causes high sedimentation to occur in low gradient valley bottom reaches. High sedimentation rates with low watershed slope stability would be a primary concern for decline in water quality for the island. Consequently, there would be no impairment of water quality as a result of the implementation of Alternative 1.

Wetland, Saltpond and Floodplain Impacts
Adverse impacts to wetland, saltpond and floodplain areas would continue under this alternative as the native flora and fauna continue to change under the foraging and predation pressures of non-native hogs throughout the Park. Increased sedimentation of the small, numerous saltponds may accelerate secondary revegetation, thus eliminating their use by migratory and resident avifauna and other wildlife. Hogs would also continue to forage on red, black and white mangrove seeds, propagules and seedlings, a protected species in the Virgin Islands. There would also continue to occur increased sedimentation rates into wetlands under this alternative. Consequently, there would be no impairment of wetlands, saltponds and floodplains as a result of the implementation of Alternative 1.

Park Operations Impacts
Adverse operational affects from non-native hogs on the Park's administrative, resources management, interpretation, law enforcement and maintenance costs would be expected to continue and increase. Potential closure of public trails where visitors have been charged by hogs reduces visitor services and increases Park operational costs. Under this alternative, NPS would continue to animal-proof trash receptacles, dumpsters and buildings at the Cinnamon Bay Campground, day use sites, concession areas, Park overlooks, and employee housing areas. Also in 2002, NPS has contracted for the construction of a burro-exclusion fence with four barbed-wire strands around the perimeter of the Cinnamon Bay Campground at an estimated cost of $67,000, that is not designed to also exclude hogs. Consequently, there would be no impairment of Park operations as a result of the implementation of Alternative 1.

Cumulative Impacts and Conclusions
The cumulative impacts from this alternative would have severe negative consequences for National Park Service marine, cultural and terrestrial resources. Many native terrestrial plant, animal and invertebrate species would be adversely impacted under this alternative. The greatest impact would be changes in plant species composition and the associated changes in native fauna, including birds, reptiles, small mammals and insect species. These, in addition to decreased visitor services and experience, while Park operational costs rise in response to a growing exotic hog population.

Health and sanitation impacts would continue to decline under this action. Increasing wild hog populations would continue to serve as co-hosts with native wildlife and livestock for infectious and parasitic diseases as when compared with the wild hog reduction alternative. Hog cholera, swine brucellosis, trichinosis, foot and mouth disease, African swine fever, and pseudo-rabies are all diseases that would continue to be transmitted from wild hogs to livestock more frequently than when compared to all hog reduction alternatives. A variety of arthropod, protozoan, helmith parasites also has been found

from the Park, including, ticks, lice, protozoa, kidney worms, esophageal worms, stomach worms, intestinal worms, and lungworms. These are common parasites for both wild and domestic swine.

This alternative is inconsistent with the National Park Service Organic Act (16 U.S.C.) and the Virgin Islands National Park General Management Plan (NPS 1983): non-native and exotic pests such as wild hogs are threats to native fauna and flora and should be controlled.

This alternative is inconsistent with the approved Coastal Zone Management Plan supporting the removal of non-native pests that damage the coastal zone and wildlife therein, and policies of the Territory of the Virgin Islands, for reasons described above.

Other planning efforts recently completed or currently underway would not affect the Park's hog reduction program: including a Commercial Services Plan (NPS 2001); Vessel Management Plan (NPS 2002); and Installation of Moorings in VICRNM (NPS 2002).

Additional planning efforts recently completed or currently underway would affect the reduction program: including a Sustained Reduction Plan for Non-native Rats, Cats and Mongooses (NPS 2002); and a Sustained Reduction Plan for Non-native Goats and Sheep (in preparation, NPS 2003). All of these plans have similar objectives for reducing non-native animal populations within VINP. Consequently, there would be no impairment of cumulative impacts and conclusions as a result of the implementation of Alternative 1.

IV.A.2. Alternative 2. Reduce Wild Hogs Within VINP and Sustain a Near-zero Population, Proposed Action

The program goals for the Proposed Action would substantially decrease the hog population throughout the Park, with periodic monitoring and hog removal and fence maintenance ongoing indefinitely. Minor impacts associated with periodic monitoring, hog removal, and fence maintenance would be well below the deleterious impacts from the present situation where hog populations are expanding throughout the Park. Because Park-wide eradication is unfeasible, the next-best choice is to dramatically reduce the hog population and sustain the reduction.

Air Quality Impacts

No adverse air quality impacts would be expected under this alternative. Consequently, there would be no impairment of air quality as a result of the implementation of Alternative 2.

Scenic Values

This alternative would result in the most rapid reduction in number of non-native hogs and, therefore, the least damage to natural, cultural and recreational resources through reduced hog depredations on Park sites. Scenic values would increase under this alternative because hogs would no longer be eating, trampling, crushing and uprooting native flora and depredating native fauna. The aesthetics of visits to the island would be greatly increased by additional native wildlife, plant cover, and increased protection of archeological and historical sites. Marine, terrestrial and cultural resource values within the park and entire island would be enhanced and protected. Consequently, there would be no impairment of scenic values as a result of the implementation of Alternative 2.

Cultural Resource Impacts
Non-native hogs would no longer continue to damage irreplaceable archeological sites and degrade the scientific importance of the St. John archeological record. This alternative would result in the most rapid reduction of hogs and, therefore, the least continued damage to cultural resources through hog depredations on archeological sites. Hog rooting through disturbance has already adversely impacted the integrity of some of the island's National Register-listed archeological sites.

