ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This "Environmental Consequences" chapter analyzes both beneficial and adverse impacts that could result from implementing any of the alternatives described in this draft *Exotic Plant Management Plan / Environmental Impact Statement* (EPMP/EIS). This chapter includes a summary of laws and policies relevant to each impact topic, definitions of impact thresholds (for example, negligible, minor, moderate, and major), methods used to analyze impacts, and the analysis methods used for determining cumulative effects. As required by the Council on Environmental Quality (CEQ) regulations implementing the *National Environmental Policy Act* (NEPA), a summary of the environmental consequences of each alternative is provided in table 24 in the "Alternatives" chapter. The resource topics presented in this chapter, and the organization of the topics, correspond to the resource discussions contained in the "Affected Environment" chapter.

SUMMARY OF LAWS AND POLICIES

Three overarching environmental protection laws and policies guide the actions of the National Park Service (NPS) in the management of the parks and their resources: the NPS *Organic Act of 1916,* NEPA and its implementing regulations, and the *Omnibus Management Act.* For a complete discussion of these and other guiding regulations, refer to the section titled "Related Laws, Policies, Plans, and Constraints" in the "Purpose of and Need for Action" chapter. These guiding regulations are described in brief below.

The *Organic Act of 1916* (16 United States Code [USC] 1) commits the NPS to making informed decisions that perpetuate the conservation and protection of park resources unimpaired for the benefit and enjoyment of future generations.

The *National Environmental Policy Act of 1969* is implemented through CEQ regulations (40 *Code of Federal Regulations* [CFR] 1500–1508). The NPS has, in turn, adopted procedures to comply with NEPA and CEQ regulations, as found in *Director's Order 12: Conservation Planning, Environmental Impact Analysis, and Decision-making* (NPS 2001) and handbook.

The *Omnibus Management Act* (16 USC 5901 *et seq.*) underscores NEPA in that both are fundamental to park management decisions. Both acts provide direction for connecting resource management decisions to the analysis of impacts, and communicating the impacts of these decisions to the public, using appropriate technical and scientific information. Both acts also recognize that such data may not be readily available, and they provide options for resource impact analysis should this be the case.

> Section 4.5 of *Director's Order 12* adds to this guidance by stating, "when it is not possible to modify alternatives to eliminate an activity with unknown or uncertain potential impacts, and such information is essential to making a well-reasoned decision, NPS will follow the provisions of the CEQ regulations (40 CFR 1502.22)." In summary, the NPS must state in an environmental assessment or impact statement (1) whether such information is incomplete or unavailable; (2) the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment; (3) a summary of existing credible scientific adverse impacts that is relevant to evaluating the reasonably foreseeable significant adverse impacts; and (4) an evaluation of such impacts based on theoretical approaches or research methods generally accepted in the scientific community.

Collectively, these guiding regulations provide a framework and process for evaluating the impacts of the alternatives proposed in this draft EPMP/EIS.

GENERAL METHODOLOGY FOR ESTABLISHING IMPACT THRESHOLDS AND MEASURING EFFECTS BY RESOURCE

The general approach for establishing impact thresholds and measuring the effects of the alternatives on each resource category includes the following elements:

general analysis methods as described in guiding regulations

basic assumptions used to formulate the specific methods used in this analysis

thresholds used to define the level of impact resulting from each alternative

methods used to evaluate the cumulative impacts of each alternative in combination with unrelated factors or actions affecting park resources

methods and thresholds used to determine if impairment of specific resources would occur under any alternative

These elements are described in the following sections.

GENERAL ANALYSIS METHODS

The analysis of impacts follows CEQ guidelines and *Director's Order 12* procedures (NPS 2001). There are varying amounts of research pertaining to the impacts that exotic plants and their controls have on natural, cultural, and social resources in south Florida and the Caribbean. In Florida, there has been extensive research conducted for specific exotic plant species and the effects these plants have had on resources from a species-specific level to broader community or ecosystem level. In the Caribbean, information is lacking, and research is only now starting to be conducted as to what effects exotic plants are having in that region. Likewise, research on the effects that exotic plant control methods have on resources is highly variable. Biological controls are extensively studied before release into the environment, whereas mechanical control methods tend to be less researched.

There are a number of agencies, including the NPS in Florida, that are continually treating exotic plants, and those staff members have extensive knowledge of the success of control methods and the threat of the exotic plants on native plant species or communities. The internal EIS team consulted with these experts in the field of exotic plant management, as well as other experts in the resource management and the scientific communities, for the various resource topics addressed in this draft EPMP/EIS.

For each resource topic addressed in this chapter, the applicable analysis methods are discussed under each resource section.

ASSUMPTIONS

Several guiding assumptions were made to provide context for this analysis. These assumptions are described below.

ANALYSIS PERIOD

This draft EPMP/EIS establishes goals, objectives, and implementation actions needed to manage exotic plants in the nine parks for the next 10 years.

TREATMENT AND RE-TREATMENT OF EXOTIC PLANTS

To perform the analysis, a few assumptions were made regarding treatment and re-treatment of exotic plants that would take place over the next 10 years. For the sake of analysis, the data describe initial treatments that would occur during the first year of plan implementation. It is recognized that not all treatments in infested areas would occur at the same time due to the size of some of the parks and available resources and funding. However, it is assumed that initial treatments would occur in all treatment areas within the first 3 years of plan implementation. The assessment of effects presented in this chapter assumes that full funding and implementation of each exotic plant management alternative would occur every year.

For purposes of the analysis, it was assumed that under all alternatives, all treatment areas in the parks would undergo an initial treatment, except Biscayne National Park, Dry Tortugas National Park, Buck Island Reef National Monument, and Christiansted National Historic site that has achieved a maintenance level of exotic plant infestation. Although areas in some of the parks have undergone initial treatments in the past, it is assumed under alternative A that, re-treatments do not currently occur at an optimal frequency, and workers returning to re-treat an area would have to perform re-treatment at a level similar to what occurred during the initial treatment.

Assumptions were also made regarding the frequency of re-treatments under each alternative. Under the current management framework, re-treatments do not occur at an optimal frequency in the parks, except in Biscayne National Park, Dry Tortugas National Park, Buck Island Reef National Monument, and Christiansted National Historic Site, which re-treat every 6 to 12 months. The other parks re-treat areas when resources and funding permit, not when it would be most appropriate given the particular exotic plants being treated. Based on records in the NPS APCAM database, the length of time between treatments in the parks varies, from as frequently as 3 years to greater than 5 years between treatments. In order to analyze impacts of alternative A, it was assumed that areas once initially treated would be treated again once every 3 years over the 10-year life of the plan. The rate of reduction of infestation would be approximately 11% which is based on the net result of substantial reduction that would be achieved with species that are slow to return and the gradual increase in infestation of more aggressive species. Based on the rate of infestation decline over the 10 year period, the amount of herbicide that would need to be applied to treat the infestation would decrease proportionally.

Under alternatives B and C, it was assumed that re-treatment activities would occur within 3–18 months of the initial treatment, as described in the "Alternatives" chapter and would occur on a regular basis until exotic plants reach a maintenance level, and native vegetation is restored to the desired future condition established for that vegetation category. For analysis purposes, 6 months was projected as the average length of time between re-treatment activities.

Treatment of exotic plant infestations would occur under an optimal schedule, and therefore, the level of intensity of treatment would decrease over time. For alternatives B and C, it was assumed that the amount of herbicide being applied would decrease by 50% with every treatment as the level of infestation (represented as the number of stems to be treated) is decreased by 50%. This assumption was based on the Florida Department of Environmental Protection's (FDEP) exotic plant management program, which assumes that if treatment occurs within 1 year of initial treatment, the amount of herbicide needed to re-treat woody species would be 25% of what was initially used and 50% for re-treating vines and grasses (FDEP 2004c). The higher level of use was assumed for this analysis to present the greatest possible level of impact on park resources.

It was assumed, based on the decrease in infestation that may occur with every treatment that the level of treatment activity decreases proportionally over time. Under alternatives B and C, as the number of stems of exotic plants decreases by 50% every 6 months, the amount of herbicide that would need to be applied to treat the infestation would decrease proportionally. To determine the change in the amount of herbicide used over time, assumptions were made regarding the rate of herbicide application per acre of infestation. It is unknown at this time what specific herbicide would be used for each treatment, although this draft EPMP/EIS describes the herbicides that are appropriate for each exotic plant species. In addition, no single rate of application for any herbicide class evaluated in this document for use in the south Florida or Caribbean national parks was available in the literature or through communications with NPS staff or other agencies. Therefore, to assess the potential range of effects of herbicide use, and to understand how much herbicide may be applied over time to control exotic plants in the parks, a range of potential herbicide application has been provided based on the herbicides considered in this document using the lowest and the highest rates.

To determine the rate of application, an average for each herbicide class (triclopyr, imazapyr, glyphosate, and metsulfuron methyl) was determined using data recorded in the NPS APCAM database for all of the parks. The concentrations for each herbicide class that were used for every treatment recorded in the database for all of the parks in this draft EPMP/EIS were averaged to arrive at an average rate of application. The average rate of application (undiluted gallons per acre) for each herbicide from lowest to highest is as follows: metsulfuron methyl, 0.05; glyphosate, 0.14; imazapyr, 0.20; and, triclopyr, 0.91. The range of minimum and maximum amount of herbicide that could potentially be used is therefore calculated based on the lowest rate of 0.05 to the highest, 0.91 undiluted gallons per acre.

Under alternative C, it is assumed for the analysis that only those areas that are left to passively restore (restored without human intervention) would undergo re-treatment. It is recognized that some re-treatment of exotic plant seedlings would likely still need to occur in actively restored areas; however, it is not possible to estimate the return of exotic plant species and the level of effort necessary to re treat in these areas, although it is assumed to be minimal.

INFESTATION

Calculating Infestation

To assess the impacts that exotic plants have on park resources and, in particular, native vegetation and threatened and endangered species, it was necessary to estimate the extent and/or distribution of exotic plant infestation in the parks. This estimation is referred to as the potential area of infestation. Because the level of detail or accuracy of information pertaining to infestation varies among the parks, assumptions had to be made to provide consistency among parks. Information regarding infestation in the parks was provided by personal observation of park staff, determined from aerial overflights, and/or obtained through the NPS APCAM database. Knowledge of infestations in Everglades National Park and Big Cypress National Preserve was based on aerial overflights that provided point data of species present and density of infestation that ranged from a single plant to areas with greater than 50% infestation. To allow for spatial analysis of the data, points were buffered by 1 kilometer (km) to give the best estimate of the potential area of infestation

The information on infestation within vegetation categories or wildlife habitat for the two parks is therefore more refined than that presented for the other parks (Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Buck Island Reef National Monument, Virgin Islands National Park, and Salt River Bay National Historic Park and Ecological Preserve), in which the areas of infestation were defined by NPS staff. The exact locations of exotic plant infestation in these parks are unknown, so it was assumed that infestations were uniformly distributed throughout the treatment area. This information allowed for an estimation of the potential infestation of exotic plants within vegetation categories and wildlife habitat. For Buck Island Reef National Monument, Virgin Islands National Park, Salt River Bay National Historic Park and Ecological Preserve, it was assumed that the treatment areas defined by park staff were 100% infested. For Canaveral National Seashore and Biscayne National Park, the percent of the park infested was calculated based on the gross infested acres within the treatment areas based on data in the NPS APCAM database or provided by EPMT or park staff. The extent of infestation in Dry Tortugas National Park, 1% of the area of Loggerhead Key, was determined by park staff.

Change in Infestation Over Time

Assumptions were made regarding the change in infestation over time under each alternative. Under alternative A, because of the infrequency of treatments and the inability of parks to treat exotic plants under an optimal treatment schedule due to lack of resources and funding, the success of treatments of different exotic plant species is variable. It is recognized that for some species, for which parks

may receive more funding to treat or treatment regimes are more successful, such as melaleuca, parks are having some success in reducing infestation within areas of the parks. However, data to support this is lacking. In other cases, such as with treating Old World climbing fern, the high rate of spread and the inability to successfully control current infestation with current treatment methods under a sub-optimum treatment schedule, would likely result in continued growth and spread of the plant in the parks. Therefore, for analysis purposes, it is assumed that infestation would gradually decline, at a rate of approximately 11% per treatment, over the life of the plan in the five parks that have not achieved maintenance level of infestations.

Under alternatives B and C, it is assumed that the level of infestation would decrease by approximately 50% every time treatment occurred under an appropriate treatment schedule given the exotic plant species that would be treated. Likewise, it was assumed that the intensity of treatment activity and the amount of herbicide that would be needed for re-treatment every time a treatment occurred would decrease. For the analysis, it was assumed that the amount of herbicide applied every time a treatment occurred would be one-half that of the previous treatment. This assumption is based on the FDEP invasive plant control program that makes the same assumption when determining the amount of herbicide that is distributed to agencies for re-treatment activities.

IMPACT THRESHOLDS

Determining impact thresholds is a key component of the NPS *Management Policies 2001* (NPS 2001) and the *Director's Order 12* Handbook (NPS 2001). These thresholds provide the reader with an idea of the intensity of a given impact on a specific topic. The impact threshold is determined primarily by comparing the impact to a relevant standard from state or federal regulations or scientific research. Because definitions of intensity vary by impact topic, intensity definitions are provided separately for each impact topic analyzed in this document. The following intensity definitions are used throughout this analysis: negligible, minor, moderate, major.

CUMULATIVE EFFECTS ANALYSIS METHOD

The CEQ regulations implementing NEPA require the assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as "the impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative impacts are considered for all alternatives, including the no-action alternative.

Cumulative impacts were determined by combining the impacts of the alternative being considered with other past, present, and reasonably foreseeable future actions. Past, ongoing, and future exotic plant control programs using biological, mechanical, physical, and chemical treatment methods would continue to be conducted by private landowners and county, state, and other federal agencies. A

description of other agency programs is provided in the "Purpose of and Need for Action" chapter under the "Relationship to other Projects and Plans" section. Actions by other Florida agencies to treat exotic plants would increase over the next 10 years as funding permits. Although agencies in Florida have made a commitment to improve public education and understanding of the problems associated with exotic plants, it is likely that private landowners and businesses, such as nurseries, would continue to propagate exotic plants within their landscapes.

In addition to exotic plant control programs, other activities would continue to occur on lands adjacent to the parks or in the region that would cumulatively impact resources. The majority of these impacts are directly related to urbanization and land development, industrial and municipal waste, agricultural and silviculture activities, and recreational use. Municipal and industrial activities such as power plants, wastewater treatment facilities, factories, and oil refineries, affect a myriad of resources due to fluctuation of water flows, discharge of effluents, noise generation, and emissions. Activities associated with urbanization (building construction, utility installation, road and bridge building, stormwater discharge) also contribute to adverse impacts on resources from loss of habitat; introduction of exotic plants and pests; nonpoint source discharges of sediment, chemicals, and nutrients into waterways; and noise emissions. Agriculture and silviculture practices in areas adjacent to the parks lead to a loss of wildlife habitat, erosion of soils, and nonpoint source discharge of nutrients and chemicals into streams, rivers, and coastal waters. Within the regions and in the national parks, increased recreational use of motor vehicles, powerboats, swamp buggies, and all-terrain vehicles affect resources by contributing emissions in the air and water, damaging habitat and cultural resources causing mortality, injury, or disturbance to wildlife, and creating noise disturbances.

In addition to the broad categories of activities described above, appendix D displays more specific information regarding projects or activities occurring inside or outside the park that would have cumulative impacts on resources. The appendix presents the actions or plans that were considered by the internal EIS team in the cumulative impacts analysis, which includes past, present, or foreseeable future activities that are not part of the actions proposed in this draft EPMP/EIS but could affect the resources identified.

IMPAIRMENT ANALYSIS METHOD

The "Purpose of and Need for Action" chapter describes the related federal acts and policies regarding the prohibition against impairing park resources and values in units of the national park system.

NPS *Management Policies 2001* state that an action constitutes an impairment when its impacts "harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values" (NPS 2001, 1.4.4). To determine impairment, the NPS must evaluate "the particular resources and values that would be affected; the severity, duration, and timing of the impact; the direct and indirect effects of the impact;

and the cumulative effects of the impact in question and other impacts" (NPS 2001, 1.4.4).

Because park units vary based on their enabling legislation, natural resources, cultural resources, and missions, the recreational activities appropriate for each unit and for areas within each unit vary as well. An action appropriate in one unit could impair resources in another unit. Thus, this draft EPMP/EIS analyzes the context, duration, and intensity of impacts of the alternatives as well as potential for resource impairment, as required by *Director's Order 12*: *Conservation Planning, Environmental Impact Analysis and Decision-making* and handbook (NPS 2001). An impact on any park resource or value may constitute an impairment, but an impact would be more likely to constitute an impairment to the extent that it has a major adverse effect upon a resource or value whose conservation is

> necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park
>
> key to the natural or cultural integrity of the park
>
> identified as a goal in a park's general management plan or other relevant NPS planning documents

A determination of impairment is included in the impact analysis section for all impact topics relating to each park's resources and values. The impact analysis includes findings of impairment of park resources for each of the management alternatives. Park management and operations and visitor use are not considered park resources; therefore, impairment findings are not included as part of the impact analysis for these topics.

NATIVE PLANTS / VEGETATION CATEGORIES

GUIDING REGULATIONS AND POLICIES

NPS *Management Policies 2001* state that the "fundamental purpose" of the national park system begins with a mandate to conserve park resources and values and provide for the public enjoyment of the park's resources and values to the extent that the resources will be left unimpaired for future generations. Native vegetation is identified as a park resource (NPS 2001e, 1.4.6). NPS *Management Policies 2001* (NPS 2001e, 4.4.2) provide general principles for the maintenance of natural resources in the park by

> preserving and restoring the natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal populations and the vegetation category and ecosystems in which they occur
>
> minimizing human impacts on native plants, animals, populations, communities, and ecosystems and the processes that sustain them

METHODOLOGY AND ASSUMPTIONS

GEOGRAPHIC AREA EVALUATED FOR IMPACTS

For parks that are essentially isolated by developed areas or large water bodies (such as Buck Island Reef National Park, Dry Tortugas National Park, and Christiansted National Historic Site), park boundaries serve as the geographic limits of the area evaluated for impacts on native vegetation categories. For the other six parks with adjacent lands, it was necessary to look beyond the parks' boundaries to determine the impacts of implementing any one of the management alternatives. Adjacent lands need only be considered for certain parks with contiguous natural areas or habitat. This was especially necessary for those parks bordering other undeveloped lands such as the Miccosukee Tribal Lands adjacent to the Everglades National Park. There are several reasons for considering adjacent lands.

> Treatment methods could potentially impact vegetation on adjacent lands, such as an accidental herbicide overspray during an aerial treatment. Also, ground crews could possibly misinterpret park boundaries and accidentally trespass into adjacent lands.
>
> Exotic plants on adjacent lands could potentially provide a seed source for the re-infestation of park lands. In such cases, cooperative agreements may be necessary to treat the adjacent lands as well as the park lands if the adjacent owner is unable to implement treatment.
>
> Treatment of exotic plants within park boundaries may result in impacts to vegetation on adjacent lands as a result of root damage due to herbicide activity in the soil and potential impacts due to the presence of ground crews.

IMPACT CRITERIA AND METHODOLOGY

Issues regarding the effects of the management activities on native plants and vegetation categories were identified during internal and public scoping meetings. These issues are described below.

Many exotic plants have mechanisms and tolerances that enable them to compete with native plants for resources. Once established, exotic plants also displace native plants by shading, allelopathy, and altering soil properties. Allelopathy is a plant's ability to produce secondary chemical compounds that can leach from leaves, seeds, or roots into the soil and suppress the germination or growth of native plant species. Allelopathy in some plants can reduce competition from other plants for nutrients, water, and light; it is believed to be present in certain species of exotic plants such as melaleuca, Brazilian pepper, and Australian pine.

Allelopathy—Release of a substance by one plant that inhibits the germination or growth of another plant.

Exotic plants change the composition, structure, and processes of native vegetation categories. Exotic plant infestations can lead to dense monotypic stands (stands of the same species), which could be shrub thickets of Brazilian pepper, savannahs of African guinea grass, or dense forests of Australian pine, tan tan, genip, and melaleuca. These areas are destined to lack the biodiversity and varied structure of native vegetation categories. For instance, a typical pristine cypress forest would have a canopy of mature cypress trees, a subcanopy of cypress or other tree saplings, shrubs (such as buttonbush), and an understory of ferns and herbaceous plants. The biodiversity and structure of these native vegetation categories are necessary for the survival of other native plants and wildlife. However, even in apparently intact habitat, exotic species can reduce the diversity and abundance of native plant species (Scofield 1999).

Sea grape is a native plant with very dense, deep, intertwined root systems that are important in stabilizing sandy beaches and preventing erosion caused by waves. The replacement of native coastal plant species by exotic plants, such as the shallow-rooted Australian pine, can jeopardize beach stability and significantly alter beach forest values.

The use of fire to control exotic plants may facilitate return of the natural fire regime; however, melaleuca has adapted a mechanism that uses fire and its associated air currents to disperse seed. In addition, in areas infested with Old World climbing fern, the fires may cause more damage to native plants than to exotic plants because the fern forms flammable mats that allow the fire to spread over the lower levels of plants and climb into the crowns of trees. Habitats that under normal environmental conditions could tolerate, or even benefit from, fires are now being destroyed by fires due to the presence of this species (Ferriter et al. 2003). This is also true with exotic grass species. If these grasses, such as the noxious cogon grass or guinea grass, infest a site otherwise dominated by woody species, the effects of a fire can be catastrophic. Although an unusually hot fire can eliminate the woody species, the grass may flourish as a result of its fire-resistant, strong underground root system. Similarly, frequency and severity of wildfires in exotic grass-infested habitats in the Caribbean can

be increased in non-fire-dependant vegetation categories. These wildfires have eliminated native plant species and increased the infestation of exotic grasses that are fire-tolerant in burned areas.

The use of impounding or water level manipulation to kill off exotic plants in an area may alter the composition of native plants or the natural hydroperiod. For this reason, impounding is not often used in natural communities in the national parks. When impounding is used, it is often in combination with another treatment, such as prescribed fires, herbicide treatments, or mechanical removal (Ferriter et al. 2003).

It takes quite a while to be able to implement a biological control because once identified, it must be thoroughly tested by the U.S. Department of Agriculture, Animal and Plant Health Inspection Service for adverse effects on humans, wildlife, domestic animals, native and commercially grown plant species, and native insects. Biological controls typically work slower than other control methods and are susceptible to environmental factors such as freezes, fires, and predation (Ferriter et al. 2003).

The potential impacts of the no-action alternative on native vegetation were evaluated based on the native vegetation categories present and their association with the exotic plant species. Alternative A provided the baseline management conditions with which alternatives B and C were compared. Alternatives B and C were evaluated to determine the potential impacts that would occur from implementation of either of those alternatives. The research used to analyze the potential impacts was obtained from scientists at the University of Florida, the South Florida Water Management District, the Florida Fish and Wildlife Conservation Commission, the Florida Exotic Pest Plant Council, the U.S. Fish and Wildlife Service (USFWS), and others. The experience and research of NPS staff at the nine national parks formed the basis for the professional judgment used in this analysis.

IMPACT THRESHOLD DEFINITIONS

Negligible — Individual native plants may occasionally be affected, but measurable or perceptible changes in vegetation category size, integrity, or continuity would not occur.

Minor — Impacts on native plants would be measurable or perceptible, but would be localized within a small area. The natural function and character of the vegetation category would not be affected.

Moderate — A change would occur in the natural function and character of the vegetation category in terms of basic properties (e.g., abundance, distribution, quantity, and quality) but not to the extent that the basic properties of the vegetation category change.

Major — Impacts on native vegetation categories would be readily apparent and would substantially and permanently change the natural function and character of the plant types over a large area in the parks.

IMPAIRMENT

An impairment of native vegetation categories would occur when the action contributes substantially to deterioration of the native plants in the parks to the extent that the vegetation categories would no longer function as natural systems. In addition, the adverse impacts on the parks' native vegetation resources and values would

contribute to the deterioration of the native vegetation resources and values to the extent that the purpose of the parks would not be fulfilled as established in their enabling legislation

affect resources essential to the natural and cultural integrity or opportunities for enjoyment in the various parks

affect the resource whose conservation is identified as a goal in each park's *General Management Plan*

IMPACTS OF THE ALTERNATIVES ON NATIVE PLANTS / VEGETATION CATEGORIES

ALTERNATIVE A — NO ACTION: CONTINUE CURRENT MANAGEMENT

Shrubland

Big Cypress National Preserve, Canaveral National Seashore, Buck Island Reef National Monument, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

The majority of the vegetation categories that fit the shrublands category are the dry evergreen scrub, thorn, and thicket communities in Virgin Islands National Park, Salt River Bay National Historic Park and Ecological Reserve, and Buck Island Reef National Park. These vegetation categories are important in that they are unique to the islands of the Caribbean and support plants and animals endemic to the region. They represent 21% of the total land area of Virgin Islands National Park, 31% of Salt River Bay National Historic Park and Ecological Reserve, and 39% of Buck Island Reef National Park. The maps in appendixes A – I show the distribution of the shrublands in the Caribbean parks and the acres of this vegetation category that are infested with exotic plants. Table 33 describes the distribution of the shrublands in the Caribbean parks and the acres of this vegetation category that are infested with exotic plants. The exotic plant species most often found in the Caribbean parks are tan tan, genip, penguin, guinea grass, ginger Thomas, wild tamarind, noni, aloe, seaside mahoe, lather leaf, Boerhavia, and Brazilian pepper.

There are also relatively small areas of shrublands (less than 400 acres) in Big Cypress Preserve and Canaveral National Seashore. The shrublands in these parks are predominantly pine flatwoods because the trees were removed by logging and have never been able to recover. These areas are dominated by saw palmetto, wax myrtle, and saplings of native trees. These vegetation categories would have the same characteristics as the pine flatwoods communities discussed in the upland dry / mesic forests section below.