Impacts to the island's cultural resources by fencing and direct reduction operations are anticipated to be insignificant. The primary movement would take the form of foot traffic, and some may be near archeological sites. These areas are currently open to the public and risk destruction by hogs unless this alternative is taken. Impacts of this nature could be minimized by orienting the reduction groups to the sensitivity of these sites to damage and requesting that they avoid traffic over them whenever possible. Campsites, fences and trap locations could be assessed in advance using shovel-testing for any cultural resources concerns. Consequently, there would be no impairment of cultural resources as a result of the implementation of Alternative 2.

Socioeconomic/Visitor Use Impacts
The proposed action to conduct Park-wide reduction of non-native hogs would have some short-term negative impacts on socioeconomic issues but would also have long-term positive impacts on the quality of the visitor experience. The long-term positive effects greatly outweigh the short-term effects. Visitor use would possibly be slightly restricted on various portions of federal lands during hog collection operations. Under this alternative, Park-wide reduction would be an intense effort over a relatively short period of 2-3 years.

Over the last ten years, the annual visitation to St. John Island averages approximately 942,800 visitors per year. However, they would possibly be denied access to various public trails due to the presence of aggressive hogs. Hog reduction personnel would contribute financially to the local economy through purchases of goods and services, vehicle rental and equipment purchases.

The quality of the visitor experience would no longer be impacted by the presence of non-native hogs or their impacts, which include evidence of rooting, occasional hog sighting and continued impacts to native wildlife that public hopes to observe. Hogs would no longer be dangerous to people in certain situations. Hogs would no longer charge visitors and employees while hiking Park trails. Park trails would also be much safer due to lack of hog damage to the tread surface caused by hog rooting. Trail closures would be unnecessary.

Health and sanitation impacts would necessarily improve under this action. Under the Park-wide reduction alternative, non-native hogs would be less likely to serve as co-hosts with native wildlife and livestock for infectious and parasitic diseases. Consequently, there would be no impairment of socio-economic/visitor use as a result of the implementation of Alternative 2.

Soil Impacts
Soil disturbing activities from non-native hogs would be reduced within three years of implementation of this alternative. Substantial hog reductions from throughout the Park would eventually allow disturbed areas to revegetate. New hog rooting areas would be prevented.

Eventually, erosion from previously disturbed sites would decline as revegetation occurs. As vegetation cover increases, overall watershed conditions would continue to improve. As watershed conditions improve, runoff within the watershed would be reduced and absorbed by vegetation. This would cause less intense runoff events and decrease the rate of gully erosion (aggredation and widening). Less intense

runoff events would cause less sediment delivery into local waterways and nearshore ocean waters where it can affect coral reef, mangrove, seagrass bed ecosystems and adjacent fisheries, nurseries and associated marine communities.

Under Alternative Two, the use of existing trails could also lead to a short-term increase in soil erosion. The increase in soil erosion and the impacts to the soil micro-flora would likely decline once the hogs are reduced from the Park and use of the hunting trails is discontinued.

Trampling of the soil by field personnel could cause alterations in the soil micro-flora and cryptobiotic soil crusts may be damaged. As discussed previously, cryptobiotic soils are important components of soils arid and semi-arid environments. Trampling, especially during the dry season easily damages these soil crusts. These soil crusts have the ability to re-colonize disturbed areas from nearby non-disturbed land, however re-colonization and re-establishment of soil crusts in an area can be slow depending on environmental factors. Consequently, there would be no impairment of soils as a result of the implementation of Alternative 2.

Threatened and Endangered Species Impacts

Under Alternative Two, non-native hogs would be gradually reduced as a threat to each of the Federally or Territorially listed Endangered and Threatened (ET) plant and animal species found on St. John Island. Under this alternative, the threats to each of the listed species would be reduced by the hogs reduction program, involving wildlife reduction experts to eliminate or substantially reduce hogs from four watersheds within the Park.

Threatened and Endangered plant species would experience increased survivorship and seedling establishment and recruitment. T&E plant species are likely to benefit from decreased disturbance levels, increased litter retention, and re-development of the soil crusts. As T&E populations recover, they would be able to better withstand any subsequent natural disturbance events that may occur. Larger population numbers provide insurance against the formation of genetic bottlenecks. Replenishment of the seed bank – for those species that rely on natural disturbance events -- means adequate seedling establishment and recruitment would occur when the next disturbance event hits.

The VINP would no longer fail to actively remove or destroy non-native species that are known to predate listed species. In St. John, the listed species include the Endangered St. Thomas Lidflower (*Calyptranthes thomasiana*), Prickly Ash (*Zanthroxyllum thomasianum*) and Marron Bacora (*Solanum conocarpum)*, which has been proposed for listing. Non-native hogs would also no longer be impacting twenty-five Territorially Threatened and Endangered listed plant species.

Non-native hogs would also no longer be depredating one Territorially Endangered and Threatened animal species, the Slipperyback Skink (*Mabuya mabouia*), an endemic to the Park. Other Territorial Endangered species include ground-nesting species such as Bridled Quail Dove, Bahama Pintail Duck and West Indian Nighthawk, all of which would no longer suffer egg and chick depredation due to hogs. Consequently, there would be no impairment of threatened and endangered species as a result of the implementation of Alternative 2.

Vegetation Impacts

Hogs are voracious browsers of vegetation and prefer native plants because these plants evolved in isolation from large herbivores and lack defenses against ungulates. Hog impacts to the native island vegetation, including endemic and federally and territorially listed plant species, would be reduced completely in Maho and Cinnamon watersheds, and substantially reduced in Reef and Lameshur

watersheds. Plant communities would readily benefit by seedling survival, increase of cover, frequency, and biomass of native plant species, increased topsoil and water absorption.

Twenty-six long-term ecological monitoring sites would be permanently fenced to exclude hog populations. Valuable ecological data would be saved. Additionally, despite the current road and trail systems, the teams might create trails between adjacent watersheds. These trails would be ephemeral and minimally used. Consequently, there would be no impairment of vegetation as a result of the implementation of Alternative 2.

Wildlife Impacts

The non-native wild hog population, estimated at from 200 to 800 individual animals would be removed from the Park over a two to three year period. The removal of hogs would have very beneficial effects on island wildlife and fauna. Removal of hogs would reduce a direct mortality factor for invertebrates during certain times of the year, since invertebrates are part of the hog's diet. Hogs would no longer adversely impact wildlife in the Park by destruction of suitable habitat. The cessation of hogs rooting in specific locales would also improve habitat for lizards, snakes, salamanders and insects. Hogs removal from riparian areas would improve riparian habitat for frogs and aquatic invertebrates. The removal of hogs rooting for other fruits and berries in years of very large food production would improve habitat for those species which depend upon these crops, such as many bird species (pigeons and doves) and bats.

Physical hog reduction actions or methods would have slightly negative impacts on island wildlife and fauna over the two or three year intensive-removal period. Hog reduction personnel would traverse steep and densely vegetated slopes throughout the Park, and small number of wildlife species may be frightened. Consequently, there would be no impairment of wildlife as a result of the implementation of Alternative 2.

Water Quality Impacts

Major adverse water quality impacts from non-native hogs would be reduced within three years of the implementation of this alternative. In the short run, hog carcasses can impact water quality depending on the number (mass) of dead animals in a given location, decomposition rate, distance to surface water and distance to groundwater.

Hog carcasses can release water quality affecting compounds into the water, including: nitrates, total dissolved solids, chloride, and ammonium-nitrogen. The rate of these releases is dependent on the decomposing environment. For instance, in anaerobic conditions (such as underwater or extremely moist soil conditions) carcass decay is very slow. Release of these compounds from the carcass would be prolonged with possibly elevated concentrations of these substances. In contrast, in well-drained conditions a carcass can decompose rapidly, with little or no effect on groundwater.

To keep concentrations of these compounds within normal ranges would require carcass burial away from water drainage or collection areas with poorly drained soils. The benefits of mineral and elemental recycling and topsoil nourishment would be important to native plant communities. Consequently, there would be no impairment of water quality as a result of the implementation of Alternative 2.

Wetland, Saltpond and Floodplain Impacts

Major adverse wetlands and floodplain impacts from non-native hogs would be reduced within several years of the implementation of this alternative. Adverse impacts to wetlands and saltponds essentially be abated under this alternative as the native flora and fauna recover with decreased foraging and predation pressure of hogs throughout the Park.

High sedimentation rates with low watershed slope stability would no longer be a concern for decline in the quality of the island's wetland, saltpond and floodplain communities. Hogs would no longer continue to forage on red, black and white mangrove seeds, propagules and seedlings, a protected species in the Virgin Islands. A decrease in hog rooting would reduce rates of erosion and sediment deposition in wetland communities. Consequently, there would be no impairment of wetlands, saltponds and floodplains as a result of the implementation of Alternative 2.

Park Operations Impacts

This alternative would have the lowest potential for adverse operational affects because non-native hog populations would be greatly reduced, and held to low levels, throughout the Park at all visitor use, administrative, cultural and natural resources sites. Under this alternative, the overall costs of administration of the non-native wildlife control program would be increased with the implementation of contracts to remove exotic wildlife ($120,000 with the U.S. Department of Agriculture's Animal Plant Health Inspection Service / Wildlife Services Division). This program would necessitate an increase in on-island personnel and vehicles. Other transportation methods may be used including but not limited to horses, all terrain vehicles and boats. Housing would utilize existing structures whenever possible, including government facilities. Temporary tent camps may be established in remote areas. Consequently, there would be no impairment of Park operations as a result of the implementation of Alternative 2.

Cumulative Impacts and Conclusions

Alternative Two would result in a vigorous reduction of non-native hogs from within the Park. This alternative would reduce hog disturbance of native plant communities within several years. This would greatly reduce the numbers of this exotic (introduced) quadruped, animals that are known to facilitate the spread of weedy species. Their removal would reduce the impacts to the island's native plant communities by invasive species disturbance. The lack of rooting in the island's plant communities would reduce impact to and facilitate the recovery of native T&E species. The lack of disturbance would allow natural regeneration of T&E via germination of seeds beneath shrub and forest canopies. The regeneration may also lead to the spread of T&E species into surrounding plant communities, and the continued recovery of other disturbed plant communities throughout the Park.

Alternative Two has high probability of success for hog population reduction. However, potential for failure exists should resource constraints become evident any time during program implementation. This alternative is totally reliant on amassing a high intensity reduction effort for a short duration period of time. Failure to maintain either component (high intensity or short duration) would result in a lower probability of success. Ongoing monitoring, fence maintenance, scrupulous record keeping and period removal (Phase III) would be a crucial component for sustained success.