TABLE 33: VEGETATION COMPOSITION AND LEVEL OF POTENTIAL INFESTATION WITHIN THE PARKS

Vegetation Category	Total Acres within Park	Percent of Total Terrestrial Acres	Total Potential Acres Infested within Park	Percent of Total Terrestrial Acres Infested
Big Cypress National Preserve				
Agriculture / Disturbed Land / Developed Area	4,797	1%	2,075	43%
Grassland / Coastal Strand	943	<1%	171	18%
Mangrove	8,038	1%	2,802	35%
Coastal Marsh	7,166	1%	2,004	28%
Sawgrass Marsh / Wet Prairie / Freshwater Marsh	249,844	34%	42,689	17%
Shrubland	390	<1%	258	66%
Upland Dry / Mesic Forest	61,563	8%	14,189	23%
Wetland Forest	393,867	54%	91,257	23%
Total	**726,607**		**155,445**	**21%**
Biscayne National Park				
Agriculture / Disturbed Land / Developed Area	174	2%	2	1%
Grassland / Coastal Strand	<1	1%	0	0%
Mangrove	5,519	71%	106	2%
Coastal Marsh	419	5%	5	1%
Sawgrass Marsh / Wet Prairie / Freshwater Marsh	32	<1%	1	3%
Beach / Dune	58	1%	1	2%
Shrubland	—	—	—	—
Upland Dry / Mesic Forest	1,615	21%	47	3%
Wetland Forest	22	<1%	1	<1%
Total	**7,780.90**		**161**	**2%**
Buck Island Reef National Monument				
Mangrove	1	1%	—	—
Shrubland	75	39%	30	40%
Upland Dry / Mesic Forest	103	54%	45	44%
Beach / Dune	11	6	0	0
Total	**190**		**75**	**39%**
Canaveral National Seashore				
Agriculture / Disturbed Land / Developed Area	527	4%	95	18%
Grassland / Coastal Strand	1,040	7%	201	19%
Mangrove	1,153	8%	396	34%
Beach / Dune	199	1%	121	61%
Coastal Marsh	3,131	21%	854	27%
Sawgrass Marsh / Wet Prairie / Freshwater Marsh	378	2%	52	14%
Shrubland	312	2%	72	23$
Upland Dry / Mesic Forest	7,231	49%	1,356	19%
Wetland Forest	648	4%	126	20%
Total	**14,617**		**3,273**	**22%**

TABLE 33: VEGETATION COMPOSITION AND LEVEL OF POTENTIAL INFESTATION WITHIN THE PARKS (CONTINUED)

Vegetation Category	Total Acres within Park	Percent of Total Terrestrial Acres	Total Potential Acres Infested within Park	Percent of Total Terrestrial Acres Infested
Christiansted National Historic Site				
Agriculture / Disturbed Land / Developed Area	7	100%	<1	7%
Total	**7**		**<1**	**7%**
Dry Tortugas National Park				
Agriculture / Disturbed Land / Developed Area	1	1%	1	100%
Beach / Dune	58	51%	0	0%
Grassland / Coastal Strand	55	48%	1	2%
Total	**114**		**2**	**2%**
Everglades National Park				
Agriculture / Disturbed Land / Developed Area	7,852	1%	4,054	52%
Grassland / Coastal Strand	694	<1%	66	105
Mangrove	361,478	38%	57,750	16%
Coastal Marsh	115,142	12%	20,339	18%
Sawgrass Marsh / Wet Prairie / Freshwater Marsh	431,389	46%	87,995	20%
Beach / Dune	2	<1%	<1	50%
Shrubland	<1	<1%	<1	100%
Upland Dry / Mesic Forest	10,852	1%	2,391	22%
Wetland Forest	20,112	2%	5,046	25%
Total	**947,519**		**177,603**	**19%**
Salt River Bay National Historic Park and Ecological Preserve				
Agriculture / Disturbed Land / Developed Area	46	10%	46	100%
Grassland / Coastal Strand	53	12%	53	100%
Beach / Dune	3	1%	0	0%
Mangrove	48	11%	<1%	<1%
Coastal Marsh	17	4%	175	100%
Shrubland	136	31%	136	100%
Upland Dry / Mesic Forest	134	31%	134	100%
Wetland Forest	3	1%	3	100%
Total	**440**		**390**	**89%**
Virgin Islands National Park				
Agriculture / Disturbed Land / Developed Area	373	4%	185	50%
Grassland / Coastal Strand	16	<1%	0	0%
Beach / Dune	58	1%	40	69%
Mangrove	73	1%	61	84%
Coastal Marsh	70	1%	23	32%
Shrubland	1,924	21%	654	34%
Upland Dry / Mesic Forest	5,460	60%	1,537	28%
Wetland Forest	1,178	13%	346	295%
Total	**9,152**		**2,846**	**31**

One of the biggest threats to this vegetation category is guinea grass. This aggressive grass invades dry communities and creates an extensive biomass (plant material) that has the potential to fuel catastrophic fires. The native vegetation in the Caribbean is not fire-tolerant, and extensive, hot fires could easily have negative impacts on the native plants and animals in one catastrophic event. The grass easily re-sprouts from underground rhizomes (thick underground horizontal stems that produce roots and have stems that develop into new plants). Other species that invade these areas are tree species that can shade out or compete with the lower-growing native plants for light and nutrients.

The Caribbean parks apply herbicides on these plants using a backpack sprayer. Depending on the herbicide used and weather conditions, results may be seen within a few days. Four herbicides are identified in appendix J that would be used in the treatment of exotic plants under the no-action alternative. They include metsulfuron methyl, triclopyr, imazapyr, and glyphosate. The herbicide is mixed with vegetable oil to act as a wetting agent and applied directly to the foliage or to the stem just above the ground. Use of herbicides has the potential to adversely impact native vegetation. Most herbicides have only limited selectivity, which could potentially result in the loss of desirable vegetation that is growing near the targeted exotic plants. Triclopyr is considered to be a selective herbicide, metsulfuron methyl is considered to be somewhat selective, and both are used to control broadleaf and woody plants. Current best management practices under this alternative are in place to ensure that such losses of native vegetation are minimal. When applying herbicides, contractors and staff follow best management practices identified in “Applying Pesticides Correctly” (Dean 1998) to reduce or minimize the impacts on native vegetation (Clark 2005). Application of the herbicides in accordance with EPA label instructions would also reduce the potential for impacts on nontarget plant species. Ground crews would continue to apply herbicides in this vegetation category using sprayers that have tiny nozzles that deliver small amounts of herbicides to a small area, which helps to reduce or eliminate adverse impacts on native plant species. When best management practices are followed during the application of the appropriate herbicide, given the environmental conditions, there would be negligible adverse impacts on native vegetation. The only other method of treating exotic plants in the shrubland vegetation category is to remove seedlings by hand pulling, and hand pulling seedlings is only effective when they are very small; when they reach a certain height, they can no longer be removed without leaving most of the root mass behind, which would result in rapid regrowth. Pulling the seedlings when they are small also reduces the potential damage to the roots of adjacent plants, thereby leaving the native vegetation intact. Continued use of mechanical methods would result in long-term negligible adverse impacts on native vegetation.

The mechanical and chemical methods used to treat exotic plants in the Caribbean parks are low impact activities that would not adversely affect the native vegetation of the shrubland communities. The majority of the treatment areas in the Caribbean parks are only accessible by foot, and some impact on native vegetation may occur from trampling of undergrowth and breaking branches. These are temporary impacts from which the plants would quickly recover. Foot traffic in dry areas, such as the shrublands, of the Caribbean is

usually less invasive and damaging to the soils and undergrowth than in wet areas, and can be further minimized by using the same tracks for entering and leaving a treated area. Details regarding the intensity of impact from foot traffic would depend upon the number of individuals in the ground crew, the amount of moisture in the soil, and the type of native vegetation in the treatment area. The adverse impact from the foot traffic would be local, negligible, direct, and short term.

Under the no-action alternative, the exotic plants (described above) occurring in shrublands would continue to be reduced by mechanical and chemical methods. Removing the exotic plants helps support the restoration of biological integrity and biodiversity of the native vegetation categories. In some instances, this means the removal of a single or small numbers of exotic plants; in other cases, it may mean the removal of a large number of exotic plants over a large area. If a large area were treated, it may take 10 years or more for the area to recover to a viable vegetation category. Under the no-action alternative, all infested areas would be initially treated and then re-treated every 3 years. Exotic plants would be controlled, but shrublands would not be fully restored. In Virgin Islands National Park and Buck Island Reef National Monument, where shrublands cover large portions of the parks, approximately 35% and 40%, respectively, are infested, and removal of exotic plants would result in long-term minor beneficial impacts. In Salt River Bay National Historic Park and Ecological Reserve, where 100% of shrublands are infested, removal of exotic plants would result in long-term moderate to major beneficial impacts.

Treatment of the small area of shrublands in Big Cypress National Preserve and Canaveral National Seashore would produce long-term, localized negligible to minor beneficial impacts.

Grassland / Coastal Strand

Big Cypress National Preserve, Canaveral National Seashore, Everglades National Park, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Dry grasslands are upland areas that support a dominance of grass, sedge, and herbaceous species and very few woody species. Natural grasslands occur in the study area as the coastal grasslands and dune communities of Canaveral National Seashore (7% of the park's terrestrial area), and as the dry prairies in small areas of Everglades National Park and Big Cypress National Preserve. Dry grasslands are present at Salt River Bay National Historic Park and Ecological Preserve and Virgin Islands National Park, but these areas are vegetated by predominantly exotic grasses and are not native vegetation categories. The dry grasslands have not been impacted by exotic plants to the degree that other vegetation categories have, likely due to the same limiting factors that prevent these vegetation categories from becoming native forested communities. Numerous factors (salt spray; occasional storm or tidal surges; low nutrient, highly drained soils in the coastal areas; frequent fires; mowing; grazing; and clearing in the inland areas) likely contribute to the lack of woody exotic plant species. Exceptions to this include Australian pine and Brazilian pepper, which can be found in the dry coastal grasslands.

When exotic plants do occur on the inland dry prairies, they are treated with chemical, physical, and mechanical treatment methods or with combinations of these methods. Chemical treatment is the method of choice because it is inexpensive and quite effective. The other treatment methods are used to enhance the success of the chemical treatment in these areas. Chemical treatment includes the use of herbicides Garlon 3a and 4, Habitat, Renovate, Arsenal, Roundup, Rodeo, Escort, and/or Stalker applied via backpack sprayer or aerial sprayers from helicopters. Both the backpack sprayers and the aerial sprayers have small nozzles that deliver small amounts of herbicides very accurately to the targeted plants. The herbicide is mixed with vegetable oil to act as a wetting agent and applied directly to the foliage or to the cut stem just above the ground. Depending on the herbicide used and weather conditions, results may be seen within a few days. With implementation of best management practices during aerial application, such as applying herbicides only when wind speeds are low and using spray nozzles that reduce drift (which allows for a focused application of herbicides), adverse impacts on native vegetation from aerial application would range up to a minor level. When applied on the ground using best management practices, impacts on marsh communities from application of herbicides would be negligible because there would be less potential for drift onto nontarget plants.

The prescribed fire in dry grasslands is part of the natural fire cycle of the fire-adapted dry prairie communities of Big Cypress National Preserve and Everglades National Park. Dry prairies usually have a 2-year natural burn cycle, and this frequency is adequate for suppression of woody exotic plant encroachment. Mechanical treatment in dry grasslands includes pulling seedlings of woody exotic species and cutting and mulching mature vegetation. Mechanical treatment of exotic plants in the dry prairie areas is facilitated by the easily accessible characteristic of the dry prairie communities. These characteristics include open vegetative cover, well-drained soils, and the resilience of native vegetation. Continued use of mechanical methods would result in long-term negligible adverse impacts on native vegetation.

Under the no-action alternative, the exotic plants (Australian pine and Brazilian pepper) occurring in dry grasslands would continue to be reduced by physical, mechanical, and chemical treatment methods. The prescribed fire method used in dry prairie is fire, which is a natural occurrence in this fire-dependent vegetation category. Treating exotic plants with fire mimics the natural fire cycle and benefits the dry prairie community by adding nutrients to the soil, limiting the succession of woody native species, and creating soil conditions suitable for the germination of native species. Neither the chemical or mechanical treatment methods would cause long-term adverse impacts on native vegetation in dry prairie due to the resilience of native vegetation, well-drained soils, and the open character of the vegetative cover. Removing the exotic plants would help promote restoration of the biological integrity and biodiversity of the native vegetation categories. Under the no-action alternative, all infested grasslands would be initially treated and then re-treated every 3 years. Exotic plants would be controlled, but dry grasslands would not be fully restored. Treatment of the small area of dry grasslands in Big Cypress National Preserve would produce long-term, localized negligible beneficial impacts. Larger areas of dry grassland treated in Canaveral National Seashore (7% of the park's terrestrial area and 20%

infested) and Salt River Bay National Historic Park and Ecological Reserve (11% of the area and 100% infested) would produce long-term, localized minor to moderate beneficial impacts.

Deciduous—Having leaves that fall off or are shed seasonally to avoid adverse weather conditions such as cold or drought.

Upland Dry / Mesic Forest

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Everglades National Park, Buck Island Reef National Monument, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

The vegetation categories in this category are unique to their specific region and support many endemic plants and animals. These characteristics are discussed in detail in the "Affected Environment" chapter. The tropical hardwood hammocks and pine rockland communities of south Florida are extremely vulnerable to the impacts of exotic plant infestation. These vegetation categories are rare and support several rare plant and animal species. When Brazilian pepper becomes established in a remnant of pine rockland, it can shade out the sensitive forbs that occur in the sparse ground cover. Old World climbing fern in a tropical hardwood hammock smothers large trees and competes with the epiphytic orchids and bromeliads by intercepting moisture and nutrients. Other species that invade south Florida upland forests include melaleuca, seaside mahoe, and Australian pine.

Ghost orchid (Dendrophylax lindenil) on a pond apple tree

The upland forests are the most affected areas of Virgin Islands National Park with respect to the exotic plant infestation (see maps in appendix I). Much of these forests are overgrown with tan tan, genip, penguin, guinea grass, ginger Thomas, wild tamarind, noni, aloe, seaside mahoe, lather leaf, Boerhavia, and Brazilian pepper, especially in areas with significant human activity such as along roadways or old homesteads.

In Buck Island Reef National Monument, guinea grass has invaded the upland forests, originating from seeds that may have been transported to the island by wind currents, water run-off, human distribution on clothes or shoes, or by granivorous birds or mice (Clark 2004b). The presence of this grass on the island is of special concern because of its tendency to form large expanses of dry, very flammable material and its ability to tolerate fire. The native vegetation on Buck Island is not fire-tolerant, and if the guinea grass were allowed to spread over a substantial amount of the island, an accidental fire could result in the extinction of many of the rare and endemic plant species. This scenario has occurred on islands throughout the Pacific Ocean and in Southeast Asia where the grass was planted for forage (Sherley 2000). Under alternative A, the NPS would continue to re-treat the guinea grass on the island, thereby reducing or eliminating the potential for wildfire to occur. The guinea grass is treated by chemical and mechanical methods. The chemical treatment uses a foliar spray of glyphosate (Roundup) mixed with water, with follow-up applications as needed, although the initial applications have been very successful. The dead vegetation is allowed to decay on site. The treatment of this grass has allowed some native species to emerge that were not visible previously due to the volume of plant material this grass produces. The chemical

applications are applied with backpack sprayers similar to the applications for the other exotic plants in the Caribbean islands. As was discussed earlier, using best management practices and applying the herbicides according to the label instructions would result in long-term negligible adverse impacts on native vegetation from the use of herbicides.

The mechanical treatment of exotic plants on the Caribbean islands is hand pulling of seedlings. This method is the same as that for shrublands, in that the seedlings must be pulled when very small to be effective, and when pulled at this stage, there is very little impact to the roots of the native vegetation. Continued use of mechanical methods would result in long-term negligible adverse impacts on native vegetation.

The tropical hardwood hammocks in south Florida are not fire-adapted vegetation categories, so only chemical, biological, and mechanical treatment methods are used in these areas. The exotic plants in these vegetation categories (usually Brazilian pepper, mother-in-law's tongue, Australian pine, lather leaf, or Old World climbing fern) are usually treated with an herbicide such as Garlon 3a and 4, Habitat, Renovate, Arsenal, Roundup, Rodeo, Escort, and/or Stalker applied with a backpack sprayer to the foliage or cut stem of the exotic plant. Ground application of herbicides to exotic plants in this habitat would have negligible impacts on native vegetation because the herbicides would be applied according to label instructions and best management practices to reduce or eliminate the potential for accidental overspray or drift onto nontarget plants. Mechanical treatment of exotic plants in the hardwood hammocks is limited to the hand pulling of seedlings when possible. Some individual plants may be trampled or disturbed during this activity by crews accessing the sites and removing the exotic plant seedlings. This is a low-impact method with negligible adverse impacts.

The pine flatwoods of south Florida are subject to infestation by Brazilian pepper and melaleuca. The open character of these vegetation categories can be altered by the infestation of these species. Both contribute to the fuel in the understory, so when fires occur, instead of moving quickly through the ground cover without impacting the pines, pines are now lost because the extra fuel causes hotter, more intense fires. These vegetation categories are treated by physical, chemical, biological, and mechanical methods.

Chemical treatment includes the aerial or ground-based spraying of herbicides such as Garlon 3a and 4, Habitat, Renovate, Arsenal, Roundup, Rodeo, Escort, and/or Stalker. Chemical treatment is effective when applied via aerial spraying. Ground treatment is very labor intensive but more accurate in areas where overspray may be a problem. Aerial treatment is also used when access to the treatment site would create extensive damage to the native vegetation and soils or where sites are simply inaccessible. With implementation of best management practices during aerial application, such as applying herbicides only when wind speeds are low and using spray nozzles that reduce drift (which allows for a focused application of herbicides), adverse impacts on native vegetation from aerial application would range up to a minor level. When applied on the ground using best management practices, impacts on pine flatwoods communities from application of herbicides would be negligible because there would be less

potential for drift onto nontarget plants. Mechanical treatment of exotic plants within the pine flatwoods is limited to hand pulling of seedlings when possible. This is a low-impact treatment methodology with negligible adverse impacts.

Prescribed fires are conducted in conjunction with the fire management program. Seedlings of some exotic plants, such as melaleuca, would not survive a fire. The fire also would benefit the pine flatwoods community by adding nutrients to the soil, limiting the succession of woody native species such as oaks, and creating soil conditions suitable for the germination of fire-dependent native species.

The moth, *Austromusotima camptozonale*, is a new biological control that would be released in the south Florida parks for the treatment of Old World climbing fern. Other biological controls, such as the snout beetle and sap-sucking psyllid, would continue to be used to treat melaleuca in Big Cypress National Preserve and Everglades National Park. The use of biological controls is based on insect specificity to a given exotic plant species. Biological controls go through a rigorous testing, screening, approval, and NEPA process by the Animal and Plant Health Inspection Service (APHIS). Biological controls are studied to authenticate their host specificity in laboratories for years before being released into the wild. Based on these trials and the approval of APHIS for the moth's release, the use of this biological control under the no-action alternative would have negative impact on native plants.

Under the no-action alternative, the exotic plants (described above) occurring in upland dry / mesic forests would continue to be reduced by mechanical, physical, biological, and/or chemical treatment methods. Impacts from accessing sites for mechanical or chemical treatment would depend on the location of the upland forest community treated, but if the site cannot be accessed without substantial impacts on native vegetation, aerial spraying would be used instead. With the implementation of best management practices, the use of herbicides and mechanical treatment methods would result in short-term negligible to minor adverse impacts on these vegetation categories.

Removing the exotic plants would help promote restoration of the biological integrity and biodiversity of the native vegetation categories. Under the no-action alternative, all infested areas would be initially treated and then re-treated every 3 years. Exotic plants would be controlled, but upland dry / mesic forests would not be fully restored. If a large area were treated, it may take 10 years or more for the area to recover to a viable vegetation category. Upland dry / mesic forests in the south Florida and Caribbean parks cover from 8% (Big Cypress National Preserve) to 54% (Buck Island Reef National Monument). Upland dry / mesic forest represents 1% of the terrestrial area of Everglades National Park but totals over 10,000 acres. Infestation is high, ranging from 44% of the upland dry / mesic forest acres on Buck Island Reef National Monument to 100% in Salt River Bay National Historic Park and Ecological Preserve. Treatment of these lands under the no-action alternative would result in long-term moderate beneficial impacts. Treatment of the 28% of upland dry / mesic forest acres that are infested in Virgin Islands National Park would result in long-term minor beneficial impacts.

Mangrove

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

The different types of mangrove communities included in this category are mangrove fringe, mangrove forest and woodland, and mangrove shrubland. Mangroves are found in all of the south Florida and Caribbean parks except for the Christiansted National Historic Site. Mangroves are most predominant in Biscayne National Park (71% of the park's terrestrial area), Everglades National Park (38%), Salt River Bay National Historic Park and Ecological Preserve (11%), and Canaveral National Seashore (8%). The remaining parks have less than 1% of their area covered by mangroves. Table 33 lists the acres of mangroves present in each of the parks. Mangroves are vital to tropical shorelines because they provide habitat for numerous species, aid in water quality improvement, and protect shorelines against storms by buffering high-energy wave action. Exotic plant species (such as Brazilian pepper, Australian pine, lather leaf, and melaleuca) often become established at the interface between the mangroves and shoreline vegetation. These species tolerate some tidal inundation and, once established, form dense stands. These stands, if tall enough, can impact mangroves by shading them and by creating a detrital (organic debris formed by the decomposition of plants or animals) layer that may prevent mangroves from becoming established. The presence of Australian pines may preclude the development of mangrove communities by reducing the availability of areas in which mangroves can germinate by allowing the erosion of the substrate.

The exotic plants infesting the mangrove interface are treated by chemical, biological, and mechanical means. Table 33 lists the acres of mangroves that are infested and treated under the no-action alternative. Chemical treatment includes the ground-based spraying of herbicides such as Garlon 3a and 4, Habitat, Renovate, Arsenal, Roundup, Rodeo, Escort, and/or Stalker. Chemical treatment with herbicides is very effective with little adverse effect on nontarget species. With application of herbicides using backpack sprayers that provide for accurate spraying of the exotic plants, and with implementation of best management practices, there would be negligible adverse impact on native vegetation.

To eliminate the potential for nontarget damage, the parks avoid the use of aerial treatment other than spot spraying. Aerial spot spraying would be used on a limited basis in Everglades National Park to treat Australian pine in mangrove areas. Spraying is targeted to individual plants and incidental spraying of nontarget plants would result in localized, minor adverse impacts to native plants.

Mechanical treatment of exotic plants within mangrove communities is limited to hand pulling of seedlings when possible. This is a low-impact treatment method resulting in long-term negligible adverse impacts from trampling or damage to individual plants. Access can be a problem in mangrove areas however so mechanical treatment in this vegetation category is not often used. When sites are accessed for mechanical and/or chemical treatments with motorboats or airboats, adverse impacts on native vegetation of minor intensity would occur. The use of boats to access treatment areas can cause direct physical damage to plants through contact with the boat. Recognizing this concern, the park staff and

contractors would be well trained in proper boating techniques in these habitats to reduce or eliminate damage on native vegetation. The impacts would be localized and short term as the plants in the system would recover from the disturbance within one or 2 years of the activity.

Biological controls (the snout beetle and the sap-sucking psyllid) would continue to be used for the treatment of melaleuca in Big Cypress National Preserve and Everglades National Park. Based on APHIS testing and evaluation of these insects, their use as biological controls under the no-action alternative would continue at the present rate and would likely not result in negative impacts on native plants.

Under the no-action alternative, the exotic plants (Brazilian pepper, Australian pine, lather leaf, and melaleuca) occurring in mangrove communities would continue to be reduced by mechanical, biological, and/or chemical treatment methods. Impacts from accessing sites for mechanical or chemical treatment would depend on the location of the mangrove community, but if the site cannot be accessed without substantial impacts on native vegetation, aerial spraying would be used instead.

Removing the exotic plants would help promote restoration of the biological integrity and biodiversity of the native vegetation categories. Under the no-action alternative, all infested areas would be initially treated and then re-treated every 3 years. Exotic plants would be controlled, but mangrove areas would not be fully restored. If a large area were treated, it may take 10 years or more for the area to recover to a viable vegetation category. Exotic plant infestation in mangroves is high in Canaveral National Seashore (34%), Big Cypress National Preserve (35%), and Virgin Islands National Park (84%). Treatment of these lands under the no-action alternative would result in long-term moderate beneficial impacts. Treatment of the infested mangrove acres in the remaining parks would result in long-term negligible to minor beneficial impacts.

Coastal Marsh

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

This category includes the salt marsh, salt flats, salt pond, and seagrass communities. Seagrass communities are not directly affected by invasive exotic plant species; however, the presence of exotic plants and the treatment of those plants on adjacent lands may cause indirect effects.

These vegetation categories are typically found around coastal areas, either in transitional areas between the land and sea, or in the more shallow areas around water bodies such as the Indian River Lagoon near Canaveral National Seashore. Because of high salinity levels, salt flat communities are usually characterized by a very sparse cover of salt-tolerant herbaceous plants. Salt marsh communities provide habitat for at least 10 species of fishes, 11 reptiles, 33 birds, 12 mammals, and 5 vascular plants considered to be rare or endangered in Florida salt marshes (FNAI 1997). Vegetation categories that are included in the

salt marsh category are found in Canaveral National Seashore (21% of the park's terrestrial area), Everglades National Park (12%), Biscayne National Park (5%), Big Cypress National Preserve (1%), Salt River Bay National Historic Park and Ecological Preserve (4%), and Virgin Islands National Park (1%). Table 33 shows the area comprising this vegetation category in each park.

Although salt marshes are not often invaded by exotic plants, Brazilian pepper, Australian pine, seaside mahoe, lather leaf, and melaleuca can often be found in the interface between the salt marsh and the adjacent uplands. Invasion of salt marsh communities by exotic plants is uncommon due to the harsh environmental conditions, but these species are tolerant of slightly saline conditions. A salt marsh that is becoming invaded by exotic woody plant species is usually indicative of hydrological impacts, such as changes in nutrient levels, salinity, or water elevations. Table 33 shows the acres of infestation and the areas treated in each park and the type of treatment methods currently being used.

The exotic plants infesting the vegetation categories in the salt marsh category are treated by chemical, biological, and mechanical means. Chemical treatment includes the aerial or ground-based spraying of herbicides such as Garlon 3a and 4, Habitat, Renovate, Arsenal, Roundup, Rodeo, Escort, and/or Stalker. Chemical treatment is effective and relatively inexpensive when applied via aerial spraying. Aerial treatment is also used when access to the treatment site would create extensive damage to native vegetation and soils or where sites are simply inaccessible. When using the aerial spraying method, Rodeo is often used near wetland areas because it is relatively harmless to aquatic life. With implementation of best management practices during aerial application, such as applying herbicides only when wind speeds are low and using spray nozzles that reduce drift (which allows for a focused application of herbicides), adverse impacts on native vegetation from aerial application would range up to a minor level. When applied on the ground using best management practices, impacts on marsh communities from application of herbicides would be negligible because there would be less potential for drift onto nontarget plants.

Mechanical treatment of exotic plants in the salt marsh category is limited to hand pulling of seedlings when possible. This is a low-impact treatment methodology but some individual plants may be trampled or disturbed during this activity by crews accessing the sites and removing the exotic plant seedlings. Continued use of mechanical methods would result in short-term negligible adverse impacts on native vegetation.

Access can be a problem in salt marsh areas, so mechanical treatment in this vegetation category is not often used. When accessing sites for mechanical or chemical treatment of exotic plants, adverse impacts on native vegetation of minor intensity would occur. The use of motorboats or airboats to access treatment areas can cause direct physical damage to plants either through grounding (propeller damage) or inadvertent placement of anchors. Recognizing this concern, the park staff and contractors would be well trained in proper boating techniques in these habitats to reduce or eliminate damage to native vegetation. The impacts would be short term because the plants in the system would recover from the disturbance within 1 or 2 years of the activity.

With respect to seagrasses, if the exotic plants are treated by mechanical methods that result in disturbance of the soils, there may be some temporary erosion and runoff that could cause turbidity or algal blooms and the reduction of sunlight to the seagrasses. In addition, access to sites has the potential to damage seagrass beds, and exposed areas may erode due to tidal movements resulting in the degradation of the sediment substrate that seagrass require for survival. Mitigation measures to reduce erosion, and training of personnel on proper boating techniques in this unique habitat, would be employed under the no-action alternative, and therefore, the adverse impacts on seagrass communities from mechanical activities and access to sites would result in negligible to minor adverse impacts, depending on the size of the adjacent terrestrial treatment area. Because some seagrass communities do not recover quickly from disturbance, the impacts could be long term.

Biological controls (the snout beetle and the sap-sucking psyllid) would continue to be used for the treatment of melaleuca in Big Cypress National Preserve and Everglades National Park. Based on APHIS testing and evaluation of these insects, their use as biological controls under the no-action alternative would continue at the present rate and would likely not result in negative impacts on native plants.

Removing the exotic plants would help promote restoration of the biological integrity and biodiversity of the native vegetation categories. Under the no-action alternative, all infested areas would be initially treated and then re-treated every 3 years. Exotic vegetation would be controlled, but coastal marsh areas would not be fully restored. Because re-treatment of sites does not occur with enough frequency on average to allow for control of exotic plant infestation, the time for vegetation to recover passively under this alternative would be greater than 10 years. Because of this, treatment of infestation of coastal marsh acres in Big Cypress National Preserve, Biscayne National Park, and Virgin Islands National Park would result in long-term negligible to minor beneficial impacts. Treatment of the infested acres in Canaveral National Seashore and Everglades National Park would result in long-term minor beneficial impacts. Coastal marshes in Salt River Bay National Historic Park are a small portion of the park's terrestrial area (4%), but are 100% infested. Treatment would result in long-term, moderate beneficial impacts.

Sawgrass Marsh / Wet Prairie / Freshwater Marsh

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, and Everglades National Park

Freshwater marsh, sawgrass marsh, and wet prairies are vegetation categories in which the dominant species are herbaceous, and the soils are usually saturated or inundated for at least 1 or 2 months during the growing season. This vegetation category is found in Canaveral National Seashore (2% of the park's terrestrial area) and Big Cypress National Preserve (34%), and they comprise almost one-half of the total land area of Everglades National Park. Table 33 provides the exact acres of this vegetation category in each of the parks. Freshwater herbaceous wetlands are important to Florida because of the wildlife habitat, water quality, flood abatement, and aquifer recharge benefits they provide.

The invasion of exotic plants into a freshwater marsh system often occurs as a result of impacts on the hydrology, natural fire cycle, or soils. The species most commonly invading the vegetation categories in this category are melaleuca, Old World climbing fern, and Brazilian pepper. As described in the "Affected Environment" chapter, when the woody species invade the marshes of south Florida, species such as the Cape Sable seaside sparrow face extinction, so the threat of habitat loss is severe. Table 33 lists the area in the sawgrass marsh / wet prairie / freshwater marsh category that is infested with exotic plants.

These exotic plants infesting the vegetation categories in this category are treated by chemical, biological, and mechanical means. Table 1 in appendixes A – I shows the areas treated in each park and the method used for treatment. Chemical treatment includes the aerial or ground-based spraying of herbicides such as Garlon 3a and 4, Habitat, Renovate, Arsenal, Roundup, Rodeo, Escort, and/or Stalker. Chemical treatment is effective and relatively inexpensive when applied via aerial spraying. Aerial treatment is also used when accessing the treatment site would create extensive damage to native vegetation and soils or where sites are simply inaccessible. When using the aerial spraying method, Rodeo is often used in wetland areas because it is relatively harmless to aquatic life. In most cases, the dead vegetation is left in place to decay. Impacts on native species would occur because the herbicides identified for use in the parks are nonselective, except for those with the active ingredient triclopyr. It is expected that aerial application of nonselective herbicides would result in some nontarget damage as individuals of native plants that are exposed to the chemical would drop leaves and/or die. With implementation of best management practices during aerial application, such as applying herbicides only when wind speeds are low and using spray nozzles that reduce drift (which allows for a focused application of herbicides), adverse impacts on native vegetation from aerial application would range up to a minor level. When applied on the ground using best management practices, impacts on marsh communities from application of herbicides would be negligible because there would be less potential for drift onto nontarget plants.

Mechanical treatment of exotic plants in the freshwater marsh category is limited to hand pulling of seedlings when possible. This is a low-impact treatment methodology in that it does not damage native vegetation or create turbidity. Seedlings are relatively easy to pull when the wetlands are hydrated. Access can be a problem in freshwater marsh areas so mechanical treatment in this vegetation category is usually conducted in the dry season to avoid impacts on water quality, soils, and native vegetation. Continued use of mechanical methods would result in long-term negligible to minor adverse impacts on native vegetation.

Freshwater marsh and wet prairies are more readily restored, assuming the soils and hydrology are suitable. Herbaceous plants have faster growth and maturity rates, and vegetation in a treated wetland can be restored within 3 years through natural recruitment of native species. Under the no-action alternative, the exotic plants (melaleuca, Old World climbing fern, and Brazilian pepper) occurring in sawgrass marsh / wet prairie / freshwater marsh areas would continue to be reduced by mechanical and/or chemical treatment methods. Impacts from accessing sites for mechanical or chemical treatment would depend on the

location of the wetland community treated, but if the site cannot be accessed without substantial impacts on native vegetation, aerial spraying would be used instead.

Removing the exotic plants would help promote restoration of the biological integrity and biodiversity of the native vegetation categories. Under the no-action alternative, all infested areas would be initially treated and then re-treated every 3 years. Exotic vegetation would be controlled, but the marsh areas would not be fully restored. Due to the infrequent re-treatment of sites, on average, the time for the system to recover in treated areas could exceed 10 years. Infestation of sawgrass marsh / wet prairie / freshwater marsh is low, ranging from 1% to 28%, in the parks where this vegetation category is present. It is an important community for the Cape Sable seaside sparrow. Treatment of exotic plant infestations in sawgrass marsh / wet prairie / freshwater marsh acres in Big Cypress National Preserve and Everglades National Park would result in long-term minor to moderate beneficial impacts. Treatment of the infested acres in Canaveral National Seashore and Biscayne National Park would result in long-term negligible to minor beneficial impacts.

Wetland Forest

Big Cypress National Preserve, Everglades National Park, Biscayne National Park, Canaveral National Seashore, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

The wetland forest category includes mixed hardwood swamp forest, basin moist forest, mixed swamp, cypress strand, cypress slough, cypress dome, bay swamp, and shrub swamp communities in Big Cypress National Preserve (54% of the park's terrestrial area), Canaveral National Seashore (4%), Everglades National Park (2%), and Virgin Islands National Park (13%), and there are small amounts (under 5 acres) in Biscayne National Park, and Salt River Bay National Historic Park and Ecological Preserve. Table 33 shows the acreage of wetland forests in each park. Wetland forests are important habitat for numerous species of fish, wildlife, and plants, including such special status species as the Florida panther, bald eagle, and wood stork. They also provide water quality treatment and flood abatement.

Wetland forests can be substantially altered when exotic plants are allowed to take over. Old World climbing fern can climb into the tree canopy and shade out understory species. Over time, the weight of large amounts of biomass (plant material) that develop can pull down a tree. Other exotic plants form thickets in the understory that crowd out native plant species by intercepting nutrients and moisture. The detritus (decaying plant material) deposited on the forest floor can build up and cause succession into a drier community. The exotic plant species most often infesting the vegetation categories in this category include Old World climbing fern, Brazilian pepper, melaleuca, and lather leaf. The areas of infestation in each park are shown in table 1 of appendixes A – I.

These exotic plant species are treated with mechanical, biological, and chemical methods in the same manner as the exotic plant species in the freshwater marsh category. Table 1 in appendixes A – I shows the treatment methods for each vegetation category in each park. Chemical treatment includes the aerial or

Cypress stand at Big Cypress National Preserve

ground-based spraying of herbicides such as Garlon 3a and 4, Habitat, Renovate, Arsenal, Roundup, Rodeo, Escort, and/or Stalker. Chemical treatment is effective and relatively inexpensive when applied via aerial spraying. Aerial treatment is also used when access to the treatment site would create extensive damage to native vegetation and soils, or where sites are simply inaccessible. When using the aerial spraying method, Rodeo is often used near wetland areas because it is relatively harmless to aquatic life. Currently, aerial spraying does not occur over the cypress stands in the parks. If Old World climbing fern infests these areas in the future, aerial spraying with herbicides would be conducted to control the plant. Spraying would only occur when the cypress are dormant to reduce nontarget damage. With implementation of best management practices during aerial application, such as applying herbicides only when wind speeds are low and using spray nozzles that reduce drift (which allows for a focused application of herbicides), adverse impacts on native vegetation from aerial application would range up to a minor level. When applied on the ground using best management practices, impacts on marsh communities from application of herbicides would be negligible because there would be less potential for drift onto nontarget plants.

Mechanical treatment of exotic plants in the wetland forest category is limited to hand pulling of seedlings when possible. This is a low-impact treatment methodology in that it does not damage native vegetation or create turbidity. Seedlings are relatively easy to pull when the wetlands are hydrated. Access can be a problem in wetland forest areas so mechanical treatment in this vegetation category is usually conducted in the dry season to avoid impacts on water quality, soils, and native vegetation. Continued use of mechanical methods would result in long-term negligible to minor adverse impacts on native vegetation.

Accessing the exotic plants in wetland forests can often be very difficult. Most of the wetland communities in this category exist as islands or strands within freshwater marshes or wet prairies, which would require access via airboat, boat, swamp buggy, or on foot. The difficulty of access adds to the cost of treating these often remote areas, and the swamp buggies are known to create substantial damage to wetland vegetation. Accessing a remote area for treatment would result in short-term, minor adverse impacts on the wetland forest and the vegetation category around it if swamp buggies or other tracked vehicles were used.

Biological controls (the snout beetle and the sap-sucking psyllid) would continue to be used for the treatment of melaleuca in Big Cypress National Preserve and Everglades National Park. Based on APHIS testing and evaluation of these insects, their use as biological controls under the no-action alternative would continue at the present rate and would likely not result in negative impacts on native plants.

Under the no-action alternative, the exotic plants (Old World climbing fern, Brazilian pepper, melaleuca, and lather leaf) occurring in wetland forest category would continue to be reduced by mechanical, biological, and/or chemical treatment methods. Impacts from accessing sites for mechanical or chemical treatment would depend on the location of the wetland forest community treated, but if the site cannot be accessed without substantial impacts on native vegetation, aerial spraying would be used instead.

Removing the exotic plants would help promote restoration of the biological integrity and biodiversity of the native vegetation categories. Under the no-action alternative, all infested areas would be initially treated and then re-treated every 3 years. Exotic plants would be controlled, but wetland forest areas would not be fully restored. Because wetland forest communities are slow growing, the time for heavily infested areas to recover passively to a viable vegetation category may exceed 20 years because re-treatment of sites, on average, would not occur with enough frequency to allow for control of exotic plant infestations. Treatment of infestation of wetland forest acres in Big Cypress National Preserve (23% infested, 54% of terrestrial area) and Salt River Bay National Historic Park (100% infested, 1% of terrestrial area) would result in long-term moderate beneficial impacts. Treatment of the infested acres in the remaining parks would result in long-term negligible to minor beneficial impacts.

Agriculture / Disturbed Land / Developed Area

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

This category includes areas of the parks that have been previously disturbed and have been converted to an early successional stage of vegetation condition and these areas tend to be dominated by exotic plants. This category can be found in every park to varying degrees, Big Cypress National Preserve (1% of the park's terrestrial area), Biscayne National Park, (2%), Canaveral National Seashore (4%), Christiansted National Historic Site (7%), Dry Tortugas National Park (1%), Everglades National Park (1%), Christiansted National Historic Site (Salt River Bay National Historic Park and Ecological Preserve (10%), and Virgin Islands National Park (4%).

These developed and disturbed areas within the Big Cypress National Preserve and Everglades National Park are infested predominantly by Brazilian pepper and melalueca. In Canaveral National Seashore, the disturbed lands are predominantly infested by Brazilian pepper. This exotic plant, as well as Australian pine, is found on disturbed sites and spoil islands of Biscayne National Park. In the Caribbean parks, a variety of exotic plants infest these areas in the parks but tan tan, limeberry, and guinea grass are dominant. In Big Cypress National Preserve and Everglades National Park, where exotic plants make up large monocultures, aerial treatment is the most effective method of treatment as large areas can be treated in a short period of time. In the other parks, ground treatments with herbicides is typically used. Chemical treatment includes the use of herbicides Garlon 3a and 4, Habitat, Renovate, Arsenal, Roundup, Rodeo, Escort, and/or Stalker applied via backpack sprayer. With implementation of best

management practices, such as applying herbicides only when wind speeds are low and using spray nozzles that reduce drift (which allows for a focused application of herbicides), adverse impacts on native vegetation would be negligible to minor as these areas are predominantly exotic plants with a lesser potential for native vegetation to be affected by treatment.

Mechanical treatments would also occur in smaller areas of infestation where there may be some damage to native plants due to trampling by personnel or equipment used to access sites. These are temporary impacts from which the plants would quickly recover. Details regarding the intensity of impact from foot traffic would depend upon the number of individuals in the ground crew and the type of native vegetation in the treatment area. The adverse impact from the foot traffic would be local, negligible, direct, and short term.

In Big Cypress National Preserve and Everglades National Park, biological control agents to treat melaleuca infestation would also be used to supplement chemical or mechanical treatment methods. As these methods have been thoroughly tested prior to release in the field to ensure that there would be no non-target damage to native plant species and these agents are highly host plant specific, there is expected to be no damage to native vegetation as a result of biological controls for melaleuca.

Under the no-action alternative, all infested areas would be initially treated and then re-treated every 3 years. Exotic plants would be controlled, but agricultural and disturbed lands would not be fully restored. Large areas within the park may take longer than 10 years to recover as they have dense infestations and a persistent seed bank would likely exists, making passive restoration using an infrequent treatment schedule difficult and unlikely that the entire area would recover. In those parks where the these lands are greater than greater than 90% infested, Dry Tortugas National Park and Salt River Bay National Historic Park and Ecological Preserve, the beneficial effect on native plants from treatment in these areas would be moderate depending on the success of re-treatment. In Virgin Islands National Park, Everglades National Park, and Big Cypress National Preserve, where the infestation ranges from 43% to 52% (see table 33), the beneficial effect would range from minor. In parks where infestation is less than 20% (Biscayne National Park, Canaveral National Seashore, and Christiansted National Historic Park) these benefits would be negligible.

Beach / Dune

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Everglades National Park, Buck Island Reef National Monument, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

The beach / dune category includes tidally influenced halophytic, xerophytic, pioneering species such as grasses, forbs, and herbs in unconsolidated substrate comprised of sand and coarse calcareous detritus. This vegetation category is found in Biscayne National Park, (1% of the park's terrestrial area), Canaveral National Seashore (1%), Dry Tortugas National Park (51%), Everglades National Park (less than 1%), Buck Island Reef National Monument (6%), Salt River Bay National Historic Park and Ecological Preserve (1%), and Virgin Islands

National Park (1%). Beach / dunes provide important habitat for the southeastern beach mouse and other rodents, feeding and nesting habitat for several species of shorebirds, and nesting habitat for sea turtles. Vegetation colonizing the upper beach and foredune is adapted to periodic disturbance by wind and wave action, but in spite of the stabilizing ability of dune plants, dunes are highly susceptible to human impacts. Vehicles traversing beaches, as well as heavy foot traffic, damage vegetation by shifting sand and roots, thus destabilizing the dune community

Beach / dunes are most commonly invaded by Australian pine and Brazilian pepper. When exotic plants do occur on beaches and dunes, they are treated with chemical and mechanical treatment methods or with combinations of these methods. Chemical treatment is the method of choice because it is inexpensive and quite effective. The other treatment methods are used to enhance the success of the chemical treatment in these areas. Chemical treatment includes the use of herbicides Garlon 3a and 4, Habitat, Renovate, Arsenal, Roundup, Rodeo, Escort, and/or Stalker applied via backpack sprayer. Backpack sprayers have small nozzles that deliver small amounts of herbicides very accurately to the targeted plants. The herbicide is mixed with vegetable oil to act as a wetting agent and applied directly to the foliage or to the cut stem just above the ground. With implementation of best management practices, such as applying herbicides only when wind speeds are low and using spray nozzles that reduce drift (which allows for a focused application of herbicides), adverse impacts on native vegetation would range up to a minor level.

The mechanical and chemical methods used to treat exotic plants in the Florida and Caribbean parks are low impact activities that would not adversely affect the native vegetation of the beach / dune communities. The majority of the treatment areas are only accessible by foot, and some impact on native vegetation may occur from trampling of plants. These are temporary impacts from which the plants would quickly recover. Details regarding the intensity of impact from foot traffic would depend upon the number of individuals in the ground crew and the type of native vegetation in the treatment area. The adverse impact from the foot traffic would be local, negligible, direct, and short term.

Under the no-action alternative, all infested areas would be initially treated and then re-treated every 3 years. Exotic plants would be controlled, but sand beaches would not be fully restored. If a large area were treated, it may take 10 years or more for the area to recover to a viable vegetation category. Where sand beaches in the south Florida and Caribbean parks are infested it is 50% of the area or greater in Canaveral National Seashore (61%), Everglades National Park (50%), and Virgin Islands National Park (69%). Treatment of these lands under the no-action alternative would result in long-term moderate beneficial impacts. Treatment of the 2% of beach / dune acres that are infested in Biscayne National Park would result in long-term negligible to minor beneficial impacts.

Cumulative Impacts

Through the combined actions of the parks and the various state and local programs, there is coordinated action to address the growing crisis facing the state of Florida with respect to the exotic plant species. This has included state

legislation (the *Everglades Forever Act*) that requires the South Florida Water Management District to establish a program to coordinate with other federal, state, and local governmental entities to manage exotic pest plants and emphasize the Everglades Protection Area. Concerned agencies in Florida are taking part in a national strategic plan to develop the state invasive exotic plant management plan. Control and management of invasive exotic plants is one of the priorities established by the South Florida Ecosystem Restoration Task Force and Working Group in 1993. The Governor's Commission for a Sustainable South Florida and the USFWS multi-species recovery plan incorporate exotic plant management as a key restoration objective. Although several state agencies, particularly the Florida Department of Environmental Protection and the South Florida Water Management District, have reasonably well-funded exotic plant programs, federal funding has lagged (Doren et al. 2002). The results of these actions would continue to produce long-term moderate to major beneficial effects on vegetation categories throughout south Florida.

Hydrologic and ecosystem restoration efforts, such as the Comprehensive Everglades Restoration Plan, would produce long-term, localized, moderate to major beneficial impacts on native vegetation categories as more natural inundation periods and water balance return to Everglades National Park and Big Cypress National Preserve. Park-specific actions (such as prescribed fire) would also provide long-term, minor to moderate benefits to local native vegetation categories.

In contrast to the collective efforts of the state and federal exotic plant management teams, there are private landowners with property adjacent to the parks that have not addressed the exotic plant problems on their lands. These areas provide a seed source for the re-infestation of public lands. Without increased action on the part of adjacent landowners, exotic plants would produce long-term, minor to major adverse impacts on park and regional native vegetation categories.

In the Caribbean parks, the actions to manage exotic plants are relatively new. The focus of the parks has been on the beaches and aquatic resources. There are no other local or territorial exotic plant management plans to contribute to the efforts of the parks. Continued increases in exotic plants on lands outside of the parks would result in long-term moderate adverse impacts.

Land development, agriculture, and consequential pollution have and would continue to degrade and reduce native vegetation categories resulting in long-term major adverse effects.

Numerous planning efforts have occurred or are underway that would provide continued benefits to native vegetation categories. Fire management plans in Florida parks are restoring natural fire regimes and reducing excessive fuel loading as well as control of exotic plants providing a major benefit. Oil and gas management plans are prescribing control of exotic plants at production sites and resulting in long-term minor benefits. New GMPs are providing enhanced goals and frameworks for management of park resources and would contribute to long-term moderate benefits.

Restoration projects such as salt marsh and Hole-in-the-Donut in Everglades National Park, as well as, minor restoration projects such as road and trail restoration that remove exotic vegetation and allow for native vegetation establishment are providing long-term minor to moderate benefits. The North Shore Road project in Virgin Islands would provide stabilization of soils and planting of nonnative grasses within the road corridor and resulting long-term minor to moderate adverse impacts.

The long-term, minor to major beneficial cumulative effects that have and would result from ecosystem restoration activities and exotic plant management programs outside of the parks would mitigate some of the minor to major adverse cumulative effects of land development, agriculture, and expanding exotic plant infestations that result in losses in native vegetation categories. Cumulative regional adverse effects could be reduced to a long-term moderate adverse effect. The cumulative beneficial effect of other plans and restoration projects within the parks would additionally off-set the outside adverse effects to some degree.

The actions of alternative A would result in short-term, negligible to minor adverse effects on native vegetation categories for exotic plant management treatment activities. The effects would not measurably add to cumulative adverse effects. Treatment activities within the park would result in long-term minor to major beneficial impacts in those parks with large areas of agricultural / disturbed land / developed areas, shrubland, upland dry / mesic forest, and sawgrass marsh / wet prairie / freshwater marsh where infestation is high, and the long-term, negligible to moderate beneficial impacts would result in grasslands, mangrove, coastal marsh, beach / dune, and wetland forests, where infestation and reductions in biodiversity are less predominant. These actions would contribute to reducing regional long-term cumulative adverse impacts to a moderate level.

Conclusion

Under alternative A, all areas of exotic plant infestation would be treated by current methods. The continued application of currently used chemicals in all native vegetation categories would result in long-term negligible adverse impacts because of the accuracy of application and the low impact on nontarget vegetation. Mechanical methods would result in long-term negligible to minor adverse impacts, and there would be temporary adverse impacts from foot traffic and vehicular access resulting from trampling of undergrowth and breaking of branches. This impact would be local and negligible to minor. When prescribed fire is used as a prescribed fire, it is used in formerly infested vegetation categories. Adverse impacts to native vegetation categories would be negligible because they are fire-adapted.

Removing exotic vegetation restores the biological integrity and biodiversity of native vegetation categories. Under alternative A, exotic plants would be controlled, but native vegetation categories would not be fully restored. Long-term minor to major beneficial impacts would result in those parks with large areas of shrubland, upland dry / mesic forest, and sawgrass marsh / wet prairie / freshwater marsh where infestation is high. In grassland / coastal strand, mangrove, coastal marsh, beach / dune, and wetland forests, where infestation

and reductions in biodiversity are less predominant, there would be long-term, negligible to moderate beneficial impacts.

The exotic plant management actions would contribute to reducing regional long-term cumulative adverse impacts to a moderate level. Alternative A would not produce major adverse impacts that would result in impairment of native plants and vegetation categories in the parks.

ALTERNATIVE B — NEW FRAMEWORK FOR EXOTIC PLANT MANAGEMENT: INCREASED PLANNING, MONITORING, AND MITIGATION

Under alternative B, exotic plants would be treated with the methods listed in table 1 of appendixes A – I and herbicides would be applied over time as shown in table 3 of appendixes A – I. The methods would be the same as those described under alternative A, but the treatments would occur with more frequency. In addition, monitoring would be conducted to determine the effectiveness of the treatment and to propose an alternative treatment if necessary. The ability to alter the treatment to provide the optimum method of exotic plant control is the adaptive management program described in the "Alternatives" chapter. The increased frequency of treatment would require more access of field crews, vehicles, and equipment into the areas of exotic plant infestation and more monitoring. The details of alternative B are discussed in the "Alternatives" chapter.

Under alternative B, initial treatment would be followed by re-treatment every 6 months. This would result in a 50% decrease in exotic plants and a 50% reduction in the amount of chemicals used at each re-treatment. Over the course of the 10-year life of the plan, restoration of infested lands would be more complete than under the no-action alternative, and there would be greater achievement of the desired future conditions in each native vegetation category in a shorter period of time. As shown in table 12 in the "Alternatives" chapter, given an optimal re-treatment schedule and plan, coastal marsh, sawgrass marsh / wet prairie / freshwater marsh, and grassland / coastal strand would recover to the levels defined in the desired future conditions in 3 to 5 years; forested wetlands and forested uplands would recover in 7 to 12 years; and shrublands would recover between 10 to 15 years.

The monitoring effort would provide information to help determine if the treatment methods and frequency are appropriate to achieve desired future conditions in the vegetation categories. Monitoring information would also be used to determine if the intensified treatment program was having negative impacts on native vegetation. If it appears that aerial spraying was causing damage to the epiphytic (air) plants in the cypress swamps, for example, it may be necessary to adopt a different methodology for this vegetation category. In another scenario, if a new herbicide were determined to be more effective, less toxic, or in any way worthy of consideration, the adaptive management program would allow it to be used during treatment.

The impacts on the eight vegetation categories from the various treatment methods the parks currently use were described in alternative A. However, methods of treatment that could occur in each vegetation category under

alternative B have been defined based on a decision matrix that accounts for the exotic plants present, the vegetation category, and species of special concern present. Using this decision tool, the most appropriate treatment and re-treatment method would be applied in each vegetation category. By using this tool, protection of native vegetation would be enhanced, and impacts would be reduced further than under alternative A. The following paragraphs describe the potential impacts of the same methods with an intensified treatment and monitoring program proposed under alternative B.

Shrubland

Big Cypress National Preserve, Canaveral National Seashore, Buck Island Reef National Monument, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Shrublands are usually a very hardy vegetation category. The only impacts likely to occur with the intensified treatment and monitoring activity would be the potential for some trampling of shrubs and branch breakage. These impacts would be negligible to minor, and most shrubs would recover within a few months to a year. To minimize these potential impacts of the intensified treatment, mitigation measures identified in the "Alternatives" chapter would be implemented. One specific measure would be to require the ground crews to create a trail into the treatment area and to utilize the trail each time they access the site. When the site has achieved the desired future condition for shrublands, the trail would be allowed to restore passively. The desired future condition would occur within 10 to 15 years, with more frequent re-treatment of sites, monitoring of success of return, and adaptive management, allowing for refinement of treatments to enhance success.

Under alternative B, all infested areas would be initially treated and then re-treated every 6 months. Exotic plants would be controlled, and shrublands would be more fully restored than under alternative A. Controlling exotic plants in the shrublands that cover large portions of Virgin Islands National Park (34% of shrublands are infested) and Buck Island Reef National Monument (40% infested), would result in long-term moderate beneficial impacts. In Salt River Bay National Historic Park and Ecological Reserve, where 100% of shrublands are infested, long-term major beneficial impacts would result.