The cumulative impacts from this alternative would have very positive consequences for National Park Service lands, plants and wildlife. Many native terrestrial plant, animal and invertebrate species would be positively impacted under this alternative. The greatest impact would be recovery of native plant species communities and the associated changes in native fauna, including birds, reptiles, small mammals and insect species. Serious negative impacts to the listed species including the Endangered St. Thomas Lidflower (*Calyptranthes thomasiana*), Prickly Ash (*Zanthroxyllum thomasianum*) and Marron Bacora (*Solanum conocarpum)*, which has been proposed for listing, would be greatly reduced.

Health and sanitation impacts would necessarily improve under this action. Under the Park-wide reduction alternative, non-native hogs would be less likely to serve as co-hosts with native wildlife and livestock for infectious and parasitic diseases. Hog cholera, swine brucellosis, trichinosis, foot and mouth

disease, African swine fever, and pseudo-rabies are all diseases that would be less likely to be transmitted from feral hogs to livestock.

This alternative is consistent with the National Park Service Organic Act (16 U.S.C.) and the Virgin Islands National Park General Management Plan (NPS 1983): non-native and exotic pests such as wild hogs are threats to native fauna and flora and should be controlled.

This alternative is consistent with the Coastal Zone Management Plan that supports the removal of non-native pests that damage the coastal zone and wildlife therein; and other policies of the Virgin Islands territorial government, for reasons described above.

Other planning efforts recently completed or currently underway would not affect the Park's hog reduction program: including a Commercial Services Plan (NPS 2001); Vessel Management Plan (NPS 2002); and Installation of Moorings in VICRNM (NPS 2002).

Additional planning efforts recently completed or currently underway would affect the reduction program: including a Sustained Reduction Plan for Non-native Rats, Cats and Mongooses (NPS 2002); and a Sustained Reduction Plan for Non-native Goats and Sheep (in preparation, NPS 2003). All of these plans have similar objectives for reducing non-native animal populations within VINP. Consequently, there would be no impairment of cumulative impacts and conclusions as a result of the implementation of Alternative 2.

IV.B. Table 1. Summary Table of Environmental Consequences

This section describes the environmental consequences of the two alternatives that were analyzed in this environmental assessment for a non-native wild hog control program within Virgin Islands National Park. The alternatives include (1) no action, and (2) proposed action, reduction through trapping, shooting and fencing.

	Alternative 1 **II.A.3**	**Alternative 2** **II.A.4**
Impact Category	**Wild Hogs Control** No Action	**Wild Hog s Control** Proposed Action: Trapping, Shooting and Fencing
Air Quality Impacts	No adverse impacts would be expected.	No adverse impacts would be expected.
Scenic Values	Highest potential for adverse impacts. The aesthetics of visits to the Park would be lessened due to the reduction of native wildlife, reduction of plant cover, and damage to cultural sites.	Lowest potential for adverse impacts. The aesthetics of visits to the Park would be increased and enhanced due to increased native wildlife, increased plant cover, and increased protection of cultural sites.
Cultural Resources Impacts	Highest potential for adverse impacts as hogs continue to damage irreplaceable archeological and historical sites and degrade the scientific importance of these sites that makes them eligible for listing on the National Register of Historic Places.	Lowest potential for adverse impacts as hogs would no longer continue to damage irreplaceable archeological and historical sites and degrade the scientific importance of these sites that makes them eligible for listing on the National Register of Historic Places.
Socio-economic/ Visitor Use Impacts	Highest potential for adverse impacts as hogs continue to charge or disrupt visitors and employees along maintained public hiking Park trails. Restricted access when trails require closure due to hog prevalence. Health and sanitation impacts would continue to decline.	Lowest potential for adverse impacts as hogs would no longer continue to charge visitors and employees whenever hiking Park trails. Enhanced access and visitor experience throughout the park. Health and sanitation impacts would necessarily improve.

	Alternative 1 II.A.3	Alternative 2 II.A.4
Impact Category	**Wild Hogs Control** No Action	**Wild Hog s Control** Proposed Action: Trapping, Shooting and Fencing
Soil Impacts	Highest potential for adverse affects as hogs continue to reduce plant cover and greatly increase soil erosion and sedimentation of streams and nearshore ocean water where it can affect coral reef and other marine communities.	Lowest potential for adverse impacts as soil disturbing activities of hogs would be reduced within 3 years of implementation. Elimination would eventually allow disturbed areas to heal over with vegetation. No new hog rooting areas would be established.
Vegetation Impacts	Highest potential for adverse affects as hogs continue to damage plant community composition and structure by selective grazing of native vegetation and distributing seeds of exotic plant species in their feces and being transmitted to new sites on their hair and coats. Numerous long-term ecological monitoring sites would be inundated and potentially destroyed by hog rooting and herbivory.	Lowest potential for adverse affects as few hogs would cause less damage to plant community composition and structure by selective grazing of native vegetation and distributing seeds of exotic plant species in their feces and being transmitted to new sites on their hair and coats. Numerous long-term ecological monitoring sites would be entirely fenced and therefore protected from all large non-native herbivores including hogs, goats, burros, sheep, and white-tailed deer.