Treatment of the small area of shrublands in Big Cypress National Preserve and Canaveral National Seashore would produce long-term, localized minor beneficial impacts.

Grassland / Coastal Strand

Big Cypress National Preserve, Canaveral National Seashore, Everglades National Park, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Grasslands / coastal strand would be one of the more easily treated and restored vegetation categories under alternative B. The intensified treatment regime may result in the creation of tracks and trails from the ground crews and vehicles, but these areas would eventually recover when restoration and monitoring are completed. The native grasses and other herbaceous species normally found in

these vegetation categories would quickly regenerate from seed that either is present in the treatment area or would enter from adjacent areas. In cases where exotic plant infestation is not too severe, passive restoration would occur during the treatment effort, and the treated area may achieve desired future conditions by the time the treatment is completed. As described in the desired future conditions for grasslands (appendix Q), the vegetation categories in this category usually recover much faster than vegetation categories dominated by native woody species do.

The prescribed fire in dry grasslands is part of the natural fire cycle of the fire-adapted dry prairie communities of Big Cypress National Preserve and Everglades National Park. Dry prairies usually have a 2-year natural burn cycle, and this frequency is adequate for suppressing the encroachment of woody exotic species. Based on the decision matrix for treatment methods, prescribed fire would be used as a re-treatment method in the control of exotic plants in Everglades National Park and Big Cypress National Preserve. Prescribed fire would produce beneficial effects in these vegetation categories. The low intensity and short duration of prescribed fires would remove litter and debris, release nutrients, and provide optimal environmental conditions for the recovery of native species.

Under alternative B all infested grasslands would be initially treated and then re-treated every 6 months. Exotic plants would be controlled, and dry grasslands would be more fully restored than under alternative A. Under alternative B, the grasslands would recover to the desired future condition within 3 to 5 years of initial treatment, with the exception of dune communities that would take longer to passively recover. Treatment of the small area of dry grasslands in Big Cypress National Preserve would produce long-term, localized negligible to minor beneficial impacts. Larger areas of dry grassland treated in Canaveral National Seashore (7% of the park's terrestrial area) that are slow to restore passively would product long-term negligible beneficial impacts. Salt River Bay National Historic Park and Ecological Reserve (11%) would produce long-term, localized moderate beneficial impacts.

Upland Dry / Mesic Forest

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Everglades National Park, Buck Island Reef National Monument, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Under alternative B, the upland dry / mesic forest category would be treated with the method described under alternative A but on a regular basis to prevent the regrowth and dominance of the exotic plant species. This vegetation category includes some of the most sensitive habitats and supports some of the rarest plants found in the parks; therefore, treatment and monitoring the effect of the treatment would help to minimize potential long-term impacts. The application of mitigation measures would further protect the native vegetation resources of these areas. Some of these forested areas may be slow to recover passively because of the low seed germination rate and slow growth rate of some of the hardwood trees. In addition, some of these forests have developed in inhospitable or isolated environments that may further decrease the already low recovery rate.

The native herbaceous species that are commonly found in the shaded understory of these forests would likely not return until a tree canopy forms through passive restoration. Early successional species may germinate until the trees have recolonized the area and matured. Native early successional species that are not listed in the desired future conditions for upland dry / mesic forests (appendix Q) would be allowed to recruit within these vegetation categories to protect the soil from oxidation, reduce the re-infestation of exotic plant species, and buffer tree seedlings against climate extremes. These native early successional species would decline as the trees mature and the canopy closes, and more shade-tolerant understory species become established.

Under alternative B, all infested areas would be initially treated and then re-treated every 6 months. Exotic plants would be controlled and upland dry / mesic forests would be more fully restored than under alternative A and would recover to the desired future condition within 7 to 12 years. Upland dry / mesic forests in the south Florida and Caribbean parks cover between 8% (Big Cypress National Preserve) and 54% (Buck Island Reef National Monument). Upland dry / mesic forest represents 1% of the terrestrial area of Everglades National Park but totals over 10,000 acres. Infestation is high, ranging from 44% of the upland dry / mesic forest acres in Buck Island Reef National Monument to 100% in Salt River Bay National Historic Park. Treatment of these lands would result in long-term moderate to major beneficial impacts. Treatment of the 28% of upland dry / mesic forest acres that are infested in Virgin Islands National Park would result in long-term moderate beneficial impacts.

Mangrove

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

The exotic plant species in the mangroves would be treated on a more frequent basis under alternative B than under alternative A. The standard treatment methods described in alternative A would be used, but some alterations in the applications may be appropriate. The decision to alter the treatment methodology would be based on site conditions and other parameters and would comply with the adaptive management program. For instance, in alternative A, very little plant material would be removed after treatment. Under alternative B, if the dead plant material is within certain parameters, it may be removed. Monitoring results would be examined to help determine which treatment method would be best for the mangrove community, and what herbicide would be least damaging to the wetlands and the fish and wildlife the mangrove systems protect.

Under alternative B, the exotic plants (described under alternative A) occurring in mangrove communities would be reduced by mechanical, biological, and/or chemical treatment methods on a more frequent schedule than under alternative A. Impacts from accessing sites for mechanical or chemical treatment would using motorboats or airboats would result in damage to individual plants from contact with the craft or propellers. Personnel would be trained and knowledgeable in how to operate vessels in this environment, thereby reducing the impacts from access to mangroves to short term and negligible levels.

Removing the exotic plants would help promote restoration of the biological integrity and biodiversity of the native vegetation categories. In some instances, this means the removal of a single or small number of exotic plants; in others, it may mean the removal of a large number of plants over a large area. Under alternative B, all infested areas would be initially treated and then re-treated every 6 months. Exotic plants would be controlled, and mangrove areas would be more fully restored than under alternative A. Under alternative B, the desired future condition for treated mangrove sites would occur within 5 to 7 years due to the increased frequency of re-treatment under this alternative. Infestation of mangroves is high in Canaveral National Seashore (34%), Big Cypress National Preserve (35%), and Virgin Islands National Park (84%). Treatment of these lands under alternative B would result in long-term moderate to major beneficial impacts. Treatment of the infested mangrove acres in the remaining parks would result in long-term minor to moderate beneficial impacts.

Coastal Marsh

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

As stated in alternative A, the vegetation categories in this category are not as likely to become infested with exotic plants, as do other vegetation categories, because of the high salinity levels. Brazilian pepper, melaleuca, and Australian pine would all tolerate somewhat saline waters and can sometimes be seen encroaching on the edges of these vegetation categories.

Under alternative B, the exotic plants occurring in salt marsh communities would continue to be reduced by mechanical, biological, and/or chemical treatment methods but on a more frequent basis. Impacts from accessing sites for mechanical or chemical treatment would depend on the location of the salt marsh community treated, but if the site cannot be accessed without substantial impacts on native vegetation, aerial spraying would be used instead. Impacts on individual plants would occur from direct physical damage that boats or vessels would cause when accessing these areas. The adverse impacts would be short term, localized, and negligible with the implementation of best management practices.

Removing the exotic plants would help promote restoration of the biological integrity and biodiversity of the native vegetation categories. In some instances, this means the removal of a single or small number of exotic plants; in others, it may mean the removal of a large number of plants over a large area. Recovery of the native vegetation category to desired future conditions would occur within 3 to 5 years under this alternative. If a seed source is present, these herbaceous communities may recover more quickly.

Under alternative B, all infested areas would be initially treated and then re-treated every 6 months. Treatment of infestation of coastal marsh acres in Big Cypress National Preserve, Biscayne National Park, and Virgin Islands National Park would result in long-term minor to moderate beneficial impacts. Treatment of the infested acres in Canaveral National Seashore and Everglades National

Park would result in long-term moderate to major beneficial impacts. Coastal marshes in Salt River Bay National Historic Park are a small portion of the park's terrestrial area (4%), but are 100% infested. Treatment would result in long-term, moderate to major beneficial impacts.

Sawgrass Marsh / Wet Prairie / Freshwater Marsh

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, and Everglades National Park

As described in alternative A, the exotic plants infesting the vegetation categories in this category would continue to be treated with chemical and mechanical methods. The tables in appendixes A – I show the acres treated in each park and the methods used to treat the exotic plants that occur in each vegetation category. Under alternative B, the methods for treatment would be similar to alternative A, but treatments would occur on a more frequent basis. During that time, the amount of exotic plants would be reduced by half or more, and the native beneficial hydrophytes (plants that grow in water or very damp environments) would be taking their place in the wetland areas. For this vegetation category, it may be possible that the site would meet or nearly meet the desired future conditions within 3 to 5 years of initial treatment.

Under alternative B, all infested areas would be initially treated and then re-treated every 6 months. Exotic plants would be controlled, and sawgrass marsh / wet prairie / freshwater marsh areas would be more fully restored than under alternative A. Infestation of sawgrass marsh / wet prairie / freshwater marsh is low, ranging from 1% to 28%, in the parks where this vegetation category is present. It is an important community for the Cape Sable seaside sparrow. Treatment of exotic plant infestations in sawgrass marsh / wet prairie / freshwater marsh acres in Big Cypress National Preserve and Everglades National Park would result in long-term moderate to major beneficial impacts. Treatment of the infested acres in Canaveral National Seashore and Biscayne National Park would result in long-term minor to moderate beneficial impacts.

Wetland Forest

Big Cypress National Preserve, Everglades National Park, Biscayne National Park, Canaveral National Seashore, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

The wetland forests are sensitive habitats that would require careful attention during treatment due to factors described in detail in alternative A. Under alternative B, the treatments would remain the same, but the frequency of treatment events would increase to every 6 months. These impacts were determined to be negligible in alternative A, but the increased frequency proposed for alternative B could result in an increase in these impacts. By training staff to use the proper techniques when accessing sites, the adverse impacts of physical damage and loss of individual plants would result in minor adverse impacts. If impacts from activities were found to exceed this level, based on monitoring results and adaptive management, additional mitigations would be implemented in order to reduce the impacts.

The wetland forest areas may be slow to recover passively because of the low seed germination rate and slow growth rate of some of the trees. The ferns and other native herbaceous species that are commonly found in the shaded understory of these forests when mature would likely not return unless a tree canopy is present. In those areas where the canopy has been lost, early successional species may germinate until the trees have recolonized the area and matured. Native early successional species that are not listed in the desired future conditions for wetland forests (see appendix Q) would be allowed to recruit within these vegetation categories to protect the soil from oxidation, reduce the re-infestation of exotic plant species, and buffer tree seedlings against climate extremes. These native opportunistic species would decline as the trees mature and the canopy closes, and more shade-tolerant understory species would become established. It is expected that recovery of the system to the desired future condition would occur within 7 to 12 years of initial treatment under alternative B, with frequent re-treatment of sites and monitoring of recovery of native plants.

Under alternative B, all infested areas would be initially treated and then re-treated every 6 months. Exotic plants would be controlled, and wetland forest areas would be more fully restored than under alternative A. Treatment of exotic plant infestations in wetland forest acres in Big Cypress National Preserve (23% infested, 54% of terrestrial area) and Salt River Bay National Historic Park (100% infested, 1% of terrestrial area) would result in long-term moderate to major beneficial impacts. Treatment of the infested acres in the remaining parks would result in long-term minor to moderate beneficial impacts.

Agriculture / Disturbed Land / Developed Area

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Under alternative B, these areas of the parks would be treated with the method described under alternative A but on a regular basis to prevent the regrowth of the exotic plant species. As described in alternative A, the exotic plants infesting the plant communities in this category would continue to be treated with chemical, biological, and mechanical methods. Some developed and disturbed lands occur near visitor use area such as along roads and under this alternative, using the priority setting framework, these areas would be a high priority for treatment. Table 9 in the park-specific appendixes provides the acreages within each park of agricultural or disturbed lands that would be treated by each method. During that time, the amount of exotic plants would be reduced by half or more, and the native plants that would be able to adjacent to these areas or in the seedbank would establish, taking the place of the exotic plants.

Under alternative B, all infested areas would be initially treated and then re-treated every 6 months. Exotic plants would be controlled, and passive restoration of agricultural and disturbed areas within Dry Tortugas National Park (100%) and Salt River Bay National Historic Park and Ecological Preserve (100%) more rapidly than Alternative A, would be a long-term moderate to major benefit. In Everglades National Park (52%), Virgin Islands National Park

(50%), Big Cypress National Preserve (43%) the long-term benefit would be long-term moderate. In Biscayne National Park (1%), Canaveral National Seashore (18%) where infestation is less, long-term minor beneficial impacts would result.

Beach / Dune

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Everglades National Park, Buck Island Reef National Monument, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Under alternative B, the beach / dune category would be treated with the method described under alternative A but on a regular basis to prevent the regrowth of the exotic plant species. As described in alternative A, the exotic plants infesting the vegetation categories in this category would continue to be treated with chemical and mechanical methods. The tables in appendixes A – I show the acres treated in each park and the methods used to treat the exotic plants that occur in each vegetation category. Under alternative B, the methods for treatment would be similar to alternative A, but treatments would occur on a more frequent basis. During that time the amount of exotic plants would be reduced by half or more, and the native, beneficial halophytic, xerophytic, pioneering species would be taking their place in dune areas. For this vegetation category, it may be possible that the site would meet or nearly meet the desired future conditions within 3 to 5 years of initial treatment.

Under alternative B, all infested areas would be initially treated and then re treated every 6 months. Exotic plants would be controlled, and passive restoration of beach / dune areas within Canaveral National Seashore (61%), Everglades National Park (50%), and Virgin Islands National Park (69%) would result in long-term moderate to major beneficial impacts. In Biscayne National Park, where 2% of beach / dune is infested, long-term minor beneficial impacts would result.

Cumulative Impacts

The effects of other past, present, and future actions would continue to produce long-term beneficial and adverse cumulative effects, as described under alternative A, the would result in net long-term, moderate, regional adverse impacts to native vegetation categories.

The impacts of alternative B would result in short-term, negligible to minor adverse effects on native vegetation categories for exotic plant management treatment activities. The effects would not measurably add to cumulative adverse effects. Treatment activities within the park would result in long-term minor to major beneficial impacts in those parks with large areas of agricultural / disturbed land / developed areas, shrubland, upland dry / mesic forest, and sawgrass marsh / wet prairie / freshwater marsh where infestation is high, and the long-term, negligible to moderate beneficial impacts would result in grassland / coastal strand, mangrove, coastal marsh, beach / dune, and wetland forests, where infestation and reductions in biodiversity are less predominant. These actions

would contribute to reducing regional long-term cumulative adverse impacts to a moderate level.

Conclusion

The treatment methods under alternative B are the same as those described in alternative A but with an increased frequency, occurring at a minimum of every 6 months for 5 or 6 years or until the exotic plants are under control. However, with mitigation measures implemented, and the monitoring and adaptive management program in place, the potential adverse impacts on native plants and natural vegetation categories would be avoided or minimized, and adverse impacts would be direct, local, short term, and negligible to minor. The benefits of the plan proposed as alternative B would be direct, long term, regional, and minor to major.

Cumulative impacts would be the same as alternative A. Alternative B would not produce major adverse impacts that would result in impairment of native plants and vegetation categories in the parks.

ALTERNATIVE C — NEW FRAMEWORK FOR EXOTIC PLANT MANAGEMENT: INCREASED PLANNING, MONITORING, AND MITIGATION, WITH AN EMPHASIS ON ACTIVE RESTORATION OF NATIVE PLANTS

Under alternative C, exotic plants would be treated with the methods listed in the table 1 in appendixes A – I, and herbicide would be applied over time, as shown in table 4 in appendixes A – I. The effects of the different methods the parks have been using on the eight vegetation categories were described under alternative A. However, methods of treatment that could occur in each vegetation category have been defined based on a decision matrix that accounts for the exotic plants present, the vegetation category, and species of special concern. Using this decision tool, the most appropriate treatment and re-treatment method would be applied in each vegetation category. By using this tool, protection of native vegetation would be enhanced, and impacts would be reduced further than under alternative B.

As in alternative B, monitoring would be conducted to determine the efficacy of the treatment and to propose an alternative treatment, if necessary, if desired future conditions of the vegetation categories were not being met; if there were impacts on sensitive species that exceed what was expected; and to determine if active restoration methods were successful. The ability to alter the treatment or the restoration techniques to provide the optimum methodology of exotic plant control and restoration is the adaptive management program described for alternative B in the “Alternatives” chapter. Under alternative C, the adaptive management plan proposed in alternative B would be implemented but with the addition of active restoration within selected areas in the parks. As described in alternative B, an increase in the intensity and frequency of access to infested sites would occur for both actively and passively restored areas. Despite the increase, the impacts of this increase would be the same as alternative B

The benefits to vegetation categories as a result of passive restoration of infested areas in the parks would be the same as those described under alternative B. The

framework for implementing active restoration in the parks is discussed in the "Alternatives" chapter, as are the criteria used to determine which areas should be restored. Active restoration would take place using native plants that are appropriate given the vegetation categories that occur within each vegetation category. Monitoring of sites would occur to ensure that restoration to the identified desired future condition for each vegetation category was occurring. If desired future conditions were not being achieved, restoration methods would be adapted to improve restoration success. Appendix Q provides a detailed description of the desired future condition for each vegetation category. Active restoration would more quickly reduce the amount of exotic plants in areas identified as appropriate for active restoration by preventing establishment of exotic plant seedlings and would allow a more rapid return of native species in these areas. Impacts of active restoration are described below.

Active restoration of sites would entail one or a combination of methods to facilitate the recovery of native plant species. Active restoration would involve soil or site amendments, seeding sites with native seed sources, planting with native plant species or system-level alterations. During active restoration, large amounts of plant or soil material may need to be moved. Crews would use trucks, hand tools, seed drills, and earth moving equipment. Equipment and materials would need to be staged in locations within reasonable proximity to the project site. Ground crews accessing the active restoration sites would produce localized, short-term, negligible to moderate adverse impacts on vegetation. These effects would result from surface disturbances, trampling, and crushing vegetation by the movement of men and machines to and from the active restoration site.

Shrubland

Big Cypress National Preserve, Canaveral National Seashore, Buck Island Reef National Monument, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Under alternative C, only three parks propose active restoration in shrublands: Virgin Islands National Park with 389 acres, Salt River Bay National Historic Park and Ecological Preserve with 99 acres, and Canaveral National Seashore with 5 acres. In the Caribbean parks, active restoration would replace exotic plants along the beach with native trees such as sea grape and gumbo limbo to screen the road and provide shade. In other areas, the shrubs would be planted to prevent erosion in areas cleared of exotic plants. Under alternative C, active restoration would allow for recovery of shrublands within 5 to 7 years, more rapidly than other alternatives. Active restoration would produce long-term minor to moderate beneficial impacts.

Grassland / Coastal Strand

Big Cypress National Preserve, Canaveral National Seashore, Everglades National Park, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Under alternative C, grasslands and coastal strands would be actively restored in Canaveral National Seashore (18 acres), Big Cypress National Preserve (74 acres), and Salt River Bay National Historic Park and Ecological Preserve (52 acres). The grasslands in Salt River Bay National Historic Park and

Ecological Preserve are currently infested with guinea grass, one of the targeted exotic plants. The restoration effort in Salt River Bay National Historic Park and Ecological Preserve would include trees and shrubs in some areas in order to restore the pre-settlement vegetation of that part of the island and to provide aesthetics, shade, and wind breaks for park visitors. In Canaveral National Seashore, replanting of the dune areas where exotic plants were removed would be the active restoration in this park. Without native plants, the unprotected dunes may erode in the wind and surf. Under alternative C, with implementation of active restoration of appropriate sites within the parks, grasslands would be restored to desired future conditions within 1 to 3 years. Active restoration of these areas of grassland would produce long-term minor to moderate beneficial impacts.

Upland Dry / Mesic Forest

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Everglades National Park, Buck Island Reef National Monument, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Under alternative C, seven of the nine parks would conduct restoration of native vegetation categories included in the upland dry / mesic forest category: Salt River Bay National Historic Park and Ecological Preserve (134 acres), Virgin Islands National Park (1,168 acres), Buck Island Reef National Monument (45 acres), Everglades National Park (2,580 acres), Biscayne National Park (15 acres), Big Cypress National Preserve (1,200 acres), and Canaveral National Seashore (75 acres). In Big Cypress National Preserve and Everglades National Park, the restoration would return former agricultural areas to upland forests or restore vegetation in areas that are visible to the public. Restoration efforts in treated areas identified as appropriate for active restoration under alternative C would result in restoration of the upland dry / mesic forest within 5 to 7 years. Active restoration of upland dry / mesic forest would produce long-term minor to moderate beneficial impacts. The restoration of larger tracts of former agricultural lands in the East Everglades addition lands would result in major beneficial impacts.

Mangrove preserve infested with Australian pine

Mangrove

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Mangroves can usually colonize an area fairly quickly on their own, if conditions are right. In some areas, however, the wave energy is too great for new mangroves to become established. For this and other reasons, active mangrove restoration would take place under alternative C in Canaveral National Seashore (33 acres), Big Cypress National Preserve (38 acres), Biscayne National Park (4 acres), Everglades National Park (acres), and Virgin Islands National Park

(52 acres). Active restoration of treated areas within the parks would be restored to desired future conditions within 3 to 5 years of initial treatment. Active restoration of mangrove areas would produce long-term minor to moderate beneficial impacts.

Coastal Marsh

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Communities in the salt marsh category are high-saline, low-nutrient wetlands that are inhospitable to most plants. Alternative C proposes to restore salt marsh communities in Salt River Bay National Historic Park and Ecological Preserve (10 acres), Virgin Islands National Park (17 acres), Everglades National Park (108 acres), Big Cypress National Preserve (164 acres), and Canaveral National Seashore (70 acres). These are some of the most difficult vegetation categories to restore, and efforts to create salt marshes often become mangroves. Salt flats and sea grasses are not infested and, therefore, not considered for active restoration. Under alternative C, using appropriate methods to restore native vegetation within this category, along with monitoring of the establishment of native plants and adaptive management to ensure success of the active restoration methods, would result in restoration of treated areas within 1 year. Active restoration would produce long-term minor to moderate beneficial impacts

Sawgrass Marsh / Wet Prairie / Freshwater Marsh

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, and Everglades National Park

Alternative C proposes the active restoration of freshwater marsh communities in Canaveral National Seashore (1 acre), Big Cypress National Preserve (12,768 acres), Biscayne National Park (1 acre), and Everglades National Park (36,544 acres). Active restoration of sawgrass marsh / wet prairie / freshwater marsh within the parks would result in desired future conditions for this vegetation category being achieved within 1 to 2 years of initial treatment and would result in major beneficial long-term impacts. The beneficial impacts in the other parks would be minor to moderate.

Wetland Forest

Big Cypress National Preserve, Everglades National Park, Biscayne National Park, Canaveral National Seashore, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Alternative C proposes active restoration in the vegetation categories in the wetland forest category in the following parks: Virgin Islands National Park (205 acres), Everglades National Park (3,008 acres), Biscayne National Park (1 acre), and Big Cypress National Preserve (14,18 acres). As described in alternative B, wetland forests can be slow to regenerate, so active restoration would be required if the wetland forests have been severely impacted by exotic plants, and the tree canopy is also impacted. Active restoration of wetland forests

would allow for achievement of desired future conditions within 5 to 7 years of initial treatment and would produce long-term minor to moderate beneficial impacts.

Agriculture / Disturbed Land / Developed Area

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Under alternative C, priority would be given to disturbed areas. These particularly large infested areas have reduced potential to passively restore as there would be limited adjacent native vegetation to provide seeds and there is a likelihood that a native seed bank no longer exists. As such, all disturbed lands in the parks that are infested would be appropriate for active restoration to achieve a desired future condition as determined by natural resource managers. This alternative would allow for a more rapid and complete restoration to a determined desired condition compared to alternative B. In Christiansted National Historic Site and Dry Tortugas National Park, active restoration of sites would not occur as the area of infestation within the parks is small and can be controlled successfully with re-treatments. Therefore the impacts of treatment would be the same as described under alternative B.

Alternative C proposes the active restoration of all agricultural and disturbed lands in the parks. This would represent a major long-term benefit to native vegetation communities in parks with large acreages of infestations within these areas such as Big Cypress National Preserve (2,075 acres) and Everglades National Park (4,054 acres). In Canaveral National Seashore (95 acres), Salt River Bay National Historic Park and Ecological Preserve (46 acres), and Virgin Islands National Park (185 acres) this would represent a moderate to major benefit. In Biscayne National Park (2 acres) the long-term benefit to native vegetation would be minor.

Beach / Dune

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Everglades National Park, Buck Island Reef National Monument, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Alternative C proposes the active restoration of beach / dune communities in Biscayne National Park (less than 1 acre), Canaveral National Seashore (8 acres), and Virgin Islands National Park (29 acres). Active restoration of beach areas within the parks would result in desired future conditions for this vegetation category being achieved within 1 to 2 years of initial treatment and would result in moderate beneficial long-term impacts.

Cumulative Impacts

The effects of other past, present, and future actions would continue to produce long-term beneficial and adverse cumulative effects, as described under

alternative A, the would result in net long-term, moderate, regional adverse impacts to native vegetation categories.

The impacts of alternative C would result in short-term, negligible to minor adverse effects on native vegetation categories for exotic plant management treatment activities. The effects would not measurably add to cumulative adverse effects. Treatment activities within the park would result in long-term minor to major beneficial impacts in those parks with large areas of agricultural / disturbed land / developed areas, shrubland, upland dry / mesic forest, and sawgrass marsh / wet prairie / freshwater marsh where infestation is high, and the long-term, negligible to moderate beneficial impacts would result in grasslands, mangrove, coastal marsh, beach / dune, and wetland forests, where infestation and reductions in biodiversity are less predominant. These actions would contribute to reducing regional long-term cumulative adverse impacts to a moderate level.

Conclusion

The implementation of treatment methods under alternative C would have the same negligible to minor adverse impacts as alternative B. The active restoration of native vegetation categories reduces or prevents the potential for re-infestation of exotic plants. This would result in long-term minor to major beneficial impacts.

Cumulative impacts would be the same as alternative A. Alternative C would not produce major adverse impacts on native plants and would not result in impairment of native plants and vegetation categories.

SOILS

GUIDING REGULATIONS AND POLICIES

Current laws and policies require that soils in national park units function as naturally as possible (NPS 2001h). The parks' general management plans and resource management plans support preserving the natural character of resources, including soils. Soil resources should be monitored regularly and mitigation provided.

METHODOLOGY AND ASSUMPTIONS

GEOGRAPHIC AREA EVALUATED FOR IMPACTS

The area analyzed for possible impacts on soils includes the terrestrial portions of all nine park units. Because exotic plants have the potential to occur throughout the parks, and because treatment actions could be carried out wherever exotic plants occur, no areas of the parks were eliminated from consideration. The boundaries for the cumulative impacts analysis are also set to correspond to park boundaries because soils are affected by local, not regional activities.

IMPACT CRITERIA AND METHODOLOGY

Information on soils and response of soils to various impacts were compiled from Natural Resource Conservation Service soil surveys, other agency maps and documentation, relevant literature, and resource experts. General soil types, erosion potential, structure, and function were discussed and impacts were analyzed based on reference information, anticipated impacts of management actions by alternative, and professional judgment.

Primary steps for assessing impacts include identifying (1) potential changes in soils from the presence of exotic plant species, (2) if soil resources are in areas likely to be affected by exotic plant control measures, (3) potential changes in soil productivity or erosion rates caused by the treatment methods, and (4) disturbance potential of proposed restoration efforts.

The issues identified during internal and public scoping that relate to impacts on soils from the presence of exotic plants and their treatments include the following:

Prescribed fire — Excessive use of fire can rapidly oxidize soils, and rapid oxidation reduces the nutrients and organic materials in the soils, thereby lowering soil productivity.

Mechanical treatment — Mechanical treatment of exotic plants may cause erosion, compaction, or other disturbance of soils, allowing additional exotic plants to become established.

Chemical treatment — Some herbicides used to treat exotic plants can persist in soil, which degrades soil quality.

Exotic plants can affect soil integrity or quality through erosion and changes to soil chemistry. Allelopathic agents (secondary chemical compounds) can leach from leaves, seeds, or roots into the soil and suppress the germination or growth of native plant species. The dense leaf litter produced by some exotic plants cools the soils and slows decomposition, which can alter soil chemistry.

Soils have the potential to be affected by the three exotic plant management techniques discussed above: mechanical, physical, and chemical. Biological control agents do not have the potential to affect the productivity or erosion rates of soils in treatment areas; therefore, they are not discussed in this soils analysis.

IMPACT THRESHOLD DEFINITIONS

Impacts were evaluated using these threshold definitions:

Negligible — Soils would not be affected, or the effects on soils would be below or at levels of detection. There would be no discernable effect on the rate of soil erosion and/or the ability of the soil to support native vegetation.

Minor — The effects on soils would be detectable, but effects on soil productivity or fertility would be small. There would be localized, detectable effects on the rate of soil erosion and/or the ability of the soil to support native vegetation. If mitigation measures were needed to offset adverse effects, they would be relatively simple to implement and would likely be successful.

Moderate — The effect on soil productivity or fertility would be readily apparent and would result in a change to the soil character over a relatively wide area. The rate of soil erosion and/or the ability of the soil to support native vegetation would be appreciably changed. Mitigation would probably be necessary to offset adverse effects and would likely be successful.

Major — The effect on soil productivity or fertility would be readily apparent and would substantially change the character of the soils over a large area in the park. The actions would have substantial, highly noticeable influence on the rate of soil erosion and/or the ability of the soil to support native vegetation. Mitigation measures to offset adverse effects would be needed, and their success would not be assured.

IMPAIRMENT

Chemical, physical, or biological changes to soils would be widespread, readily measurable, and would be altered substantially and frequently from the historical soil conditions. The impacts would involve deterioration of the parks' soils to the point that park purposes could not be fulfilled, or resources could not be experienced and enjoyed by future generations.

IMPACTS OF THE ALTERNATIVES ON SOILS

ALTERNATIVE A — NO ACTION: CONTINUE CURRENT MANAGEMENT

Big Cypress National Preserve and Everglades National Park

The prescribed fire method used in these parks is prescribed fire for control of Old World climbing fern. Fire is useful in these environments because the south Florida ecosystems are fire-adapted, and have a range of natural fire recurrence and succession patterns (Ewel 1990). The use of fire to control Old World climbing fern has been limited, and this exotic plant species generally reestablishes quickly, indicating few adverse impacts on soils from prescribed fire.

Brenner and Wade (2003) note that prescribed fire expedites nutrient cycling in soils and is essential to the management of many of Florida's vegetation categories. Therefore, the effects of controlled fire treatments on soils would be localized, beneficial, short term, and negligible to minor.

Mechanical treatments in these parks include hand pulling saplings and small plants, and cutting and mulching mature plants. Seedlings of Old World climbing fern, melaleuca, and Brazilian pepper are hand pulled in both parks. In addition, guinea grass and mother-in-law's tongue have been pulled in Everglades National Park. The very limited surface disturbance associated with this removal technique would generate short-term, negligible, adverse impacts on local soils at the removal site.

Brazilian pepper has been cut and mulched in the Flamingo area of Everglades National Park. Cut and mulch activities reduce monotypic stands to wood chips which are left in place. In Florida's warm, humid environment, the mulch degrades rapidly and returns carbon and nitrogen to the soil. Adverse effects of mulching on soils at this location have not been noted (Taylor 2004e). During cut and mulch activities, the use of large chipping equipment and trucks would produce site-specific, short-term, minor, adverse impacts on soils from compaction and surface disturbance.

Chemical treatments in these parks include the use of herbicide components (glyphosate, imazapyr, metsulfuron methyl, and triclopyr). Each of these compounds has a particular tendency to bind to soil, a measured half-life in the soil, and degradation pathway. These characteristics are outlined briefly below to facilitate this analysis.

> Glyphosate has no soil activity and attaches rapidly and tightly to soil particles by binding to phosphate adsorption sites present in virtually all types of soil. Thus, the herbicide becomes inactive. Because of this chemical bond, glyphosate has little tendency for lateral movement or runoff. In the soil, glyphosate is degraded primarily by microbial action, with up to 55% given off as carbon dioxide within 1 month of application (Vencill 2002; Schuette 1998). Glyphosate generally has no measurable effect on the numbers of bacteria, fungi, or actinomycetes (rod-shaped bacteria responsible for primary degradation of tough plant fibers) in soils or litter beneath treated systems. In addition, no effects to nitrogen cycling have been noted (Schuette 1998). Transplantation or seeding into

glyphosate-treated soil can occur almost immediately because the chemical does not affect emergent plant activity (Vencill 2002; Schuette 1998).

Imazapyr is generally weakly bound to soil by the attraction of charged particles, and adsorption increases as the soil content of organic matter and clay particles increase. Studies in temperate climate agricultural use show the half-life of imazapyr in soil to be 25 to 142 days, with microbial action and photodegration (breaks down in sunlight) being the primary pathways of decay. In studies of application in temperate forested areas, imazapyr remained in the top 12 to 18 inches of soil, showed no tendency for lateral movement, and did not run off into nearby streams (Vencill 2002). Studies performed at tropical temperatures in soils high in organic matter produced a half-life of 69 days, with decreasing persistence as soil moisture increased (McDowell et al. 1996). Relatively high concentrations of imazapyr (approximately four times that resulting from approved application rates) are necessary to result in detectable adverse impacts on soil microbes. This finding is consistent with the use of imazapyr as an effective agricultural herbicide. If normal application rates damaged soil function, crop failure or loss would have been reported (Durkin and Follansbee 2004).

Metsulfuron methyl has a low capacity to bind to clay particles and moderate binding to organic matter. Degradation occurs mainly from microbial processes, with chemical hydrolysis playing a secondary role. Metsulfuron methyl has moderate vertical mobility, and detectable soil levels could be expected at depths of 10 inches or more following applications typically used for forestry and natural lands management (Vencill 2002; Extoxnet 1996a). The environmental fate of metsulfuron methyl varies widely between temperate and tropical climates. Persistence and mobility depend largely on the temperature, pH, and moisture content of the soils. Studies conducted in North America show an overall half-life of 30 days, with a moderate residual. Replanting in treated soils is not recommended for 10 to 22 months following treatment (Vencill 2002; Extoxnet 1996a). However, recent work on tropical soils shows a much shorter persistence at high soil temperatures and moisture content. These studies report rapid degradation and a half-life of 2 to 8 days and conclude that metsulfuron methyl degrades and dissipates rapidly when used at recommended rates (Ismail and Azlizan 2002; Ismail and Tet-Vu 2003).

Triclopyr, as Garlon 3A and Garlon 4, converts to triclopyr acid in both soil and water in less than 1 day. It is not strongly adsorbed to soil particles initially, but binding increases as organic matter and clay content increase and over time. Thus, the tendency for leaching decreases in organic-rich soil and as time passes. Triclopyr is considered “fairly degradable” with a half-life in soil of 12 to 27 days. Microbial degradation is the primary decay pathway, with minor photodegration (Schuette 1998). Triclopyr is somewhat prone to lateral movement but shows no tendency for vertical dissipation. Simulated precipitation studies have shown triclopyr remains within the top four inches of soil under repeated applications of simulated one-inch rainfall events. In forest runoff tests, no triclopyr was detected 24 hours after application (Vencill 2002; Ganapathy 1997; Schuette 1998).

These compounds may be applied at individual treatment sites by ground crews using backpack sprayers or aerially using helicopters. Appropriate planning and mitigation would limit the aerial spread of the herbicides during any application, and containment measures would be undertaken in the event of herbicide spill.

The use of glyphosate in treating exotic plants in Big Cypress National Preserve and Everglades National Park would produce negligible, short-term adverse impacts on soils. This is due to the rapid binding to soil that causes the active component to become inert. Imazapyr and triclopyr are not strongly bound to soil, degrade rapidly in the environment, and show little tendency to move far from application areas. Their use would produce localized, short-term, and negligible to minor adverse impacts on soils in the treatment areas. In the warm, moist climate of Florida, metsulfuron methyl also has a short period of persistence and a low likelihood of lingering effects. Continued use of the agent in exotic plant control would also produce localized, short-term, and negligible to minor adverse impacts on soil resources.

These compounds are used recurrently in large-scale treatment of monotypic stands and in spot treatments across many habitats in the parks. NPS staff has not noted adverse impacts on soils associated with using these herbicides under approved application methods and rates. These agents have also been used for many years as effective agricultural herbicides, without affecting the long-term productivity of soils for crop production. Both the researched effects and evidence from use in agricultural and natural areas indicate that continued use under the alternative A would produce localized, short-term, negligible to minor adverse impacts on soils. Ground crews accessing infested sites to apply physical, mechanical, and chemical treatments would produce localized, short-term, negligible to minor adverse impacts on soils. These impacts would result from low levels of compaction and surface disturbance generated by movement of men and machines (truck, off-road vehicle [ORV], and tractor) to, from, and through the treatment sites.

Erosion following exotic plant control efforts has not been noted in the two parks. Bare soil is not generally exposed following treatment, and regrowth of juvenile exotic plants or revegetation by native species is rapid—occurring within weeks or months. In addition, the parks have little change in topography, low slopes, and dense surrounding vegetation to limit sediment transportation. Therefore, adverse impacts on soils due to accelerated erosion following exotic plant control and management would be localized, short term, and negligible.

As discussed in the “Affected Environment” chapter, exotic plants can alter the environments they invade. Australian pines fix nitrogen, which increases soil productivity in the immediate area, giving the monotypic stand a competitive advantage (Gordon 1998). Brazilian pepper and melaleuca stands deposit large quantities of litter that accumulate and increase soil depth, which artificially raises elevation. This can transform a wetland habitat to an upland habitat. In addition, litter decomposition rates can be very low in these forests because soil chemistry and nutrient cycling have been altered (Gordon 1998).

Under the no-action alternative, site-specific removal of melaleuca and Brazilian pepper forests would help restore local soil function and nutrient cycling. This is

evidenced by the rapid regrowth of sawgrass in treated melaleuca stands. However, changes in topography resulting from extended periods of exotic plant presence may not be reversed without further intervention. Because the overall infestation rates in the parks would not be markedly reduced under this alternative, the parkwide effects of a constant rate of exotic plant infestation on soil function and productivity would be localized, long term, negligible to minor, and adverse.

Biscayne National Park, Canaveral National Seashore, and Dry Tortugas National Park

Mechanical treatments in these parks include hand pulling seedlings of melaleuca, Brazilian pepper, Australian pine, guinea grass, Old World climbing fern, melaleuca, and other species, as necessary. The very limited disturbance associated with removal of seedlings would generate short-term, negligible, adverse impacts on local soils at the removal site.

Chemical treatment with herbicides has been used in these parks by ground crews to control monotypic stands and as spot treatment. No aerial spraying has been done in these parks. Basal bark, cut stump, and foliar applications limit the impacts on soils in these parks. As discussed above, glyphosate is bound rapidly in soils and rendered inactive, producing negligible, short-term adverse impacts on soils. Though not tightly bound to soil particles, imazapyr, triclopyr, and metsulfuron methyl degrade rapidly in warm, moist conditions and have little migration tendency. Their use would produce localized, short-term, negligible to minor adverse impacts on soils in the treatment areas.

As discussed for Big Cypress National Preserve and Everglades National Park, erosion following exotic plant control efforts has not been noted in these parks. Vegetation reestablishes quickly in these environments, and bare soil is not seen following treatment. Low elevations and dense vegetation would restrict movement of sediment. Therefore, impacts of erosion resulting from current exotic plant control efforts would be localized, short term, and negligible.

Ground crews accessing infested sites to apply physical, mechanical, and chemical treatments would produce localized, short-term, negligible adverse impacts on soils. These impacts would result from low levels of compaction and surface disturbance generated by movement of men and machines to, from, and through the treatment sites.

Similar to the effects discussed for Big Cypress National Preserve and Everglades National Park, under alternative A, removal of monotypic stands of Brazilian pepper at Canaveral National Seashore and Australian pine at Biscayne National Park would help restore natural soil function and nutrient cycling. However, changes in topography resulting from extended periods of exotic plant presence may not be reversed. Because the overall infestation rates in the parks would not be markedly reduced compared to existing conditions, the parkwide effects of a controlled, constant coverage of exotic plants on soil function and productivity would be localized, long term, and negligible to minor adverse.

Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

To date, fire has not been used as an exotic plant control method in the Caribbean national parks. The native vegetation categories in these parks are not fire adapted, and the use of prescribed fire would not replicate natural conditions or restore ecosystem functions. Therefore, prescribed fire methods are not analyzed for the Caribbean parks.

Mechanical treatments in these parks include pulling seedlings of tan tan, limeberry, and other species, as necessary. The very limited disturbance associated with removal of seedlings would generate short-term, negligible, site-specific, adverse impacts on local soils.

Chemical treatment in the Caribbean national parks has not included aerial application of herbicides. All herbicide use to date has been accomplished manually with backpack sprayers and hand application. Basal bark, cut stump, and foliar application limits the impacts on soils in these parks. As discussed above, the use of glyphosate in the Caribbean parks would produce negligible, short-term adverse impacts on soils. Imazapyr, triclopyr, and metsulfuron methyl would produce localized, short-term, and negligible to minor adverse impacts on soils in the treatment areas.

Ground crews accessing infested sites to apply physical, mechanical, and chemical treatments would produce localized, short-term, negligible adverse impacts on soils. These effects would result from low levels of compaction and surface disturbance generated by movement of men and machines to, from, and through the treatment sites.

Two of the exotic plant species treated in the Caribbean parks have the ability to grow in dense monocultures: tan tan and guinea grass. Dense stands of tan tan along roadsides and in other disturbed sites may affect soil productivity by limiting sunlight to the understory and by depositing leaf litter. However, no detailed information is available, and the effects of tan tan stands on soils are not known.

Guinea grass, which was cultivated in monoculture, is known to change the local fire regimen and could have an indirect, adverse impact on soils by introducing wildfire potential to a naturally fire-free environment. The guinea grass monoculture on Buck Island Reef National Monument has been treated and is being monitored. Treatment of the stand at Salt River Bay National Historic Park and Ecological Preserve would take place under current management, removing the long-term threat posed by the presence of this exotic plant. Thus, the no-action alternative would provide a long-term, localized, minor, beneficial effect on the soils of the Caribbean national parks.

Under the no-action alternative, intermittent treatment resulting in maintenance of overall infestations that are interspersed among the hardwood forests would have little or no impact on the natural productivity of local soils. Removal of guinea grass monocultures would provide minor, long-term, local benefits by reducing the threats posed to soils by high intensity wildfires.

To answer initial questions about potential erosion following exotic plant treatments in Caribbean parks, a test plot was established on Buck Island National Monument prior to treatment of a large stand of guinea grass. The site is located on a steep hillside and was treated using glyphosate and backpack sprayers. The guinea grass responded to treatment, and no erosion was detected at the site despite an unusually heavy rain event in December 2003 (Clark 2003; Hillis-Starr 2004). This result may be explained by the persistence of the guinea grass root ball system, providing a measure of soil stabilization.

Although this positive result was obtained at Buck Island Reef National Monument, NPS staff remain concerned that treatment of large stands of exotic plants could result in erosion. To protect soil resources, and also to limit the effects of sediment delivery to nearby coral reefs, standard erosion and sedimentation protection measures would be put in place at treatment sites. By use of such measures, erosion in treated areas of the Caribbean national parks would produce localized, negligible to minor, long-term, adverse impacts on soil resources in the parks.

Cumulative Impacts

Within the parks, soils would be affected by development and resource management activities. Hydrologic and ecosystem restoration efforts, such as the Comprehensive Everglades Restoration Plan, would produce long-term, localized, negligible to minor beneficial effects on soils as more natural inundation periods and water balance return to Everglades National Park and Big Cypress National Preserve. Park-specific actions, such as use of prescribed fire, would also provide long-term, minor benefits to local soils by removing heavy litter layers, allowing oxygen to reach the soil surface, and returning bound nutrients to the soil.

Development of visitor services and infrastructure, such as the Seminole housing and oil and gas activities in Big Cypress National Preserve, and improvements to facilities at Dry Tortugas National Park would produce short- and long-term, localized, negligible to minor adverse impacts caused by disturbance and loss of productivity. In concert with the short-term, negligible to minor impacts of current exotic plant management, the resulting cumulative adverse impacts on soils would be localized, short- and long-term, and minor.

In conjunction with ongoing exotic plant management actions, cumulative short-term impacts on soils would be localized, adverse, and negligible to minor. Cumulative long-term impacts would be localized, beneficial, and negligible to minor.

Conclusion

In Big Cypress National Preserve and Everglades National Park, prescribed fire using prescribed fire would produce localized, beneficial, and negligible to minor impacts on soils as deep litter layers are removed, nutrients are recycled, and soil function is enhanced by this natural process.

Mechanical pulling of saplings occurs in all parks, and removal of small plants would produce site-specific, short-term, negligible adverse, impacts on soil resources from very limited surface disturbance. During cut and mulch activities, the use of large chipping equipment and trucks would produce site-specific, short-term, minor, adverse impacts on soils from compaction and surface disturbance.

The continued use of herbicides to treat exotic plant infestations would produce limited adverse impacts. Due to the brief half-life of these chemicals (especially in warm, humid tropical climates), their limited ability to move through the soil and absence of adverse effects in previously treated areas, the impacts of their continued use on park soils would be localized, short term, negligible to minor, and adverse.

Throughout the parks, there would be localized, negligible, adverse, short-term impacts on soils from crews accessing treatment sites and using equipment and vehicles during treatment. These temporary effects would result from compaction and limited surface disturbance from foot and equipment access.

The presence of a relatively constant rate of overall exotic plant infestation in the parks would produce adverse impacts on soils that would result form altered soil chemistry, function, and loss of productivity. These impacts would be long term, localized, and negligible to minor.

Cumulative long-term impacts would be beneficial and negligible to minor. Alternative A would not result in impairment of soil resources within the parks.

ALTERNATIVE B — NEW FRAMEWORK FOR EXOTIC PLANT MANAGEMENT: INCREASED PLANNING, MONITORING, AND MITIGATION

Big Cypress National Preserve and Everglades National Park

The use of fire as a *prescribed fire* to remove exotic plants would be used in more areas and employed more frequently during early stages of plan implementation. Fire would be used to control melaleuca and other saplings and as a more aggressive treatment of Old World climbing fern. Thus, the beneficial effects on soils from the use of fire would extend to larger areas but would not change in intensity or duration from current conditions. The effect of this prescribed fire on park soils would be beneficial, short term, localized, and negligible to minor.

As outlined for alternative A, hand pulling of saplings and small plants would continue to yield negligible, site-specific adverse impacts on soils. Continued or expanded use of cut and mulch activities would also yield the short-term minor adverse effects on soils as described for alternative A.

The use of chemical treatments, in the form of herbicide applications, would increase under alternative B, both spatially and in frequency, for approximately the first 3 years of plan implementation. As outlined for alternative A, the effects of these chemical agents on soils are limited, producing localized, negligible to minor, short-term, adverse impacts. Although application would occur

approximately every 6 months at treatment and re-treatment sites, it is unlikely that an increase in intensity of impacts would be seen. This is due to the rapid degradation and dissipation of these agents in this warm, wet environment.

During the initial phase of the plan more areas within the parks would be treated, resulting in more areas within the parks being affected, the localized impacts on soils would be negligible to minor as described for alternative A, as soils recover quickly from disturbance in the sub-tropical environment. Over time, these impacts would become less, as fewer crews are required to maintain treated sites and the methods of treatments are less intensive.

Under alternative B, exotic plant infestations would be brought under control, with an overall reduction in the infestation and coverage, thus eliminating the effects of deep litter accumulations, nitrogen fixation (nutrient loading), and elevation changes associated with forests of exotic plant species would produce localized, long-term, minor, beneficial effects on soil resources.

Biscayne National Park, Canaveral National Seashore, and Dry Tortugas National Park

The effects of mechanical treatments, such as pulling seedlings of melaleuca, Brazilian pepper, Australian pine, Old World climbing fern, melaleuca, and other species, would short-term localized and negligible as described for alternative A.

The impacts of chemical treatment with herbicides would be similar to those described for alternative A—adverse, localized, short term, and negligible to minor.

At Dry Tortugas and Biscayne National Parks and Canaveral National Seashore, the sandy soils, low relief, and greater control of exotic plant species in the parks make erosion less of a concern than at parks with large standing monocultures or steep slopes. Potential accelerated control efforts at Canaveral National Seashore and Biscayne National Park would not be expected to result in erosion problems, producing localized, short-term, negligible adverse impacts from erosion.

The impacts from ground crews accessing infested sites to apply physical, mechanical, and chemical treatments would be similar to those discussed for alternative A and would decline over time as fewer crews would be required to maintain treated sites and the methods of treatment become less intense.

The long-term benefits of reducing the overall exotic plant infestation rates and maintaining functioning vegetation categories of exotic plant control would be localized and negligible to minor. These benefits would result from reducing the presence of nitrogen-fixing Australian pines and eliminating deep litter beneath melaleuca and Brazilian pepper stands.

Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Fire would not be used under the new management framework proposed in alternative B; therefore, the use of fire to remove exotic plants in the Caribbean parks is not analyzed.

Mechanical treatments and their impacts would remain unchanged from those described under alternative A, short-term, localized, and negligible.

Chemical treatment in the Caribbean parks would be applied more frequently during the initial phases of plan implementation, with quantities of chemicals used decreasing as re-treatment progresses. Because the agents used would have limited adverse impacts, changes in intensity or duration of impacts would not be anticipated and would remain localized, negligible to minor, and short term.

The impacts from ground crews accessing infested sites to apply mechanical and chemical treatments would be the same as those described for alternative A.

The guinea grass monocultures in the Caribbean parks would continue to be treated as they are under current management, and alternative B would not change the effects of treatment as discussed for alternative A. The impact on soil function from the removal of tan tan stands is not known. However, potential increases in erosion or soil loss on slopes would be reduced by the use of standard erosion control and best management practices.

Accelerated removal of exotic plant species in the Caribbean national parks would have short-term, negligible to minor adverse impacts on soils. Because most exotic plant infestations in these parks are dispersed, long-term benefits may not be quantifiable and would therefore be negligible.

Cumulative Impacts

The benefits of regional hydrology and ecosystem restoration projects in south Florida would be as described for alternative A—localized, long term, and negligible to minor. However, a more aggressive treatment of exotic plants in Big Cypress National Preserve and Everglades National Park, under alternative B, would reduce the overall infestation rates within approximately 3 years of plan implementation. This would contribute to the beneficial effects of regional ecosystem restoration plans being undertaken in south Florida. Reduction in acreage of standing monocultures, local improvements in hydrology and surface flow, and recurrent use of prescribed fire would add minor, long-term, localized beneficial effects to those anticipated from regional restoration activities. The result would be localized, long-term, minor beneficial effects on soil resources.

The cumulative impacts resulting from access and disturbance related to exotic plant control activities combined with park development and resource management activities would be the same as for alternative A—short term, localized, and minor.

In conjunction with ongoing exotic plant management actions, cumulative short-term impacts on soils would be localized, adverse, and negligible to minor. Cumulative long-term effects would be localized, beneficial, and negligible to minor.

Conclusion

Accelerated treatment of exotic plant species and reduction of the total acreage of infestation in the parks would result in short-term adverse and beneficial effects and long-term benefits to park soil resources.

Prescribed fire using fire would produce negligible to minor, localized short-term benefits; chemical treatment using herbicides would produce localized, short-term, negligible to minor adverse impacts; and mechanical treatment would produce site-specific, negligible to minor, short-term adverse impacts on soils. These adverse effects would lessen over time as less intensive methods would be used to maintain treated sites and fewer crews are needed to perform treatments.

Over the long term, reduction in the total acreage of exotic plant infestation and maintenance of functioning native vegetation categories would produce localized, negligible to minor, beneficial effects on soils as nutrient cycling, soil chemistry, and the natural fire regimen (or lack thereof) are returned to the system.

Cumulative impacts would be the same as alternative A. Alternative B would not result in impairment of soil resources within the parks.

Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants

Big Cypress National Preserve and Everglades National Park

Because this alternative proposes accelerated initial treatment and scheduled, routine re-treatment and monitoring as outlined for alternative B, the effects of these activities would be similar to those described under alternative B.

The active restoration methods proposed under alternative C include use of soil amendments, seeding, planting, and physical site alterations. Each of these has some potential to affect local soils to varying degrees. Active restoration would take place following initial exotic plant treatments, so restoration effects are analyzed separately from the treatment activities.

Seeding and planting require access to the site, use of work crews, and a variety of large and small equipment. The anticipated soil disturbance at the restoration sites from these activities would include localized surface disturbance and temporary compaction. These impacts would be adverse, short term, and negligible. The long-term effects of establishing native vegetation categories on previously infested sites would be site-specific, beneficial, and minor. These benefits would result because deep litter would no longer accumulate, and nitrogen enrichment from exotic plants would cease.

The use of soil amendments would directly change the chemical, physical, or biological properties of soils with the objective of improving the environment for plant growth. For example, fertilization, composting, and pH modifiers (such as lime) are soil amendments. In areas where exotic plants have altered natural soil conditions, such as beneath long-standing forests of Australian pine, melaleuca, and Brazilian pepper, soil amendments would be used to restore soil to more natural conditions. By returning functions that promote establishment and growth of native vegetation categories, soils would experience short-term, site-specific, and minor to moderate benefits.

The use of physical site alterations would include changes in site hydrologic conditions, addition of soils to increase elevation, or removal of soils to eliminate the exotic plant seed bank and to lower elevation.

Increased or reduced hydroperiods as a result of large-scale restoration efforts would affect soils by changing the nutrient cycling, microbial community, and inducing or reducing the formation of hydric soil properties. Changes in the water regimen at individual locations would be determined based on site-specific needs. Flow or drainage modifications would be used to reestablish a natural or native vegetation category at the site. Because soils would respond to changes in hydrology (inundation period) gradually, the effects would be long term, minor, and likely beneficial.