	Alternative 1 II.A.3	Alternative 2 II.A.4
Impact Category	**Wild Hogs Control** No Action	**Wild Hog s Control** Proposed Action: Trapping, Shooting and Fencing
Threatened/ Endangered Species Impacts (T&E)	Highest potential for adverse affects as hogs continue to impact T&E plants and animals protected under the Endangered Species Act (ESA). In St. John, the listed species include the Endangered St. Thomas Lidflower, Prickly Ash and Marron Bacora, which has been proposed for listing. Hogs also potentially impact twenty-five territorially T&E listed plant species. Hogs may also depredate one Territorially T&E animal species, the Slipperyback Skink, an endemic to the Park. Other Territorial T&E species include ground-nesting species such as Bridled Quail Dove, Bahama Pintail Duck and West Indian Nighthawk, all of which may suffer egg and chick depredation due to hogs.	Lowest potential for adverse affects as hogs would no longer continue to impact T&E plants and animals protected under the Endangered Species Act (ESA). In St. John, hogs would no longer continue to predate listed species including the Endangered St. Thomas Lidflower, Prickly Ash and Marron Bacora, which has been proposed for listing. Hogs would also no longer be impacting twenty-five territorially T&E listed plant species. Hogs would no longer continue to depredate one Territorially T&E animal species, the Slipperyback Skink, an endemic to the Park. Other Territorial T&E species include ground-nesting species such as Bridled Quail Dove, Bahama Pintail Duck and West Indian Nighthawk, would no longer continue to suffer egg and chick depredation due to hogs.

	Alternative 1 II.A.3	Alternative 2 II.A.4
Impact Category	**Wild Hogs Control** No Action	**Wild Hog s Control** Proposed Action: Trapping, Shooting and Fencing
Wildlife Impacts	Highest potential for continued adverse impacts from hog populations on native wildlife in the Park. Native wildlife would continue to be adversely impacted because hogs depredate native fauna including several native birds, reptile and amphibian species and numerous insect and spider species. Because herpto-fauna and invertebrates are small, often slow and readily available, they are particularly susceptible to local extirpation from hog depredation. Of particular concern are the varied native reptile and amphibian populations in the Park and their associated links in the food and ecological web of the island. The Park has listed over 232 common insect species, including 13 species of dragonflies and damselflies and over 1500 beetle species.	Lowest potential for adverse native wildlife impacts because hog populations would be substantially reduced within the Park and immigrants would be periodically removed. Very large numbers of native fauna, including several native bird, reptile and amphibian species and numerous insect and spider species would benefit when hog populations are kept low or at zero. Hog impacts including depredation of eggs, chicks or adults, despoiling food, resting, nesting, or breeding habitat from shorebird, waterfowl, and other birds nesting on the ground would decline. Numerous species of reptiles, amphibians, spiders and insects would similarly benefit from reduction of hog populations. Hogs would also no longer continue to depredate many birds and one reptile species that are Locally Endangered by the Government of the U. S. Virgin Islands.
Water Quality Impacts	Highest potential for adverse affects as hogs would continue to reduce plant cover and greatly increase soil erosion and sedimentation of streams and nearshore ocean water where it can affect coral reef, sea grass and mangrove ecosystems and associated marine fisheries, nurseries and relate communities.	Lowest potential for major adverse water quality impacts from hogs would be reduced within three years of the implementation of this alternative. Hog carcasses would readily decompose on land or would be consumed when opened and weighted one mile from shore.

	Alternative 1 II.A.3	Alternative 2 II.A.4
Impact Category	**Wild Hogs Control** No Action	**Wild Hog s Control** Proposed Action: Trapping, Shooting and Fencing
Wetland, Saltpond and Floodplain Impacts	Highest potential for adverse impacts to wetlands and saltponds would continue as native flora and fauna change under the foraging and predation pressures of hogs throughout the Park. Hogs would also continue to forage on red, black and white mangrove seeds, propagules and seedlings, a protected species in the Virgin Islands. There would also continue to occur increased sedimentation rates into wetlands under the no action alternative. Saltponds may experience increased soil deposition and accelerated forest encroachment, especially by invasives, reducing migratory and resident waterfowl and associated habitat.	Lowest potential for adverse impacts to wetlands from hogs would be reduced within several years of implementation of this alternative. Hog removal from riparian areas would improve riparian habitat for frogs, salamanders & aquatic invertebrates. Adverse impacts to wetlands would no longer occur under this alternative as the native flora and fauna would no longer change under the foraging and predation pressures of hogs throughout the Park. Extremely limited and important saltpond habitat would remain open for migratory and resident waterfowl.
Park Operations Impacts	NPS would continue to animal-proof trash receptacles, dumpsters and buildings at campgrounds, day use sites, concession areas, Park overlooks, and employee housing areas; and contracted for the construction burro-exclusion fence for the perimeter of Cinnamon Bay Campground, that is not designed to also exclude hogs.	Hog reduction program would occur in three phases: 1) administration, infrastructure acquisition and fencing; 2) collection using baits, traps, dogs and contract hunters; and 3) monitoring for remnant hogs, periodic hog removal, education, record keeping and fence maintenance. Fences constructed to exclude animals from some long-term monitoring plots. $120,000 contract with APHIS to control hogs and construct 2 – 3 miles of fence.