Addition of soils to increase elevation or reduce the influence of the exotic plant seed bank could be used to promote growth of native vegetation categories. Soils would be obtained from within the park or from outside sources able to provide certified weed-free topsoil. Given that the value of soil in the parks is judged by its ability to support production of native plants, the effects would be beneficial, long term, and site-specific.

Under alternative C, the potential exists for large-scale soil removal projects, such as those currently being pursued at the “Hole-in-the-Donut” site in Everglades National Park. This exotic plant removal and control effort involves the removal of the top layer of soil that contains the exotic species seed bank. The temporary disturbance caused by excavation, the use of heavy equipment, and exposure of soils would worsen erosion and result in short-term, localized, moderate, adverse impacts on soils. However, native vegetation has rapidly colonized the excavated site, although at a lower elevation than the original native vegetation category has. Thus, such activities pursued under alternative C would be expected to produce localized, long-term, minor benefits to soil production and function.

Biscayne National Park, Canaveral National Seashore, and Dry Tortugas National Park

The effects of exotic plant treatment and scheduled, routine re-treatment and monitoring at these parks would be the same as those described for alternative B.

Although the total areas eligible for active restoration in these parks is dwarfed by the eligible areas in Everglades National Park and Big Cypress National Preserve, the impacts of similar restoration efforts in these parks would have

impacts similar to those discussed above for Everglades National Park and Big Cypress National Preserve.

Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

The effects of exotic plant treatment and scheduled, routine re-treatment and monitoring in the Caribbean parks would be the same as those described for alternative B.

The Caribbean national parks have limited areas identified for potential active restoration. The surface disturbance and access associated with the likely range of activities, including replanting, reseeding, or soil modification, would yield short-term, negligible to minor, localized adverse impacts on soils. Erosion control and best management practices would be implemented to prevent soil loss on slopes or during heaving rains.

Cumulative Impacts

The short- and long-term cumulative impacts of accelerated exotic plant treatment and routine, scheduled re-treatment and monitoring would be similar to those discussed for alternative B.

Active restoration efforts would contribute to beneficial effects anticipated from the restoration efforts in the south Florida national parks. Site-specific restoration of native vegetation categories would contribute to local long-term, minor benefits. This would produce local, long-term, and minor to moderate beneficial effects.

Conclusion

The effects of accelerated exotic plant treatment and scheduled, routine re treatment and monitoring would be similar to those outlined for alternative B.

By actively restoring native vegetation categories on previously infested sites, soils would experience localized, long-term, minor beneficial effects. The beneficial effects would be due to a return to more natural hydrologic conditions, enhanced nutrient cycling and soil chemistry, and reestablishing native microbial communities. The short-term adverse impacts of restoration efforts would be negligible to moderate, and localized.

Cumulative long-term impacts would be beneficial and minor to moderate. Alternative C would not result in impairment of soil resources within the parks.

WATER QUALITY AND HYDROLOGY

GUIDING REGULATIONS AND POLICIES

FEDERAL GUIDANCE

The objective of the *Clean Water Act* and amendments is to "restore and maintain the chemical, physical and biological integrity of the nation's waters." The overall goal of the *Clean Water Act* is to produce waters of the United States that are "fishable and swimmable." A primary means for evaluating and protecting water quality is the establishment and enforcement of water quality standards. Under the *Clean Water Act*, the federal government delegated responsibility for establishing water quality criteria to each state, subject to approval by the U.S. Environmental Protection Agency (EPA). Water quality standards consist of three parts: (1) designated beneficial uses of water (for example, drinking, recreation, aquatic life); (2) numeric criteria for physical and chemical characteristics for each type of designated use; and (3) an "antidegradation" provision to protect uses and water quality.

In accordance with the *Clean Water Act*, states and territories define the uses for waters occurring within their borders, and each water body must be managed in accordance with its designated uses. Water quality standards are established for each designated use. Standards must be at least as stringent as those established by the Environmental Protection Agency, and in most cases, states have adopted the same EPA standards.

The Environmental Protection Agency has developed national recommended ambient water quality criteria for approximately 120 priority pollutants for the protection of both aquatic life and human health through ingestion of water, fish, or shellfish (EPA 1999). However, standards have not yet been set for many pollutants, including the herbicides being analyzed in this draft EPMP/EIS. In some cases, the Environmental Protection Agency has developed advisory levels for contaminant concentrations, but such advisory levels are not enforceable.

Under section 313 of the *Clean Water Act*, the NPS and all other federal agencies and departments must comply with all federal, state, interstate, and local requirements regarding the control and abatement of water pollution. This includes management of any activity that may result in the discharge or runoff of pollutants.

NATIONAL PARK SERVICE GUIDANCE

The NPS *Management Policies 2001* state that the NPS would "take all necessary actions to maintain or restore the quality of surface waters and ground waters within the parks consistent with the *Clean Water Act* and all other applicable federal, state, and local laws and regulations" (NPS 2001e, 4.6.3). The NPS has also established general goals for water quality, and in accordance with these goals, the NPS works cooperatively with the states and territories to protect and enhance the quality of water in the national park units.

The NPS manages the waters in the nine Florida and Caribbean park units in accordance with the *Clean Water Act* and water quality standards of the state of Florida and the territory of the U.S. Virgin Islands. Therefore, the NPS must meet state antidegradation provisions, which means the existing quality of state waters must not be degraded. This ensures that park waters can serve their intended purposes, as defined by the assigned beneficial uses.

STATE OF FLORIDA GUIDANCE

The *Florida Administrative Code* states, "The waters of the state are among its basic resources. Such waters should be managed to conserve and protect natural resources and scenic beauty and to realize the full beneficial use of the resource. Water quality standards shall be enforced to protect waters of the State from point and non-point sources of pollution" (Florida Administrative Code 62-40.110, 1996).

Under Florida's Designated Beneficial Uses, water quality classifications are arranged in order of the degree of protection required. The surface waters of the state of Florida are designated as Class III, except where exceptional circumstances dictate otherwise. Classes I, II, and III all share water quality criteria established to protect recreation and the propagation and maintenance of a healthy, well-balanced population of fish and wildlife. A water body may also have special standards such as designation as an "Outstanding Florida Water" (Florida Administrative Code 62-302, 1996) (see table 34).

TABLE 34: FLORIDA DESIGNATED BENEFICIAL USES OF PROJECT AREAS WATERS

Class	Description	Project Area
I	Potable Water Supplies	None
II	Shellfish Propagation or Harvesting	Canaveral National Seashore
III	Recreation, Propagation and Maintenance of a Healthy Well-Balanced Population of Fish and Wildlife	Big Cypress National Preserve, Biscayne National Park, Dry Tortugas National Park, Everglades National Park
IV	Agricultural Water Supplies	None
V	Navigation, Utility, and Industrial Use	None

"Outstanding Florida Waters" legislation applies to all freshwaters of the state that have been designated for this protection. Water bodies deemed worthy of special protection, through an open public process, might be designated Outstanding Florida Waters, and efforts must be taken to protect their water quality. Requirements do not allow surface waters to be degraded in any way (Florida Administrative Code 2002). Most Outstanding Florida Waters are areas managed by the state or federal government as parks, including wildlife refuges, preserves, marine sanctuaries, estuarine research reserves, certain waters within state or national forests, scenic and wild rivers, or aquatic preserves (FDEP 2004b). All surface waters of the Florida park units are included in the Outstanding Florida Waters designation.

In May 2003, the 1994 *Everglades Forever Act* was amended (Florida Administrative Code 62-302.540, Everglades Protection Area Phosphorus

Criterion). The law includes an enforceable schedule and funding to reduce phosphorus contamination of the Everglades by 2006 (FDEP 2004a).

U.S. VIRGIN ISLANDS TERRITORIAL GUIDANCE

The Water Quality Standards of the U.S. Virgin Islands (Title 12, Chapter 7, Section 186) define the appropriate physical, chemical, biological, and ecological limits to support designated uses of water bodies in the U.S. Virgin Islands. Water Quality Standards provide the framework for maintaining, improving, and protecting water quality (U.S. Virgin Islands DEP 2003).

The Virgin Islands Department of Envrionmental Protection has developd a water pollution control program, which is entrusted with the responsibility for implementing and enforcing water quality and pollution control laws in the U.S. Virgin Islands. Under the *Clean Water Act*, Section 106, the Water Pollution Control Program is tasked with monitoring the marine waters of the U.S. Virgin Islands and controlling discharges into those waters.

METHODOLOGY AND ASSUMPTIONS

GEOGRAPHIC AREA EVALUATED FOR IMPACTS

To assess the magnitude of water quality impacts on park waters under the various alternatives, state water quality standards governing the waters of the parks were examined and compared to baseline water quality data (if available). The area analyzed for possible impacts on water quality and hydrology includes all lands within park boundaries. The area of analysis includes the freshwater, marine (salt water), and groundwater resources that could be affected by the presence of exotic plants and treatments to control the plants.

IMPACT CRITERIA AND METHODOLOGY

Each alternative was assessed to determine the impacts of the actions relative to surface water, groundwater, and hydrology. The evaluation of surface water includes an assessment of effects on freshwater, salt water, and groundwater resources. The types of surface water resources present in each park have been identified, but not all parks contain all three types of water resources; therefore, the analyses vary according to the surface water resources contained in each park unit.

Water quality refers to meeting federal *Clean Water Act* and state and territory water quality requirements and to the suitability of surface water for wildlife use or human contact. Particular attention is paid to the potential for the enhancement or degradation of water quality. Hydrology refers to water-related processes, such as stream and channel flow, overland or sheet flow, ephemeral discharges, and groundwater movement. Particular attention is given to alterations in natural patterns of water flow.

Primary steps for assessing impacts included identifying (1) the location of surface water in areas likely to be affected by the proposed alternatives,

(2) potential changes in surface water and hydrology from current and future exotic plant management actions, and (3) potential changes in surface water and hydrology caused by road modifications. To understand the effects of exotic plant management methods on the hydrology and water quality in specific areas of concern, park resource inventories and management plans, scientific literature, and published technical data were consulted to identify the information contained in this analysis.

Other considerations in assessing the magnitude of water quality impacts is the effect on those resources dependent on a certain quality or condition of water. Sensitive aquatic organisms, submerged aquatic vegetation, riparian areas, and wetlands are affected by changes in water quality from direct and indirect sources.

The issues identified during internal and public scoping that relate to water quality and hydrology include the following:

> The rapid growth of exotic plants can allow the plants to clog waterways and cause impoundment and stagnation of fresh water. The presence of exotic plants in aquatic systems may reduce or deplete water levels or alter runoff patterns and increase soil erosion, thus diminishing water quality. Exotic aquatic plants in riverine systems may reach estuarine and/or marine systems, altering fresh water quality and quantity delivered to these systems.
>
> *Mechanical treatment and access* — The removal of exotic plants by mechanical methods (including the use of heavy equipment) may lead to soil erosion, with consequential effects such as discharges of sediments and particulate matter into adjacent waters and increases in turbidity levels in aquatic environments during heavy rain or storm events.
>
> *Chemical treatment* — The introduction of herbicides into the water as a result of terrestrial treatment of exotic plants may affect water quality, and decaying herbicide-treated plant material can cause water quality impacts by adding nitrogen and phosphorous to aquatic systems. Some herbicides contain surfactants or other compounds that poison aquatic organisms and degrade water quality.

Water quality and hydrology have the potential to be affected directly or indirectly by three of the four exotic plant management techniques used by the parks: mechanical, physical, and chemical. Biological control agents for terrestrial exotic plants

Biological controls, targeted to a single species of invasive plant, are unlikely to result in adverse effects to riparian function and water quality. Biological controls act very slowly, often taking a decade or more to substantially reduce the invasive plant population (Bautista et al. 2005). Therefore, indirect effects to water quality and aquatic species are unlikely and as such biological control agents are not discussed in this analysis.

IMPACT THRESHOLD DEFINITIONS

Given the above water quality issues, methodology, and assumptions, the following impact thresholds were established in order to describe the relative changes in water quality and hydrology under the management alternatives.

Negligible — Chemical, physical, or biological changes to water quality and hydrology would not be detectable, would be well below water quality standards or criteria, and would be within historical or desired water quality and hydrologic conditions.

Minor — Chemical, physical, or biological changes to water quality and hydrology would be detectable in and/or immediately adjacent to treatment areas but would be well below water quality standards or criteria, and would be within historical or desired water quality and hydrologic conditions.

Moderate — Chemical, physical, or biological changes to water quality and hydrology would be detectable beyond the immediate treatment area and across relatively large areas of the parks, but would be at or below water quality standards or criteria. Water quality and hydrology would be altered compared to historical baseline or desired water quality and hydrologic conditions.

Major — Chemical, physical, or biological changes to water quality and hydrology would be readily measurable across large areas of the parks, and would be frequently altered from the historical baseline or desired water quality and hydrologic conditions. Chemical, physical, or biological water quality standards or criteria would be locally exceeded.

IMPAIRMENT

Chemical, physical, or biological changes to water quality and hydrology would be widespread, readily measurable, and would be altered substantially and frequently from the historical baseline or desired water quality or hydrologic conditions and/or water quality standards. The impacts would involve deterioration of the parks' water quality and aquatic resources, to the point that park purposes could not be fulfilled, or resources could not be experienced and enjoyed by future generations.

IMPACTS OF THE ALTERNATIVES ON WATER QUALITY AND HYDROLOGY

ALTERNATIVE A — NO ACTION: CONTINUE CURRENT MANAGEMENT

Big Cypress National Preserve and Everglades National Park

The impacts on water quality related to mechanical treatment of exotic plant species would result from the potential for generation of sediment by ground disturbance. Sediment affects water quality by increasing turbidity and suspended particle concentration in surface waters.

Under current management, saplings of several species are pulled in both parks. This generates very limited soil disturbance and little potential to affect water quality. The low slopes and dense vegetation would protect waters from sediment delivery related to pulling saplings and result in no impact on water quality.

In Everglades National Park, cutting and mulching of monotypic stands of Brazilian pepper have been undertaken using relatively large trucks and equipment. Such activities produce local soil disturbance but also leave a layer of protective mulch on the ground. In addition, emergence of native or nonnative plant species after treatment is rapid, and bare soils would soon be revegetated. Following these exotic plant control activities, localized, short-term, negligible adverse impacts on water quality would result if a precipitation event were to deliver small quantities of disturbed soil to sheet flow or adjacent surface waters.

Due to the low level of disturbance generated by mechanical treatment, these actions would have no potential to affect groundwater quality in Big Cypress National Preserve and Everglades National Park. The dominance of peat soils and filtering capabilities of underlying karst topography (limestone landscape) in these parks would provide protection from silt and sediment potentially resulting from these activities.

Small quantities of sediment would be unlikely to affect marine water quality. The dense vegetation of these parks would act as buffers for flows in disturbed area, and the low topography would provide ample time for settling of particulate matter. Therefore, no groundwater effects would result from mechanical treatment of exotic plant species.

Both parks currently use prescribed fire as a prescribed fire method to control exotic plant species. The influence of fire on hydrology and water quality can be viewed as a continuum, with effects of prescribed fire at the beneficial extreme and wildfire at the adverse extreme. If properly executed, prescribed fire would not appreciably affect the integrated overland flow and stream flow regime of a watershed (Hogen 2001). However, increased streamflow for the first year following treatment has been observed, with flows decreasing as the vegetation canopy closes (Robichaud 2000). In addition, fire can release nutrients, namely nitrogen (as nitrate) and carbon (Stephens et al. 2003). Export of these nutrients to surface flows or nearby streams is highly variable, depending on rainfall, topography, and initial concentration. Because these elements are essential building blocks for vegetation, they are generally taken up quickly as native vegetation recovers. In the second year following a fire, nitrogen levels dramatically decline as it is used by growing vegetation (Meixner et al. 2004).

Fire is used to effectively control seedlings in melaleuca stands after initial treatment with herbicides. These sites are wet for much of the year, have little slope, deep litter accumulations, and adequate fuel in the form of standing or dead melaleuca trees. Applying prescribed fire in these sites would clear the surface litter accumulation and release the nutrients bound in the dead vegetation. Repeated use could exhaust the melaleuca seed bank and dramatically reduce the local population of this exotic plant.

Over the short term, the post-fire impacts on freshwater quality would be adverse, localized, and negligible to minor as nutrients are released from the site. Groundwater and marine waters would not likely be affected, as the lush vegetation in the parks would utilize these resources as percolation occurs, and streams and sheet flow move toward the surrounding marine environment.

Significant erosion or sedimentation in nearby waters has not been noted following use of prescribed fire. As discussed for mechanical treatment, the topography and rapid rate of revegetation would limit the effects of erosion on local water quality. In addition, Hogen (2001) notes that "prescribed fire generally consumes surface fuels and has little effect on soils or substrates," with erosion and formation of hydrophobic soils being associated with high-intensity wildfire. Given these parameters, the anticipated effects of post-fire erosion on water quality and hydrology would be short term, localized, adverse, and negligible to minor.

Chemical treatments in Everglades National Park and Big Cypress National Preserve include the use of herbicide compounds (glyphosate, imazapyr, metsulfuron methyl, and triclopyr). These compounds may be used on the ground or aerially at individual treatment sites. Herbicides are applied according to EPA-approved label directions and only those labeled for use in aquatic environments would be applied near waterbodies. In wetland areas, use of herbicides is prohibited during inundation periods. Entry of these compounds into surface water would only occur from precipitation events or overland flow because they would not be introduced directly. Appropriate planning and mitigation would limit the aerial spread of the herbicides during any application, and containment measures would be undertaken in the event of herbicide spill.

Each of these herbicides has a particular persistence in water and degradation pathway. These characteristics are outlined briefly, below, to facilitate this analysis.

> Glyphosate binds rapidly and tightly to virtually all types of soil particles. Because of this chemical bond, it has little tendency for lateral movement or runoff (Vencill 2002; Schuette 1998). When soil particles are transported into nearby waters, the glyphosate remains bound and unavailable to plants. Most glyphosate found in water has entered by runoff from vegetation, spray drift, or unintentional overspray (Tu et al. 2003). If glyphosate does enter water, it is subject to rapid degradation by sunlight, hydrolysis (decomposition of a chemical compound by reaction with water), and transformation by microbes. It has a half-life in water of 1.5 to 14 days, depending on the temperature and the amounts of sediment and organic matter present. Higher ambient temperatures accelerate the degradation of glyphosate by supporting higher concentrations of microbes in the environment (Vencill 2002; Schuette 1998).
>
> In studies of application in forested areas, imazapyr that remained in the top 12 to 18 inches of soil showed no tendency for lateral movement, did not run off into nearby streams, and had little potential to contaminate groundwater (Vencill 2002). Runoff potential is considered negligible where soils are high in sand, loam, and organic matter (Durkin and

Follansbee 2004). If imazapyr would enter surface waters, its half-life would be 2 to 3 days, and it would be degraded primarily by light and microbes (Vencill 2002). Tu et al. (2003) reported no detection of imazapyr in surface water following treatments in forested areas.

Metsulfuron methyl has low capacity to bind to soils and is moderately mobile in the environment. Laboratory research shows it has a half-life in water at 77° Fahrenheit of 21 days. Degradation occurs mainly from microbial processes and is more rapid at higher temperatures. This compound can have residual activity during its half-life, affecting vegetation for 10 to 22 months (Vencill 2002; Extoxnet 1996a). Recent field research in tropical environments shows that metsulfuron methyl is degraded more quickly in wet environments, indicating that it is broken down by chemical hydrolysis, in addition to microbial processes. In these studies, tropical field half-life ranged from 7 to 13 days, with no accumulation or detrimental affects on subsequent crop plantings (Ismail and Azlizan 2002; Ismail and Tet-Vu 2003).

Triclopyr is not strongly adsorbed to soil particles and is somewhat prone to lateral movement. However, this compound shows little tendency for vertical movement, and no effects to groundwater are anticipated. In forest stream runoff tests, triclopyr was not detected beyond 24 hours after application, but it has a high potential for immediate runoff during extreme precipitation events (such as the 50-year rainfall) (Vencill 2002; Ganapathy 1997). Once in water, triclopyr is very short-lived, being rapidly degraded by sunlight and microbes. Its half-life in water is 2 to 6 hours (Vencill 2002). Tu et al. (2003) report that neither leaching nor long-distance overland flow added measurable amounts of triclopyr to nearby streams, concluding that it poses little threat to downstream organisms or water users. Triclopyr was included in the U.S. Geological Survey (USGS) nationwide pesticide assessment report published in 1998. Over a 4-year period, the USGS assayed 8,200 surface and groundwater samples, in and around areas of high agricultural production, testing for 76 pesticides. Triclopyr was detected in the parts per billion range in approximately 1% of agricultural streams, 2% of urban streams, and was undetected in large streams or rivers and groundwater samples (USGS 1998).

When used properly, glyphosate, imazapyr, triclopyr, and metsulfuron methyl all have little potential to affect water resources. These compounds persist for hours to 13 days in the warm waters of the Florida environment. Although metsulfuron methyl could persist for nearly 2 weeks, this compound is the least used in the parks, being applied only to Old World climbing fern. Treatment of Old World climbing fern has been limited due to poor response and rapid return of this exotic plant species. Therefore, the effects of continued herbicide use under the no-action alternative would result in negligible to minor, localized, adverse impacts on freshwater resources of the two parks.

Impacts on local groundwater or marine water resources would not occur under the no-action alternative. Because they are not used above standing surface water, the rapid degradation of these chemicals results in brief persistence and limited opportunities for them to move into groundwater or marine environments.

In addition, the dense vegetation and presence of organic peat soils, which bind the active ingredients, would also limit the mobility of the chemicals toward these water resources. Thus, there would be no impacts on groundwater or marine water resources from herbicide use to control exotic plants.

Access to treatment sites in these parks is accomplished by helicopter for aerial treatment and ORV, truck, or airboat for ground crews. The limited amount of disturbance generated by men and machines would unlikely generate detectable changes in water quality because low slopes and dense vegetation would limit sediment dissipation. Given the limited amount of disturbance and low sediment delivery rate, no impacts on water quality or hydrology would be anticipated from access to treat exotic plant species.

Because the existing treatment regimen is not likely to result in an overall decline of exotic plant populations, herbicide use would likely continue at a relatively constant rate from year to year. Thus, the short-term effects from treatment at specific sites would not change overall; rather, they would be shifted to varying treatment locations within the parks.

The natural water regimen in the two parks has been adversely affected by the presence of exotic plants, especially melaleuca, Brazilian pepper, and Australian pine. Because of its high transpiration rate, melaleuca was introduced to dry up the Everglades system as an aid to development; Australian pine, Brazilian pepper, and melaleuca deposit vast quantities of litter that alter soil chemistry and can adversely affect local water quality (Gordon 1998). Removal of large monotypic stands of these exotic plant species would help restore local sheet flow and native wetland hydroperiods and would remove the unnatural nutrient load beneath the canopies. However, because overall infestation rates would likely remain static under current management, the parkwide adverse impacts would continue at the current rate, which are estimated to be localized, long term, and minor.

Biscayne National Park and Canaveral National Seashore

Mechanical treatment used under current management includes hand pulling of saplings of several exotic plant species. This activity generates very limited soil disturbance and little potential to affect water quality. It is unlikely that detectable impacts on water quality would result from removing saplings by hand.

Neither park has used aerial spraying of herbicides, but both parks have completed the bulk of initial treatment and are entering the maintenance phase of exotic plant control. The existing treatment regimen and resulting effects of herbicide use would likely continue under this alternative.

As discussed in the “Affected Environment” chapter, these parks have little fresh water. Inflows to the marine environment are supplied directly by rainfall, by sheet flow from the mainland, and by minor natural and man-made drainages.

As discussed above, glyphosate, imazapyr, and triclopyr have little potential to affect water quality. Only metsulfuron methyl is mobile and somewhat persistent

in water. Its limited use for treating Old World climbing fern, coupled with the rapid degradation of the three other herbicides, would result in short-term, localized, negligible adverse impacts on water quality. Although these parks do not currently use this herbicide, in the future, if Old World climbing fern is detected within the park, it may be employed.

As discussed for Everglades National Park and Big Cypress National Preserve, the effects of continued herbicide use at Biscayne National Park and Canaveral National Seashore would not impact groundwater or marine water resources.

Ground crews accessing treatment sites in Biscayne National Park and Canaveral National Seashore use ORVs, trucks, or boats. The limited amount of disturbance generated by men and machines would unlikely generate sediment delivery because sandy soils are not easily transported over low slopes with limited surface flows. Therefore, there would be no impacts on water quality from access activities.

Although Biscayne National Park and Canaveral National Seashore have treated Brazilian pepper and Australian pine, the extent of infestation at these parks was far less than at Big Cypress National Preserve and Everglades National Park. In addition, these parks are coastal environments with scarce freshwater resources, not long-hydroperiod wetlands. The effect of these exotic plants on water quality and hydrology has not been detectable. Therefore, the long-term benefits of removing or reducing the numbers of these species would also produce no effect to the overall water quality and hydrology of the parks.

Dry Tortugas National Park

Mechanical treatment used under current management includes hand pulling of saplings of several exotic plant species. These activities generate very limited soil disturbance and little potential to affect water quality. As outlined in the "Affected Environment" chapter, Dry Tortugas National Park does not contain freshwater or groundwater resources. It is unlikely that detectable impacts on the water quality of the park's marine waters would result from removing saplings by hand.

Dry Tortugas National Park does not use prescribed fire methods for management of exotic plant species under current management; therefore, prescribed fire was not analyzed for this park unit.

The chemical treatment methods employed at this park include the use of glyphosate, imazapyr, and triclopyr. These herbicides have been used only on the ground to control a variety of exotic plant species. This park has completed its initial treatment and has entered the maintenance phase.

These three herbicides have little mobility or potential to affect water quality and are short-lived in the environment of Dry Tortugas National Park. Continued use of these herbicides in the limited quantities currently needed for maintenance control of exotic plants would produce no impacts on marine water resources.

Access to treatment sites at Dry Tortugas National Park is provided by foot or ORV. As in Biscayne National Park and Canaveral National Seashore, these activities would unlikely generate or deliver sediment because the parks' sandy soils are not easily transported over low slopes with limited surface flows. Therefore, there would be no impacts on water quality from access to treat exotic plant species.

Dry Tortugas National Park does not have large monotypic stands of exotic plant species capable of altering hydrology and water quality. Therefore, removing or reducing the population of exotic plants would produce no discernable, long-term impacts on the park's marine water resources.

Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Three of the four Caribbean parks have undertaken exotic plant control: Buck Island Reef National Monument, Christiansted National Historic Site, and Virgin Islands National Park. Salt River Bay National Historic Park and Ecological Preserve has not instituted exotic plant control measures, so there would be no impacts on hydrology and water quality from current management. However, the proposed location of the park's visitor center is a former home site that has been planted with a monoculture of guinea grass. In the event that this stand should burn, there is a concern that localized adverse impacts on water quality could result.

To address erosion concerns regarding their exotic plant treatments, NPS staff at Buck Island Reef National Monument established test plots on a treated slope of guinea grass on the island. Post-treatment, the site has shown little potential for soil loss and only a limited chance for sediment delivery to local waters. It is also unlikely that a wildfire in the guinea grass in Salt River Bay National Historic Park and Ecological Preserve would release notable amounts of sediment into the estuary. However, nutrient flushing associated with a fire would release pulses of nitrogen and carbon into sheet flow during rain events. This condition could persist for the first year following a fire, delivering limited quantities of nutrients to Salt River Bay. Therefore, the impacts of current management on water quality at Salt River Bay would be long term, adverse, localized, and negligible.

Buck Island Reef National Monument, Christiansted National Historic Site, and Virgin Islands National Park hand pull saplings as a mechanical treatment to control exotic plants. At Virgin Islands National Park, removing stands of tan tan saplings from the steep hillsides of the park would generate little soil disturbance. Given the dense surrounding vegetation, the low level of soil disturbance would unlikely impact freshwater, groundwater, or marine water resources. These would be no impacts on water resources from current mechanical treatment methods in the Caribbean parks.

The three Caribbean parks with ongoing control plans use glyphosate, imazapyr, and triclopyr to treat exotic plant species. The herbicides are used exclusively by ground crews and no aerial spraying is undertaken. With the exception of Buck Island Reef National Monument, current management includes limited treatment

to protect cultural resources and improve resource conditions at highly visited areas. At Buck Island, all terrestrial areas have received initial treatment for a variety of exotic plant species, and the park has entered the maintenance (re-treatment) phase of exotic plant control. Re-treatment of the island with herbicides occurs every 6 months.

The three herbicides used at Buck Island have little mobility or potential to affect water quality. The herbicides are also short-lived in the warm, tropical environment. Continued use of these compounds for maintenance control of exotic plants could result in negligible, short-term, localized, adverse impacts on water quality if a runoff event occurred immediately (within 24 hours) after treatment. Given the brief persistence and rapid degradation of these compounds, impacts on marine waters or groundwater would be unlikely, resulting in no impacts on these water resources.

Access for ground crews to treat sites in the Caribbean parks is accomplished on foot, by truck, or boat. Relatively large, multiple-acre monotypic stands can be present in the parks in mosaic patches. The limited amount of disturbance generated by ground crews and machines to access these sites would unlikely generate detectable changes in water quality, as sparse freshwater flows and dense vegetation would limit sediment delivery. Therefore, there would be negligible impacts on water quality from access to treat exotic plant species.

The current exotic plant controls in the Caribbean parks focus on treating understory growth, tan tan stands, and individual nonnative trees. Although these parks have monotypic stands of tan tan, their effect on local hydrology and water quality is not known. Tan tan is a member of the legume family, and like Australian pine, fixes nitrogen. This may help explain its success in the nutrient-poor tropical soils of the islands. However, its ability to enrich soils locally has not been noted to have effects on water quality. This may also be due to the scarcity of fresh surface water in these parks. Therefore, it is unlikely that reducing the population of exotic plants would produce discernable, long-term impacts on the water quality and hydrology of the parks.

Cumulative Impacts

Water quality and hydrology at Big Cypress National Preserve and Everglades National Park would be affected by large-scale, multi-agency restoration efforts such as the Comprehensive Everglades Restoration Plan and South Florida Ecosystem Restoration Plan. It is hoped that more natural overland and stream flow can be established in the remaining Everglades ecosystem and produce moderate, long-term, beneficial effects on water quality and hydrology. The effects of these projects would likely overshadow any single project undertaken by either of these parks.

Planned management activities and construction development in the parks, such as facilities or oil and gas development, would produce a range of negligible to minor impacts on local water quality, and the no-action alternative would contribute only negligible to minor short-term adverse impacts. Thus, the cumulative impacts on water quality and hydrology would be long term, beneficial, and moderate.

Biscayne National Park is developing a water management plan and Canaveral National Seashore has a water management plan that involves aquatic habitat restoration activities that are anticipated to improve local water quality over the long term at a minor level. In addition, these parks remain concerned about the long-term, adverse effects of low-quality urban stormwater runoff. The no-action alternative would not contribute measurably to these other cumulative impacts, resulting in both adverse and beneficial, long-term, minor effects on water quality and hydrology.

Dry Tortugas National Park plans to implement improvements to their dock, which would likely generate short-term, localized minor impacts on marine water quality. The no-action alternative would not generate noticeable water quality effects, and the cumulative impacts would be short term, adverse, localized, and minor.

The Caribbean national parks are planning a variety of resource protection plans and small-scale development to facilitate visitor use. In combination, these plans are anticipated to produce short-term adverse impacts of negligible to minor intensity, and long-term benefits of negligible to minor intensity. The primary concerns for long-term, adverse impacts on water quality in these parks are stormwater runoff and wastewater discharge into the marine environment and groundwater contamination by agriculture and industry. The no-action alternative would not contribute appreciably to these other influences, and the cumulative impacts would be both beneficial and adverse and vary in intensity.

Conclusion

The impacts of exotic plant treatments on water quality and hydrology range from no effect to short term, localized, adverse, and minor. These would result from sedimentation from disturbance, erosion, and nutrient loading from use of prescribed fire and herbicide application. None of these effects would likely persist past one year.

The long-term effects of a relatively consistent rate of overall exotic plant infestation would range from no impact on water quality and hydrology to long-term, localized, adverse impacts of minor intensity. These impacts would result from persistence of altered nutrient loading and altered natural hydrologic regimens caused by the presence of large monotypic stands of exotic plants.

Cumulative effects for South Florida parks would be minor to moderate beneficial. Cumulative effects for Dry Tortugas National Park would be short-term minor adverse. Cumulative effects for Caribbean parks would be long-term negative to minor beneficial. There would be no impairment of water quality or hydrology as a result of implementation of alternative A.

ALTERNATIVE B — NEW FRAMEWORK FOR EXOTIC PLANT MANAGEMENT: INCREASED PLANNING, MONITORING, AND MITIGATION

Big Cypress National Preserve and Everglades National Park

The water quality and hydrology effects related to mechanical treatments, including pulling and cut and mulch activities, would be similar to those discussed for alternative A, and would range from no impact to localized, short-term, negligible, and adverse impacts. The increased use of mechanical treatments, either more frequently or over expanded areas, would likely not change either the intensity or duration of impacts.

Increased use of prescribed fire as a physical re-treatment method would yield effects similar to those described for alternative A. A more frequent use of fire in many native vegetation categories would stimulate growth and reduce the long-term potential for wildfire. Short-term impacts on freshwater quality would be adverse, localized, and negligible to minor. Groundwater and marine waters would likely not be affected. Long-term impacts on hydrology and water quality are not anticipated.

Chemical treatments with herbicides would be increased during approximately the first 3 years of implementation of alternative B. Initial treatment and scheduled re-treatment at 6-month intervals would likely not increase the intensity or duration of impacts on water quality from those described for alternative A. The quantity of herbicide is expected to decrease with each subsequent application, with maintenance levels achieved within 5 years. Inactivation by soil binding, a short half-life, and rapid degradation by various pathways would prevent the accumulation of these compounds in park waters. Therefore, the impacts of continued herbicide use under alternative B would be negligible to minor, localized, and adverse.

As described for alternative A, no impacts on local groundwater or marine waters would be anticipated under alternative B.

The effects of site access generated by increased frequency of treatment would be similar to those described for alternative A. The limited amount of disturbance generated by ground crews and machines would be unlikely to cause detectable changes in water quality, resulting in no impact on water quality and hydrology.

Reducing the rate of exotic plant infestation under alternative B would benefit water quality and hydrology. As described for alternative A, monotypic stands of exotic plants have altered the natural water regimen of the parks. Benefits to the natural water regimen would be anticipated as forests of melaleuca, Brazilian pepper, and Australian pine are reduced. Beneficial effects on water quality and hydrology would be localized, long term, and minor.

Biscayne National Park and Canaveral National Seashore

The impacts of mechanical treatments would be similar to those described for alternative A.

Chemical treatment of exotic plants using glyphosate, imazapyr, triclopyr, and metsulfuron methyl would have little potential to affect water quality or hydrology. Metsulfuron methyl is somewhat mobile and persistent for up to two weeks, but its use is likely to remain limited. Accelerated use of these herbicides during early implementation of alternative B would result in short-term, localized, and negligible to minor adverse impacts on water quality. As described for alternative A effects to groundwater or marine water resources would not be anticipated.

The impacts of ground crews accessing treatment sites at increased frequency would be similar to those described for alternative A. There would be no impacts on water quality from access activities.

As described for alternative A, the long-term benefits of removing or reducing the numbers of these species would also produce no impacts on the overall water quality and hydrology of the parks.

Dry Tortugas National Park

Dry Tortugas National Park has achieved primary control of exotic plants and is pursuing maintenance activities; therefore, the impacts of alternative B on water quality and hydrology would be similar to those described for alternative A.

Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Buck Island Reef National Monument has completed primary treatment, and would pursue re-treatment and maintenance under alternative B. Christiansted National Historic Site is urban, with much of the landscape maintained as lawn. Salt River Bay National Historic Park and Ecological Preserve would institute treatment beyond the guinea grass stand at the proposed visitor center location. Under this alternative, the impacts on water quality and hydrology in these parks would be similar to those described for alternative A.

Virgin Islands National Park would accelerate treatment activities to meet the new management framework under alternative B and scheduled re-treatment regimen. Because exotic plant infestations at this park are generally dispersed throughout the native vegetation category (do not exist as monotypic forest stands), the impacts of increased mechanical or chemical treatments would be similar to those described for alternative A.

Cumulative Impacts

Large-scale, multi-agency restoration efforts would result in long-term, moderate beneficial effects on water quality and hydrology at Big Cypress National Preserve and Everglades National Park. As described for alternative A, the effects of these projects would likely overshadow any exotic plant control measures undertaken by either of these parks.

Planned management activities and construction development in the parks would produce a range of negligible to minor impacts on local water quality. Alternative B would contribute only negligible to minor short-term adverse impacts; thus, the cumulative impacts on water quality and hydrology would be long term, beneficial, and moderate.

The cumulative impacts at Biscayne National Park and Canaveral National Seashore would be similar to those described for alternative A.

The cumulative impacts at Dry Tortugas National Park would be similar to those described for alternative A.

The cumulative impacts at the Caribbean national parks would be similar to those described for alternative A.

Conclusion

The impacts of alternative B on water quality and hydrology range from no effect to short term, localized, adverse, and minor. The impacts would result from sedimentation from disturbance, erosion, and nutrient loading from use of prescribed fire and herbicide application. None of these impacts would likely persist beyond 1 year.

The long-term effects of reducing the overall infestation rates in the parks would vary from no effect to beneficial, long term, localized, and minor effects. These benefits would result from return to a more natural hydrologic regimen, including increased sheet flow and hydroperiod, as dense stands of exotic plants are removed and native vegetation takes their place.

Cumulative effects would be the same as alternative A. There would be no impairment of water quality or hydrology as a result of the implementation of alternative B.

ALTERNATIVE C — NEW FRAMEWORK FOR EXOTIC PLANT MANAGEMENT: INCREASED PLANNING, MONITORING, AND MITIGATION, WITH AN EMPHASIS ON ACTIVE RESTORATION OF NATIVE PLANTS

Big Cypress National Preserve and Everglades National Park

Because this alternative proposes accelerated initial treatment and scheduled, routine re-treatment and monitoring under alternative B, the effects of these activities would be similar to those described for alternative B.

The active restoration methods included under alternative C include use of soil amendments, seeding, planting, and physical site alterations. The limited surface disturbance caused by seeding and planting would have little potential to affect water quality. Soil amendments and physical site alterations do have the potential to adversely affect local water quality and hydrology, depending on the scale of the action undertaken. In addition, establishing native vegetation categories on previously infested sites also has the potential to benefit water resources.

Soil amendments, such as fertilizers, compost, and pH modifiers (such as peat or lime) can be used to restore soil to a more natural condition. Potential locations for soil amendment use would be sites previously covered by monotypic forests of melaleuca, Brazilian pepper, or Australian pine. The use of these products in or near wetlands or surface waters would be decided on a site-by-site basis, and potential impacts on water quality would be considered. In the event that fertilizers or pH modifiers were to enter surface water, their adverse impact would likely be minor, short term, and localized. The dense vegetation in these parks would utilize any excess nutrients or buffers introduced to the system.

The use of physical site alterations would include changes in site hydrologic conditions, addition of soils to increase elevation, or removal of soils to eliminate the exotic plant seed bank and lower elevation.

Even a small (inches) increase or reduction in elevation would affect local surface flows and hydroperiods in these low-relief wetland environments. Changes in the water regimen at individual locations would be determined based on site-specific needs. Flow or drainage modifications could be used to reestablish a natural or native vegetation category at the site. These modifications would directly affect hydrology and water quality, resulting in localized, long-term, minor benefits.

Under alternative C, large-scale soil removal projects, such as the "Hole-in the-Donut" restoration project, could be undertaken. This exotic plant control effort involves the removal of the top layer of soil that contains the exotic species seed bank. This process also changes the local hydrology, resulting in a longer hydroperiod. The disturbance caused by excavation, the use of heavy equipment, and exposure of bare soil contribute to erosive processes. It is anticipated that native vegetation would rapidly recolonize any such excavated site and stabilize the substrate. Restoration activities, therefore, would result in short-term, localized, minor, adverse impacts on water quality and hydrology.

Biscayne National Park, Canaveral National Seashore, and Dry Tortugas National Park

The effects of exotic plant treatment and scheduled, routine re-treatment and monitoring would be the same as those described for alternative B.

Although the total areas eligible for active restoration in the three parks is dwarfed by the eligible areas in Everglades National Park and Big Cypress National Preserve, the similar efforts in these parks would result in impacts similar to those discussed above for the two parks.

Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

The effects of exotic plant treatment and scheduled, routine re-treatment and monitoring would be the same as those described for alternative B.

The Caribbean parks have limited areas identified for potential active restoration measures. The surface disturbance and access associated with the likely range of activities, including replanting, reseeding, or soil modification, would yield short-term, negligible, localized adverse impacts on water quality and hydrology. Erosion control and best management practices would be implemented to protect water resources from sediment delivery in the event of precipitation.

Cumulative Impacts

The short- and long-term cumulative effects of accelerated exotic plant treatment and routine, scheduled re-treatment, and monitoring would be similar to those discussed for alternative B.

Active restoration efforts would contribute to beneficial effects anticipated from the restoration efforts in the south Florida parks. Site-specific restoration of native vegetation categories would contribute to local long-term, minor benefits. This would produce local, long-term, and minor to moderate beneficial cumulative impacts on water quality and hydrology.

Conclusion

The effects of accelerated exotic plant treatment and scheduled, routine re-treatment, and monitoring would be similar to those outlined for alternative B.

By restoring native vegetation categories to sites densely infested with exotic plant species, water quality and hydrology would experience long-term, localized benefits of minor intensity. These benefits would result from return to more natural hydrologic conditions and hydroperiods. Where exotic plants are dispersed throughout the native vegetation category, little restoration activity is anticipated, and no impacts on water resources would be anticipated.

There would be no impairment of water quality or hydrology as a result of the implementation of alternative C.

SPECIAL STATUS SPECIES

GUIDING REGULATIONS AND POLICIES

The *Endangered Species Act of 1973* provides strict legal protection for endangered and threatened species, as well as those species proposed for listing, that may be in jeopardy of extinction, and for which special protection under federal and state law is afforded. The federal list of plants and animals is published in 50 CFR 17.11-12, and is administered by the USFWS. Special status species of plants and wildlife are included in this section. If the NPS determines that an action may adversely affect a federally listed species, consultation with the USFWS and National Oceanic and Atmospheric (NOAA) National Marine Fisheries Service, when applicable, is required to ensure that the action would not jeopardize the species' continued existence or result in the destruction or adverse modification of critical habitat.

The *Bald and Golden Eagle Protection Act of 1940*, as amended, provides for the protection of the bald eagle and the golden eagle (as amended in 1962) by prohibiting the take, possession, sale, purchase, barter, offer to sell, purchase or barter, transport, export or import, of any bald or golden eagle, alive or dead, including any part, nest, or egg, unless allowed by permit. "Take" includes pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb.

The Southeast Region of the USFWS developed specific bald eagle habitat management guidelines within their region to avoid or minimize detrimental human-related impacts on bald eagles, particularly during the nesting season. These guidelines identified management zones, including a primary zone (750 to 1,500 feet) and a secondary zone (750 feet to 1 mile), with recommended restrictions and nesting site buffers from certain activities that may be detrimental to bald eagles, according to the USFWS *Habitat Management Guidelines for the Bald Eagle in the Southeast Region*. These buffers and recommended restrictions are taken into consideration and integrated into mitigation measures when implementing exotic plant management activities.

METHODOLOGY AND ASSUMPTIONS

GEOGRAPHIC AREA EVALUATED FOR IMPACTS

The geographic boundaries for the analysis are the parks' boundaries, except for wide-ranging species such as the Florida panther. Any actions in the parks must be analyzed to determine if those actions would impact the panther and its habitat outside the park. All other special status species are analyzed for impacts on habitat inside the parks.

IMPACT CRITERIA AND METHODOLOGY

Potential impacts on special status species or their habitat were evaluated based on the known presence of a species or its potential presence due to suitable available habitat. The methods used to evaluate the impacts on special status

species used alternative A as the baseline condition against which alternatives B and C were compared, because alternative A provides the current management conditions. The analysis focuses on the effects on special status species with respect to the implementation of the management actions described in alternatives B and C. The analysis relies heavily on research conducted by scientists at the University of Florida, the South Florida Water Management District, and the USFWS, as well as on the experience of NPS staff at the participating national parks.

Potential effects to a listed species are treated very conservatively to provide maximum protection. Long-range effects of seemingly beneficial actions must be evaluated for potential impacts on listed species. For instance, the removal of Australian pines would have the obvious benefit of removing nonnative tree species and making room for native tree species. Nevertheless, if those Australian pines were providing the only nesting area for wood storks in the area, then the action would have a negative impact on a listed species.

For those listed species with potential habitat and potential infested habitat identified within parks (as presented in table 35 and developed from park-specific information), the intensity of effect was determined with consideration of several factors. These factors include the relationship between the presence of exotic plants and the listed species, percent of potential habitat located within the park, and percent of the potential habitat infested. For example, if a species potential habitat covered a very small percentage of the park, if this area was heavily infested, and the listed species was known to be vulnerable to exotic plant infestations, effects would likely be of major intensity. The opposite would hold true if a park had a large percentage of available potential habitat, there was low infestation, and the listed species did not have a strong relationship with exotic plants. These effects would be considered negligible.

Similar information was extrapolated for those listed species with no distribution information available. For these species, typical habitat preferences, collected from research and information provided by the USFWS, were presented and then considered with respect to the vegetation category this habitat occurs (as presented in table 5 of appendixes A – I). For example, typical habitat for the Florida semaphore cactus in Biscayne National Park includes hardwood hammocks on bare rocks with limited soil cover. This habitat would occur within the broader vegetation category, upland dry / mesic forest, for which we have data. Although this cactus would only occur in specific areas of upland dry / mesic forest because hardwood hammocks comprise a portion of the overall vegetation category, more detailed information is not available. Therefore, the effects to the Florida semaphore cactus take into consideration that there are 1,615 acres (21% of park) of estimated potential habitat (upland dry / mesic forest), 47 acres (less than 1%) are potentially infested, and there is a direct relationship between exotic plants and the semaphore cactus because exotic plants directly compete with other plants for light, moisture, and space. The beneficial effects from treatment actions in upland dry / mesic forest for the Florida semaphore cactus would be considered negligible to minor in intensity. This is the case because there is a strong relationship between the listed plant species and exotic plants, a moderately low percentage of estimated potential habitat in the park, and low potential infestation.

TABLE 35: ACRES OF POTENTIAL THREATENED AND ENDANGERED SPECIES HABITAT THAT ARE POTENTIALLY INFESTED

Species	Potential Habitat within Park (acres)	Potential Habitat Potentially Infested (acres)	Potential Habitat Restored			
			Alternative A Passive	Alternative B Passive	Alternative C	
					Passive	Active
Big Cypress National Preserve						
Florida panther	430,855	103,634	103,634	103,634	93,437	10,197
Bald eagle	7,242	598	598	598	572	26
Eastern indigo snake	384,716	95,361	95,361	95,361	86,360	9,001
Wood stork	477,486	88,786	88,786	88,786	74,619	14167
Everglade snail kite	13,334	3,708	3,708	3,708	18	3,690
Red-cockaded woodpecker	2,029	441	441	441	0	441
Biscayne National Park						
American crocodile	370	6	6	6	6	0
Eastern indigo snake	3,070	91	91	91	74	17
Buck Island Reef National Monument						
Brown Pelican	9	3	3	3	3	0
Hawksbill sea turtle, leatherback sea turtle, green sea turtle	11	<1	<1	<1	<1	0
Canaveral National Seashore						
Southeastern beach mouse	242	94	94	94	83	11
Florida scrub-jay	1,744	303	303	303	267	36
Eastern indigo snake	11,867	2,294	2,294	2,294	2,088	206
Wood stork	4,220	1,048	1,048	1,048	1,007	41
Bald eagle	2,736	526	526	526	518	8
Everglades National Park						
Cape Sable seaside sparrow	102,326	10,359	10,359	10,359	10,043	316
Florida panther	25,145	3,789	3,789	3,789	1,777	2,012
Everglade snail kite	26,472	7,859	7,859	7,859	0	7,859
Wood stork	585,502	93,431	93,431	93,431	93,431	0
Easter indigo snake	95,036	26,924	26,924	26,924	22,489	4,435
American crocodile	44,356	1,242	1,242	1,242	1,236	6
Bald eagle	4,177	144	144	144	144	0
Salt River Bay National Historic Park and Ecological Preserve						
Sensitive natural area	87	45	45	45	0	45
Virgin Islands National Park						
Brown pelican	154	0	0	0	0	0
St. Thomas lidflower	92	0	0	0	0	0
St. Thomas prickly ash	83	0	0	0	0	0
Roseate tern	1	0	0	0	0	0
Hawksbill sea turtle, leatherback sea turtle, green sea turtle	29	0	0	0	0	0

Although treatments would occur under alternative A to control exotic plant species, it is assumed that within the life of the plan all acres may not be restored. Under alternatives B and C, it is assumed all acres would be restored due to re-treatment of exotic plant species under an optimal re-treatment schedule (see pages 134–136).

The issues identified during public and internal scoping regarding special status species include the following:

> Exotic plants can alter habitat, food availability, and behavior of threatened and endangered species. Brazilian pepper's weak, brittle wood makes it difficult for some species to nest, and the bark on melaleuca has evolved a continuous peeling or sloughing characteristic to prohibit the colonization of epiphytic plants (plants that grow on top of, or are supported by, other plants). If melaleuca displaces the native trees, then locally many endangered epiphytic orchids and bromeliads might be extirpated and on a regional level the range of these epiphytes could be reduced.
>
> Exotic plants compete with native threatened and endangered plants by altering habitat. The changes that may occur to habitat include shading, allelopathy (release of a substance by one plant that inhibits the germination or growth of another plant), or alteration of nutrient composition and moisture availability in soils (Levine 2003). For example, melaleuca's very high transpiration rate can alter the character of a habitat by reducing groundwater availability or altering community structure. Melaleuca also alters the environmental condition in wet prairies to a drier state that prevents native species from becoming established, which provide habitat for the Cape Sable seaside sparrow. Alteration of habitat from exotic plants replacing native coastal plants may affect sea turtle nesting activities. Other listed species in the Caribbean (such as the brown pelican and roseate tern) may be affected by the habitat alteration resulting from the presence of exotic plants along beaches.
>
> Treatment methods to remove exotic plants, and the presence of humans and machinery to implement treatments, may interfere with threatened and endangered species' nesting and foraging behavior or may remove or alter critical habitat.

IMPACT THRESHOLD DEFINITIONS

Negligible — No federally listed species would be affected, or the action would affect an individual of a listed species or its critical habitat, but the change would be so small that it would not be of any measurable or perceptible consequence to the protected individual or its population. Negligible effect would equate with a "no effect" determination in USFWS terms.

Minor — The action would result in detectable impacts to an individual (or individuals) of a listed species or its critical habitat, but they would not be expected to result in substantial population fluctuations and would not be

expected to have any measurable long-term effects on species, habitats, or natural processes sustaining them. Minor effects would equate with a may affect / not likely to adversely affect determination in USFWS terms.

Moderate — An action would result in detectable impacts on individuals or population of a listed species, its critical habitat, or the natural processes sustaining them. Key ecosystem processes may experience disruptions that may result in population or habitat condition fluctuations that would be outside the range of natural variation (but would return to natural conditions). Moderate level adverse effects would equate with a "may affect / likely to adversely affect / adversely modify critical habitat" determinations in USFWS terms.

Major — Individuals or population of a listed species, its critical habitat, or the natural processes sustaining them would be measurably affected. Key ecosystem processes might be permanently altered resulting in long-term changes in population numbers and permanently modifying critical habitat. Major adverse effects would equate with a "may affect / likely to adversely affect / adversely modify critical habitat determinations in USFWS terms.

IMPAIRMENT

An impairment of a special status species would occur when the action contributes substantially to deterioration of the special status species or their critical habitat in the parks to the extent that the special status species would no longer survive as a viable population. Impairment would "jeopardize the continued existence" of a special status species in that the action would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species [50 CFR 402.02]. In addition, the adverse effects on the special status species in the parks and their critical habitat resources and values would:

Contribute to the deterioration of the special status species resources and values to the extent that the purpose of the parks would not be fulfilled as established in their enabling legislation.

Affect resources essential to the natural and cultural integrity or opportunities for enjoyment in the various parks.

Affect the resource whose conservation is identified as a goal in the general management plan for each of the parks addressed in the study area for this draft EPMP/EIS.

IMPACTS OF THE ALTERNATIVES ON SPECIAL STATUS SPECIES

ALTERNATIVE A — NO ACTION: CONTINUE CURRENT MANAGEMENT

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Table 35 shows the areas of potential habitat for each species that is infested with exotic plants in the parks in which special status species occur.

Plants

The plants listed below are found in pine rocklands and the edges of tropical hardwood hammocks in south Florida and on Long Pine Key and other pine rockland areas in Everglades National Park.