	Alternative 1 II.A.3	Alternative 2 II.A.4
Impact Category	**Wild Hogs Control** No Action	**Wild Hog s Control** Proposed Action: Trapping, Shooting and Fencing
Cumulative Impacts and Conclusions	Highest potential for adverse cumulative impacts from hogs in the Park. The impacts would have severe negative consequences for NPS lands and wildlife. Many native terrestrial plant, animal and invertebrate species would be adversely impacted The greatest impact would be changes in plant species composition and the associated changes in native fauna, including birds, reptiles, small mammals and insect species. Health and sanitation impacts would continue to decline.	Lowest potential for adverse cumulative impacts from hogs in the Park. The impacts would have very positive consequences for NPS lands, plants and wildlife. Many native terrestrial plant, animal and invertebrate species would be positively impacted. The greatest impact would be recovery of native plant specie communities and the associated changes in native fauna, including birds, reptiles, small mammals and insect species. Health and sanitation impacts would necessarily improve.

V. CHAPTER V. COMPLIANCE WITH ENVIRONMENTAL LAWS AND REGULATIONS

The proposed program for a reduction of non-native wild hog populations within Virgin Islands National Park is consistent with the **National Park Service Organic Act (16 U.S.C.)** "to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the same in such a manner and by such means as would leave them unimpared for the enjoyment of future generations."

(a) Federal Insecticide, Fungicide and Rodenticide Act (FIFRA)(7 U.S.C. 136 *et seq*.) – Occasionally, chemical restraint drugs would be used to sedate captured wild hogs. Intramuscular injections of Telazol would be administered by a jab stick, blow gun or CO2 pistol. Chemical restraint drugs and delivery equipment would be restricted to employees responsible for hog management; these employees would complete a Wildlife Restraint and Mobilization Course of specialized training as required by NPS-77. Chemical restraint drugs would be stored in a locked safe and records would be maintained to include the date, amount used, purpose, and signature of the user. Since Telazol is listed as a Class II substance, all guidelines for use and storage specified by the Drug Enforcement Administration would be followed. The Park has also obtained pesticide use approval through the Southeast Regional Integrated Pest Management Program (IPM) and the Washington IPM Office.

(b) Endangered Species Act of 1973 (ESA)(7 U.S.C. 136, as amended) and VI Endangered and Indigenous Species Act of 1990 (Act No. 5665) – Virgin Islands National Park provides habitat for Endangered Hawksbill and Leatherback sea turtles at numerous beach areas along the north, east and southern beaches. Endangered Roseate and Threatened Least Terns nest at several sites in the Park. Habitat for Endangered St. Thomas Lidflower, Prickly Ash, and Marron Bacora (which has been proposed for listing) are located at numerous sites throughout the Park. Grazing and rooting by hogs potentially impacts these listed species with extirpation. In order to comply with the ESA of 1973, the Park must protect endangered species and their habitats (PL 93-205). With release of Draft EA, NPS would initiate formal consultation with the U.S. Fish and Wildlife Service.

Virgin Islands National Park also provides habitat for one Territorially Endangered and Threatened animal species, the Slipperyback Skink and many other Territorial Endangered species include ground-nesting species such as Bridled Quail Dove, Bahama Pintail Duck and West Indian Nighthawk, all of which may suffer egg and chick depredation due to hogs. Grazing and rooting by hogs potentially impacts twenty-five Territorially Threatened and Endangered listed plant species with extirpation.

(c) Migratory Bird Treaty Act of 1918 (40 Stat 755) provided clear authority and direction for the proposed action.

(d) Animal Damage Control Act of 1931 gives authority to remove injurious animals for the protection of birds and other wildlife.

(e) Coastal Zone Management Act (16 U.S.C. 1 {1916} *et seq*.) "Preserve, protect, develop and where possible restore or enhance the resources of the nation's coastal zones" supports the removal of non-native pests that damage the coastal zone and wildlife therein. With release of Draft EA, NPS would initiate formal consultation with the Territory's Department of Planning and Natural Resources in conformance with the Coastal Zone Management Act.

(f) General Management Plan – Virgin Islands National Park, 1983 – feral and exotic pests such as non-native wild hogs are identified as a threat to native fauna and flora and must be controlled.

(g) National Historic Preservation Act of 1966 (16 U.S.C. 470 *et seq,*), Archeological Resources Protection Act of 1979 (16 U.S.C. 470aa-11). With release of Draft EA, NPS would initiate formal consultation with the State Historic Preservation Office regarding effects on the Park's archeological and cultural resources.

(h) National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. 4332, as amended). Title I of NEPA require that Federal agencies plan and carry out their activities…"so as to protect and enhance the quality of the environment. Such activities shall include those directed to controlling pollution and enhancing the environment.**"** With release of Draft EA, NPS would initiate NEPA process.

(i) Resource Management Plan – Virgin Islands National Park, 1999 – feral and exotic pests such as non-native wild hogs are identified as a threat to native fauna and flora and must be controlled.

VI. CHAPTER VI. CONSULTATION AND COORDINATION

Personnel from the following agencies and organizations have been consulted or participated in the formulation of this Environmental Assessment:

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Consultation with Local St. Johnian Neighbors and Former Park Residents

These individuals would be given an opportunity to comment on this draft document which would be made available at two local libraries, two Park visitor centers and on the Park and Friends of the Virgin Islands Internet sites. Or, they may request a copy of this draft plan after learning about it by reading a press release in one of several local island newspapers.

We would also contact local former St. Johnian hunters and ask them to participate as Volunteers-In Park (VIP) program in implementing this hog reduction program. There was hog hunting in the Park in the recent past, until it was determined that the enabling legislation for the Park did not allow it. We would be able to contact these individuals, as we have their previous hunting permits on record (also see page 21, Use of Local Field Volunteers).

VIII. CHAPTER VIII. PLANNING TEAM / PREPARERS

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IX. CHAPTER IX. REFERENCES CITED

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XI. CHAPTER XI. APPENDICES

APPENDIX A. List of Endangered Plants and Animals of the U. S. Virgin Islands

Compiled by the Division of Fish and Wildlife (DPNR), the UVI Cooperative Extension Service, Eleanor Gibney (Caneel Bay), Gary Ray (U. of Wisconsin) and William Mclean (UVI).

Scientific Name	Common Name	Distribution/Remarks
PLANTS		
Federal List		
Buxaceae		
Buxus vahlii	Vahi's Boxwood	Endangered, St.X.- May be Extinct
Rutaceae		
Zanthoxyllum thomasianum	Prickly Ash	Endangered, St T., St .J.
Myrtaceae		
Calyptranthes thomasiana	St. Thomas Lidflower	Endangered, St. T., St. J.
Virgin Islands List		
Agavaceae		
Agave eggersiana	Egger's Agave	St. X.
Aizoaceae		
Cypselia humifusa		St. T., St. J.
Aquifoliaceae		
Ibex urbanii	Urban's Holly	St. J., Tortola
I. sideroxyloides	Central Amer. Oak	St. J.
Bromeliaceae		
Tillandsia lineatispica	Pinon	Rare bromeliad, St. J., St. T
Cactaceae		
Mammilaria nivosa	Wooly Nipple	St. X, St. J, St. T, offshore cays
Opuntia triacantha		Buck Is. (St. X,), St. T.
Celastraceae		
Maytenus cymosa		St. X., St. T.
Convolvulaceae		
Operculina triquetra		St. X., St. T. endemic
Euphorbiaceae		
Croton fishlocklii		Recent St. J. sightings
Fabaceae		
Erythrina eggersii	Egger's Cockspur	St. X, St. J, St. T,
Galactia eggersii	Egger's Galactia	St. T., St. J.
Malpighiaceae		
Malpighia woodburyana	Cowage Cherry	St. T., St. J., offshore cays
M. infestissima (=pallens)	Stinging Bush	St. X.
M. linearis		All VI
Malpighia sp.		Similar to M. coccigera, St. J.
Byrsonima sp.		New Species, St. J.
Malvaceae		
Psidium amplexicaule		St. J.
Psidium sp.		St. J., new species?
Sida eggersii		N. Offshore cays
Myrtaceae		
Eugenia sp.		Recent St. J. sightings

Endangered Plants and Animals of the U. S. Virgin Islands (Cont.)

Olacaceae		
Schoepfia schreberi		St.T., *St.J., St.X.*
Orchidaceae		
Brassavola cuccullata		St.T.
Psychilis macconelliae	Sandy Pt. Orchid	St.X.
Encydia ciliare	Christmas Orchid	St.T., St.J., St.X.
E. cochleata	Cockle-shell Orchid	*St.X.*
Habenana alata		St.T.
Tolumnia (Oncidium) prionochila	Yellow Dancing Lady	St. J, St.T.
T. variegatuni	White Dancing Lady	St.T., St.J., St. X.
Polystachya concreta		St.T., Virgin Gorda
Ponthieva racemosa		St.T., St.J., Tortola
Prescottia oligantha		St.T., St.J., Tortola.
P. stachyoides		*St.J.*
Spiranthes torta		St.T.
Tetrainicra canaliculata		St.T., St.J., St. X.
T. canaliculata alba		End. subsp., Water Is.
Vanilla barbellata	Vanilla Orchid	St. T.
Piperaceae		
Peperomia myrtifolia	Myrtle-leaved Peperomia	*St.J., St.X*
Polygonaceae		
Coccoloba rugosa		May be extinct in VI
Rubiaceae		
Catesbaea melanocarpa		St.X.
Macháonia woodburyana		New St. J. sightings
Sapotaceae		
Mani1kara bidentata	Bulletwood	St.T., St.J.
Solanaceae		
Solanum mucronatuni		Confused taxonomy, *St.T., St.J.*
S. conocarpum		Rediscovered 1993, 2 indivs., St.J.
Urticaceae		
Pilea richardii	Richard's Clearweed	St.T.
Verbenaceae		
Callicarpa ampla	Capa Rosa	Info. needs update
Nashia inaguensis		St.X.
Zygophyllaceae	Lignum Vitae	
Gualacum officinale		W.I., High hort. demand

ANIMALS

Federal List

Chelonia mydas	Green turtle	Threatened, Resident, breeding
Eretmochelys imbricata	Hawksbill turtle	Endangered, Resident, breeding
Dermochelys coriacea	Leatherback turtle	Endangered, Migrant, breeding
Pelecanus occidentalis	Brown pelican	Endangered, Resident, breeding
Falco peregrinus	Peregrine falcon	Endangered, Winter migrant
Epicrates monensis granti	VI Tree boa	Endangered, Resident, breeding
Ameiva polops	St. X. ground lizard	Endangered, Resident, breeding
Sterna dougallii	Roseate tern	Threatened, migrant, breeding

Virgin Islands List

Mabuya inabouia	Slipperyback skink	Resident, breeding
Otus nudipes newtom	VI Screech owl	Resident, breeding?
Chordeiles gundlachii	West Indian nighthawk	Resident, breeding?
Anthracothorax dominicus	Antillean mango	Resident, breeding?
Podiceps dominicus	Least grebe	Migrant, breeding
Sterna antillarum	Least tern	Resident, breeding
Phaethon lepturus	White-tailed tropicbird	Resident, breeding
Ardea herodius	Gt. blue heron	Resident, breeding
Casmerodius albus	Great (common) egret	Resident, breeding
Egretta thula	Snowy egret	Resident, breeding
Nycticorax nycticorax	Black-cr. night heron	Resident, breeding?
Ixobrychus exilis	Least bittern	Resident, breeding
Anas bahaniensis	Bahama duck	Peripheral resident
Oxyura jamaicensis	Ruddy duck	Resident, breeding
Rallus longirostris	Clapper rail	Resident, breeding
Fulica caribea	Caribbean coot	Resident, breeding?
Charadrius alexandrinus	Snowy plover	Resident, breeding
Catoptrophorus semipalmatus	Willet	Migrant, breeding
Puffinus Iherminieri	Audubon shearwater	Resident, breeding
Aratinga pertinax	Brown-throated parakeet	Resident, breeding
Columba leucocephala	White-crowned pigeon	Resident, breeding
Geotrygon mystacea	Bridled Quail dove	Resident, breeding
Myiarchus stolidus	Stolid flycatcher	Resident, breeding
Noctilio leporinus	Fisherman bat	Resident, breeding
Stenoderma rufum	Red fruit bat	Resident, breeding
Brachyphylla cavernarum	Cave bat	Marine benthic, high demand
Order Antipatharia	Black coral	Resident, breeding
Epinephelus itajara	Jewflsh	Marine

The above list represents plants and animals occurring in the US Virgin Islands which are protected by either the US Endangered Species Act of 1973 or the VI Endangered and Indigenous Species Act of 1990 (Act No. 5665). This list is promulgated under Act 5665, Section 104(g) and may be revised as new information becomes available.

Roy E. Adams, Commissioner, DPNR
5 June 1991

APPENDIX B. List of Introduced Animals to St. John, U. S. Virgin Islands

Common Name	Scientific Name	Area of Origin	When Introduced	Introduced By
MAMMALS				
Cat, domestic	*Felis catus*	Afr./SW Asia	?	Europeans
Cattle, domestic	*Bos taurus*	Eurasia	?	Europeans
Deer, White-tail	*Odocoileus virginianus*	U.S.	1700's	Europeans
Dog, domestic	*Canis familiaris*	Eurasia	?	Europeans
Burro	*Equus asinus*	N. Africa	?	Europeans
Goat, domestic	*Capra hircus*	SW Asia	1500's	Spaniards
Horse	*Equus caballus*	Eurasia		Europeans
Pig, domestic	*Sus scrofa*	Eurasia	1500's	Spaniards
Mongoose, Indian	*Herpestes auropunctatus*	India	1880's	Europeans
Mouse, house	*Mus musculus*	Mid E/Asia	?	Europeans
Rat, black	*Rattus rattus*	SE Asia	?	Europeans
Rat Norway	*Rattus norvegicus*	SE Asia	?	Europeans
Sheep, domestic	*Ovis aries*	Mid East	?	Europeans
BIRDS				
Bullfinch, L.Ant.	*Loxigilla noctis*	Lesser Ant.	1960's	Natural
Fowl, domestic	Various sp.		?	Various
Parakeet, Brn-thr	*Aratinga pertinax*	Curacao	1900's	Unknown
Sparrow, English	*Passer domesticus*	Eurasia	1980's	Ship
AMPHIBIANS				
Tree frog, Cuban	*Osteopilus septentrionalis*	Cuba	1980's	Plant trade
Tree Frog, Coqui	*Eleutherodactylus Coqui*	Puerto Rico	1970's	Residents
REPTILES				
Iguana, green	*Iguana iguana*	S. America	<1500's	Native Ams.
Tortoise, redfoot	*Geochelone carbonaria*	S. America	<1500's	Native Ams.

APPENDIX C. Consultation Letter from U. S. Fish and Wildlife Service

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Boqueron Field Office
Carr. 301, KM 5.1, Bo. Corozo
P.O. Box 491
Boqueron, PR 00622

Received
JUL 18 2002
Superintendent's Office
VIIS National Park

July 15, 2002

Mr. John H. King
Superintendent
National Park Service
Virgin Islands National Park
1300 Cruz Bay Creek
St. John, USVI 00830

Re: Sustained Reduction Plan for Non-native Wild Hogs within Virgin Islands National Park
St. John, USVI

Dear Mr. King:

Thank you for your letter of July 1, 2002, requesting comments regarding the above referenced project. Our comments are provided in accordance with the Endangered Species Act (Act) of 1973, as amended (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.).

Based on a review of the information provided and that available in this office, we believe that the proposed plan is not likely to adversely affect any threatened or endangered species under our jurisdiction in the project area. Therefore, no further consultation is required. Nevertheless, if the project is modified or if information on impacts to listed species becomes available this office should be contacted concerning the need for the initiation of consultation under section 7 of the Act. We concur with your determination that the implementation of the plan will result in beneficial effects to federally listed species within the park.

Sincerely,

James P. Oland
Field Supervisor

mtr/