Blodgett's silverbush (*Argythamnia blodgettii*): Everglades National Park

Cape Sable thoroughwort (*Chromolaena frustrata*): Everglades National Park

Crenulated lead plant (*Amorpha crenulata*): Everglades National Park

Everglades bully (*Sideroxylon reclinatum* ssp. *austrofloridense*): Big Cypress National Preserve, Everglades National Park

Florida pineland grass (*Digitaria pauciflora*): Big Cypress National Preserve, Everglades National Park

Florida prairie clover (*Dalea carthagenensis* var. *floridana*): Big Cypress National Preserve, Everglades National Park

Garber's spurge (*Chamaesyce garberi*): Biscayne National Park, Everglades National Park

Pineland sandmat (*Chamaesyce deltoidea pinetorum*): Everglades National Park

Small's milkpea (*Galactia smallii*): Biscayne National Park, Everglades National Park

The populations of these plants have been decimated by habitat loss and degradation due to development, fire suppression, and by the introduction and spread of Brazilian pepper, *Schefflera,* and giant reed (*Neyraudia* sp.) (USFWS 1996b). These exotic plant species compete with the pine rockland plants for light, moisture, and space, and they interfere with the natural fire cycle in this native vegetation category. The normal fire cycle for the pine rocklands community is 3 to 7 years, with fires started by lightning during summer storms. Frequent fires keep fuel levels down and prevent the succession of this community to tropical hardwood hammocks (USFWS 1999b).

Scientists have determined that the encroachment of exotic plant species into pine rocklands is second only to outright loss of habitat from development. Bradley and Gann (1999) stated that development, exotic plant species, and fire suppression are the major threats to the 12 endemic pine rockland plant species. The *Multi-species Recovery Plan for South Florida* (USFWS 1999b) includes pine rocklands in their assessment of tropical hardwood hammocks and states that the management of these rare communities must include the prevention of further degradation from exotic plant species.

Treatment of exotic plants in the pine rockland vegetation community requires chemical, mechanical, biological, and prescribed fire methods. Herbicides in this environment are applied by ground crews using backpack sprayers. Use of herbicides has the potential to adversely impact the native vegetation found in the pine rocklands. Most herbicides have only limited selectivity and could potentially result in the loss of desirable vegetation that is growing with or near the targeted exotic plants. Of the herbicides identified in appendix J, only triclopyr is considered to be a selective herbicide and is used to control broadleaf and woody plants; the others are nonselective and would adversely impact nontarget plants that may come in contact with the chemical. Current best management practices under this alternative would be in place to ensure that such losses of native vegetation are minimal. When applying herbicides, contractors and staff would follow the best management practices identified in "Applying Pesticides Correctly" (Dean 1998) to reduce or minimize the impacts on native vegetation (Clark 2005). Application of the herbicides according to the EPA label would also reduce the potential for impacts to nontarget species. Ground application of the herbicides in this vegetation category would be done with sprayers that have tiny nozzles that deliver small amounts of herbicides to a small area, thus reducing or eliminating adverse impacts on native species. When best management practices are followed during the application of the appropriate herbicide, given the environmental conditions, there would be negligible adverse impacts on native vegetation.

Mechanical treatment would continue to be used for the removal of exotic plant seedlings in the pine rockland habitat. This treatment is usually a follow up for physical or chemical treatment. In heavily infested areas, the exotic plants would be cut down, and an herbicide is applied to the cut stem with a backpack sprayer. Mechanical removal of seedlings would have a short-term negligible adverse impact on native plants found in the pine rocklands. Removal of larger trees in the pine rocklands could have up to minor adverse impact on native plants in the area as individual plants may suffer direct physical damage when trees are cut and felled. The impacts would be highly localized and short term.

Infestations of melaleuca and Old World climbing fern would continue to be treated using biological controls. The moth, *Austromusotima camptozonale*, is a new biological control that would be released in the south Florida parks for the treatment of Old World climbing fern. Biological controls (the snout beetle and the sap-sucking psyllid) would continue to be used in the treatment of melaleuca in Big Cypress National Preserve and Everglades National Park. The use of biological control is based on insect specificity to a given exotic plant species. Biological controls go through a rigorous testing, screening, and approval process by the Animal and Plant Health Inspection Service (APHIS). Biological controls

are studied to authenticate their host specificity in laboratories for years before being released into the wild. Based on these trials and the approval of APHIS for the moth's release into the wild, the use of this biological control under the no-action alternative would have no negative impact on the native plants that inhabit the pine rocklands. Prescribed fire of exotic plants would continue to follow the mechanical treatment in the form of a prescribed fire. Once the exotic plants and other fuel sources are removed, a prescribed fire would be used during the appropriate season to burn off the layer of detritus (dead or decaying plant material) on the ground and open up the area for the germination of the pine rockland plants. These plants have adapted to survival in a fire-dependent habitat, so the fire itself would not result in adverse impacts on the pine rockland plants.

The treatments required to rid the pine rocklands of exotic plants would continue to have negligible to minor adverse impacts on pine rockland plants under the no-action alternative. Inadvertent trampling of plants during mechanical treatment or burning during prescribed fire would continue to result in minor and temporary short-term effects. Impacts from chemical overspray would not likely occur due to the accuracy of the backpack sprayers and, with implementation of best management practices, would result in only negligible effects. Under the no-action alternative, all infested areas would be initially treated and then re-treated every 3 years. Exotic plants would continue to be treated, but control of infestation may not be achieved within 10 years because re-treatment, on average, does not occur consistently over time. Upland dry / mesic forests, which contain the pine rocklands, cover 9% of Big Cypress National Preserve and are potentially 23% infested. Upland dry / mesic forests represent 1% of the terrestrial area of Everglades National Park but total over 10,000 acres, and are potentially 22% infested. Upland dry mesic forests represent 21% of Biscayne National Park, with 3% potentially infested. Treatment of these lands under alternative A would result in long-term moderate beneficial impacts on these plant species.

Florida semaphore cactus (*Consolea corallicola*): Biscayne National Park — Florida semaphore cactus is a large cactus endemic to the Florida Keys and grows in hammocks on bare rocks with a minimum amount of organic soil cover. This habitat would occur in the upland dry / mesic forest vegetation category, which is approximately 3% potentially infested in Biscayne National Park, although the habitat requirements are very specific within this category.

Mechanical and chemical re-treatments of infested areas would continue under alternative A. Herbicides would continue to be applied via ground crews using backpack sprayers with small spray nozzles. This would ensure application of herbicides only to targeted plants and reduce or eliminate potential for non-target damage to the Florida semaphore cactus or its habitat. The presence of ground crews could result in trampling of some surrounding vegetation; however, areas where the cactus is identified would be specifically avoided. Adverse effects from treatments where the Florida semaphore cactus could potentially occur would be short term and negligible.

Continuation of re-treatment activities of the 3% potentially infested upland dry / mesic forest areas in Biscayne National Park would have long-term, minor, beneficial effects on the Florida semaphore cactus.

St. Thomas lidflower (Calyptranthes thomasiana): Virgin Islands National Park — St. Thomas lidflower is an evergreen shrub found in the evergreen tropical forests of Bordeaux Mountain in Virgin Islands National Park. The population is in peril because of feral pigs and donkeys (USFWS 1995) that eat the shoots and leaves. It is likely that the growth of invasive exotic plants such as tan tan and genip would impact the endangered plant if they were present, but no infestations have been identified within known locations of the St. Thomas lidflower. Treatment of exotic vegetation in Virgin Islands National Park consists of mechanical and chemical methods or a combination of the two treatments. These treatment methods are discussed in the section regarding native vegetation.

Under the no-action alternative, the exotic plants in Virgin Islands National Park would continue to be reduced by mechanical and chemical methods. According to table 35, there are approximately 92 acres of potential habitat for the St. Thomas lidflower in Virgin Islands National Park, although currently, there is no known infestation directly within the identified habitat. Removing the exotic plants in the park would slow the potential spread of exotic plants into the habitat of the St. Thomas lidflower, and with the observational monitoring that would occur under alternative A, infestations into this habitat could be controlled, which would result in no adverse effects and beneficial effects that would be long term and minor in intensity.

St. Thomas prickly ash (Zanthoxylum thomasianum): Virgin Islands National Park — St. Thomas prickly ash is an evergreen shrub or small tree that has become endangered due to the loss of habitat. The only known occurrence on the island of St. John is on private lands on Gift Hill, near Salt Pond, and Lameshur (USFWS 1992). Approximately 83 acres of potential habitat has been identified in Virgin Islands National Park (see table 35) with no known current infestation of exotic plants occurring. This species would likely benefit from the control of exotic plants, but there is no information specifically regarding the impacts of exotic plants on its habitat. Little is known about this particular species to be able to understand specifically how it would benefit from the removal of exotic plants. Best professional judgment of the characteristic of exotic plants would indicate that removing the exotic plant species would reduce the competition for nutrients, water, light, and air, so the treatment of exotic plants would provide benefits to the endangered plant. Removing the exotic plants in the park would slow the potential spread of exotic plants into the habitat of the St. Thomas prickly ash, and with the observational monitoring that would occur under alternative A, infestations into this habitat could be controlled, which would result in no adverse effects and beneficial effects that would be long term and minor in intensity.

Animals (Mammals, Reptiles, Birds, and Invertebrates)

Mammals. The following text describes potential impacts of alternative A on special status mammal species present in the parks addressed in this draft EPMP/EIS:

Florida panther (Felis concolor coryi): Big Cypress National Preserve, Everglades National Park — The rarest mammal in the Everglades is the Florida panther, whose preferred prey is white-tailed deer (*Odocoileus virginianus*). The

white-tailed deer's food preference is swamp lily (*Crinum americanum*), a monocot (plant with a single seed leaf) that grows in wet prairies and tree islands in Everglades National Park and Big Cypress National Preserve (Labisky et al. 2003). The wetlands in which the swamp lily occurs are becoming overrun with melaleuca, Brazilian pepper, and other exotic plant species; therefore, limiting the availability of the habitat for the swamp lily. Reports show that juveniles and nonbreeding female panthers feed almost exclusively on smaller prey (such as feral hog, raccoon, and nine banded armadillo), and breeding females prey primarily on white-tailed deer. If the deer populations decline significantly, the panther must expend more energy to capture more prey and this may contribute to a decline in the panther population.

Treatment of exotic plants would continue to include the chemical, mechanical, biological, and prescribed fires described in the native vegetation section for freshwater marsh, forested wetland, and upland dry / mesic forest vegetation categories. The chemical and mechanical treatments would continue to result in short-term adverse effects on panther habitat due to the intrusive nature of the treatment methodologies (Wear and Greis 2002). Chemical treatments require the use of surface vehicles, chain saws, helicopters, and other intrusive equipment, so the noise and activity may affect panthers in the vicinity (Wear Greis 2002). The noise generated during these activities would disturb the animals infrequently and for short periods of time. Impacts would continue to be minor and short term.

In addition to impacts on the foraging opportunities of their preferred prey, exotic plants also impact the panther's preferred habitat. Upland forests, especially pine flatwoods and hardwood hammocks, have been determined to be the preferred habitat for panthers, and dense saw palmetto is the preferred denning habitat (USFWS 1999b), as well as hardwood hammocks in Everglades National Park (Alvear 2005). These vegetation communities, as well as the wetlands that support the swamp lily, are being degraded by the influx of exotic plant species such as Brazilian pepper, melaleuca, and Old World climbing fern.

Except for the noise and treatment activities, the chemicals used in treatments are generally harmless to the panther. As described in appendix J, the herbicides have been tested for effects on animals and have been determined to be extremely low in toxicity. Once applied, they also break down quickly in the environment to harmless compounds. The adverse affects on panthers would be short term and negligible.

The use of biological controls would continue to be the least intrusive in that the control agents are released once, and except for occasional monitoring, no further disruption in the form of human activity would occur. As stated above in the "Native Vegetation" section, biological controls would not have an adverse impact on the native vegetation that provides food and habitat for the panther.

Crews manage prescribed fires by creating fire breaks using heavy equipment, chain saws, and surface vehicles. This may cause a temporary disturbance as long as it is conducted during nonbreeding and denning periods. Fire management practices recommend leaving unburned escape corridors for panthers so they do not become trapped by fires or forced into areas that may place the animals in unnecessary danger. Panthers rarely cross open, unvegetated land, especially

during the day. Denning females need dense vegetation cover for their kittens and also uplands to forage for deer. They cannot forage, breed, or move about successfully in areas with no cover. Burning large areas without leaving vegetated areas for the panthers to move through would put the animals at jeopardy. After a low energy fire, the palmetto can grow to eight feet high in 5 years, and the trees would leaf out in the next season, but if the fire is too hot, it may take up to 30 years for the habitat to recover, depending on the type of habitat. The use of prescribed fire, with implementation of mitigation measures (see table 13 in the "Alternatives" chapter), would have negligible to minor short-term adverse impacts on the panthers.

Under the no-action alternative, the treatment methods used in Everglades National Park and Big Cypress National Preserve would continue to have minor adverse impacts on the panther because of the human activity involved. The impacts of herbicides on the panther would continue to be negligible.

Under the no-action alternative, all infested areas would be initially treated and then re-treated every 3 years. Exotic vegetation would be controlled, but infested areas in panther habitat would not be fully restored as part of the exotic control treatment. Panther habitats in Big Cypress National Preserve and Everglades National Park are 24% and 15% infested, respectively. Treatment of these lands under the no-action alternative would result in long-term minor beneficial impacts on panthers.

Southeastern beach mouse (*Peromyscus polionotus niveiventris*): Canaveral National Seashore — The Southeastern beach mouse is found in Canaveral National Seashore on sand dunes vegetated with such plants as sea oats and panic grass, and with adjacent scrub dominated by oaks and palmetto. Within their dune habitat, beach mice construct burrows to use as refuges, nesting sites, and food storage areas (USFWS 1999b). The *South Florida Multi-Species Recovery Plan* (USFWS 1999b) states that managing areas to avoid invasion by exotic vegetation may help to ensure the survival and recovery of the beach mouse over the long term.

Chemical and mechanical treatments would continue to be used in Canaveral National Seashore. Herbicides would be applied by ground crews with backpack sprayers with small spray nozzles. This would ensure application of herbicides only to targeted plants and reduce or eliminate potential for non-target damage to native plants the Southeastern beach mouse may use for foraging. The presence of crews and noise associated with chemical and mechanical treatment activities could cause temporary disturbance or displacement if individuals, which would be a short-term, minor, adverse effect.

Specific distribution information is not available for the Southeastern beach mouse, but there are approximately 199 acres (1% of park) of beach / dune in the park and 121 acres (61%) of these are potentially infested (see table 5 of appendixes A – I). Treatment of exotic plants would help protect habitat by maintaining native plant species that are a food source or those native plants that are critical in stabilizing dunes. This would help prevent wind and water erosion and protect other Southeastern beach mouse habitat in the vicinity. Treatment

activities would have a long-term, moderate, beneficial effect on the Southeastern beach mouse.

West Indian manatee (*Trichechus manatus*): Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park — The West Indian manatee is a fully aquatic herbivorous mammal that is most frequently found in fresh or brackish waters and may be encountered in canals, rivers, estuarine habitats, saltwater bays, and off the Florida Gulf coast. The manatee feeds primarily on submerged aquatic vegetation, predominantly seagrasses and other plants including turtle grass (*Thalassia testudinum*), manatee grass (*Syringodium filiforme*), and Cuban shoal grass (*Halodule wrightii*) (USFWS 1999b).

The effects from exotic plant management actions that could degrade water quality and adversely affect seagrasses, which the manatee relies on for foraging, mating, and calving, would also have an effect on the West Indian manatee. The use of herbicides within the parks is expected to have short-term, negligible to minor, effects on water quality when the herbicides are used as directed by EPA labeling. Therefore, the effects to the West Indian manatee from herbicide use would be of the same magnitude and duration.

If controlled burns are used to treat exotic plants in areas adjacent to waterways with the West Indian manatee, this could result in short-term negligible to minor effects to the water quality as nutrients are released from the site. Bare soils may also be exposed leading to increases in erosion potential. Following a rain event, transport of soils after a burn would increase sedimentation and turbidity in areas with submerged aquatic vegetation, which can impact the ability of submerged aquatic vegetation, such as seagrasses, to survive and grow. However, because of the rapid recovery of the vegetation and the low slopes in the region, there would be little transport of soils to the aquatic environment. The adverse effects on the West Indian manatee from prescribed fire activities would be short-term and negligible to minor. The impacts of sedimentation and turbidity on seagrass has been described in the “Vegetation” section of the “Environmental Consequences” chapter.

The use of mechanical methods to pull seedlings or cutting and mulching of monotypic stands using large trucks and equipment that would expose bare soils may lead to sediment delivery into manatee habitat. As stated above, due to the topography and the high recovery rate of vegetation in the region little transport of soils to aquatic environments would be expected. Mechanical activities to remove exotic plants would have short-term, negligible to minor, adverse impacts on the West Indian manatee.

Access to project areas via motor or airboats has the potential to result in direct physical damage to submerged aquatic vegetation. Motorboat or airboat use to access sites would be done in Everglades National Park. The impacts of motorized access on seagrasses have been described in the “Vegetation” section of the “Environmental Consequences” chapter. With access to sites limited to well-trained park staff and contractors, the direct physical effects seagrasses from access to sites would be short-term and minor. In addition, the potential for

collision with manatees from use of motorboats or airboats would be eliminated because only well-trained, knowledgeable staff would access sites.

Reptiles. The following text describes the potential impacts of alternative A on special status reptile species present in the parks addressed in this draft EPMP/EIS:

American crocodile (*Crocodylus acutus*): Biscayne National Park, Everglades National Park — The American crocodile inhabits the mangrove swamps, low-energy bays, creeks, and inland swamps from the lower end of Elliot Key on the east coast of Florida, from around Florida Bay to Cape Sable on the west coast, in Everglades National Park and Biscayne National Park. There are 370 acres (5% of park) of potential habitat within Biscayne National Park, with 6 acres potentially infested, and there are 44,356 acres (5% of park) of potential habitat within Everglades National Park, with 1,242 acres potentially infested.

The *South Florida Multi-Species Recovery Plan* (USFWS 1999b) identified exotic plants as a factor in the degradation of American crocodile habitat. Species that cause the most problems are Australian pine, melaleuca, and Brazilian pepper. These species interfere with the crocodile nesting activity by encroaching into and degrading the open nesting areas and by disturbing existing nests by sending root suckers and seedlings up through them (Pernas 2004a). Everglades National Park treats these species with chemical, mechanical, and biological methods in areas of crocodile habitat. The timing of the treatments is important because an American crocodile may abandon her nest if repeated interactions with humans occur (USFWS 1999b). The parks would continue to time actions to avoid effects during nesting periods.

Herbicides (Garlon 3a or 4, Arsenal, Renovate, Habitat, Escort, Stalker, Rodeo, or Roundup) would continue to be applied to the cut stem or foliage by ground crews using backpack sprayers or, in Everglades National Park, to the foliage with a small pore nozzle via helicopter. Depending on the location of the infestation, the dead foliage may be left in place to decay or removed by hand to reduce the fuel load. Australian pines are often left in place to provide roosting areas and cover for birds and mammals. Except for the noise and activity, chemical treatments are generally directly harmless to the American crocodile. The herbicides used by the parks are regarded as posing relatively low risk for use in natural areas because they are not likely to contaminate groundwater, have limited persistence in the environment, and are of low toxicity to animals (Tu et al. 2001). Adverse effects to the American crocodile's prey, primarily fish and other aquatic species, would be negligible as herbicides are used as directed by EPA labeling and only those herbicides approved for use over water are considered non-toxic to fish. Herbicides used above land have little potential to affect water quality due to their rapid degradation and low tendency for lateral movement. (An analysis of impacts on fish and other aquatic species is provided in the "Wildlife and Wildlife Habitats" section of the "Environmental Consequences" chapter.) Therefore the adverse impacts on the crocodile from the use of herbicides would also be short term and negligible. Impacts on the habitat in Everglades National Park could range up to minor with aerial application of herbicides because there would be some nontarget damage to native vegetation in the area. With implementation of best management practices during aerial

application, such as applying herbicides only when wind speeds are low and using spray nozzles that reduce drift (which allows for a focused application of herbicides), adverse impacts on native vegetation from aerial application would be minimal.

The chemical treatments potentially would continue to cause temporary, negligible adverse impacts on the American crocodile due to the intrusive nature of the treatment activity; the disturbance may result in the American crocodile leaving the area for a period of time (USFWS 1999b).

Hand pulling seedlings of the Australian pine, Brazilian pepper, or melaleuca would be the extent of mechanical treatment in these types of habitats. This is a maintenance activity usually conducted on sites previously treated with herbicides. As with the chemical treatments, the mechanical treatments would continue to present potential disturbance of a resident crocodile or a nesting female. The biological treatment of melaleuca would not adversely affect the habitat of the American crocodile because the controls are host specific to the exotic plants and cause no adverse impacts on native vegetation.

Under the no-action alternative, the adverse impacts on the American crocodile would be short term and negligible to minor with chemical and mechanical treatments and no adverse effects would result from the use of biological control methods.

Under the no-action alternative, all infested areas would be initially treated and then re-treated every 3 years. Exotic plants would be controlled, but crocodile habitat would not be fully restored. Crocodile habitat in Biscayne and Everglades National Parks are 2% and 3% infested, respectively. Treatment of these lands under the no-action alternative would result in long-term minor beneficial impacts.

Atlantic salt marsh snake (*Nerodia clarkii taeniata*): Canaveral National Seashore — The Atlantic salt marsh snake is found in coastal salt marshes and mangrove swamps that vary in salinity from brackish to full strength seawater. The snake feeds on small fishes, crabs, shrimp, and other invertebrates trapped in isolated pools of water by the falling tide. The predominant threat to this species is from loss of habitat due to development, and, although no specific exotic plant information is available for this species, it is likely that exotic plants provide less suitable habitat conditions in heavily infested areas.

Chemical and mechanical treatments would continue to be used in Canaveral National Seashore. Herbicides would be applied by ground crews with backpack sprayers with small spray nozzles. This would ensure application of herbicides only to targeted plants and reduce or eliminate potential for non-target damage to native plants in potential Atlantic salt marsh snake habitat. Impacts on aquatic fish and invertebrates the Atlantic salt marsh snake feeds on would be negligible as herbicides are used as directed by EPA labeling, and only those herbicides approved for use over water are considered non-toxic to fish. Herbicides used above land have little potential to affect water quality due to their rapid degradation and low tendency for lateral movement. (An analysis of impacts on fish and other aquatic species is provided in the “Wildlife and Wildlife Habitats”

section of the "Environmental Consequences" chapter.) Access to sites for treatment would result in some trampling and mortality of plants within the salt marsh snake's habitat. Noise and activity of crews would also cause displacement of some of the snake's prey species. The salt marsh snake itself may be displaced and disturbed from any vibrations and other nuisances caused by the presence of work crews and management activities; however, loss of individual snakes would not be expected. The adverse impacts would be short term and minor.

There is no specific distribution information available for the Atlantic salt marsh snake in Canaveral National Seashore; however, this species typical habitat requirement of coastal marshes and mangrove swamps covers about 29% of the park (total of two vegetation categories) and is potentially about 61% infested (34% of mangroves is potentially infested and 27% of coastal marsh is potentially infested). Treatment of these lands under the no-action alternative would result in long-term minor to moderate beneficial impacts.

Eastern indigo snake (*Drymarchon corais couperi*): Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Everglades National Park — In south Florida, the eastern indigo snake is found in pine flatwoods, pine rocklands, tropical hardwood hammocks, coastal dune/scrub areas, and in other undeveloped areas in Everglades National Park, Canaveral National Seashore, Big Cypress National Preserve, and Biscayne National Park. It appears that the snakes prefer hammocks and pine forests since they are found more frequently in these habitats. The snake feeds on small prey such as fish, frogs, toads, snakes, lizards, turtles, turtle eggs, small alligators, birds, and small mammals. Although there is no specific information available regarding the impacts exotic plants may have on this snake, assumptions can be made that a monoculture of exotic plants would provide less appropriate habitat than native habitat. Gordon (1998) stated that the infestation of exotic plants reduces the biodiversity of pine rocklands by at least half. This loss of biodiversity means there are fewer prey opportunities for the indigo snake in the infested habitat. While the *South Florida Multi-Species Recovery Plan* (USFWS 1999b) for the Eastern indigo snake does not specifically mention the control of exotic plants as part of the management plan for the species, it does state that maintaining the habitat for the snake is essential to its survival.

Pine flatwoods, pine rocklands, and tropical hardwood hammocks in the south Florida parks are generally infested with Brazilian pepper, melaleuca, and Old World climbing fern. Treatments used to control these species in these vegetation communities include mechanical, chemical, and biological methods. In the pine flatwoods, prescribed fire methods would also be employed.

The chemical methods currently in use include herbicide applications of Garlon 3a or 4, Arsenal, Renovate, Habitat, Escort, Stalker, Rodeo, or Roundup applied by ground crews using backpack sprayers or applied by aerial spraying from helicopters. Ground crews create more disturbances because they use trucks and ATVs to access treatment areas. The herbicides are applied to the cut stem or foliage with the backpack sprayers or, in the case of certain vegetation types within Big Cypress National Preserve and Everglades National Park, to the foliage with a small pore nozzle via helicopter. Application of herbicides to the habitat of the eastern indigo snake would cause negligible to minor effects as a

result of any potential adverse effects to snake habitat from non-target damage to native plants, which could result from aerial spraying. Impacts on the Eastern indigo snake's primary prey would be negligible as herbicides are used as directed by EPA labeling, and only those herbicides approved for use over water are considered non-toxic to fish. Herbicides used above land have little potential to affect water quality due to their rapid degradation and low tendency for lateral movement. Effects to amphibians would be negligible to minor. Therefore, effects on the Eastern indigo snake would also be negligible to minor. (An analysis of impacts on fish and other aquatic species is provided in the "Wildlife and Wildlife Habitats" section of the "Environmental Consequences" chapter.) Mechanical treatment in these types of habitats would be the continued use of manual hand pulling of exotic plant seedlings, which is a maintenance activity usually conducted on sites previously treated with herbicides. Prescribed fire would be the continued use of fires to control the resprouting and seedling growth of melaleuca after treatment with herbicides. The eastern indigo snake has adapted to life in fire-dependent habitats and can avoid low-energy ground fires by occupying burrows and burrow-like structures. Adverse effects from the use prescribed fire would be short term and negligible to minor.

The biological treatment of melaleuca and Old World climbing fern would not adversely affect the habitat of the eastern indigo snake because the controls are host specific to the exotic plants and cause no adverse impacts to native vegetation.

Access to sites for treatment would result in some trampling and mortality of plants within the indigo snake's habitat. Noise and activity of crews would also cause displacement of some of the snake's prey species. The indigo snake itself may be displaced and disturbed from any vibrations and other nuisances caused by the presence of work crews and management activities; however, loss of individual snakes would be unlikely. The adverse impacts would be short term and minor.

The adverse impacts on the Eastern indigo snake from exotic plant treatments would continue to be short term and range from negligible to minor in intensity.

Under the no-action alternative, exotic plants would be controlled so habitat improvements would occur, but indigo snake habitat would not be fully restored as part of the exotic control treatment. Potential indigo snake habitat is extensive throughout the south Florida parks and is from 3% to 28% infested. Depending on the quality of the habitat, treatment of these lands under the no-action alternative would result in long-term minor beneficial impacts.

Sea turtles – Green, Hawksbill, Leatherback: Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Salt River Bay National Historic Park and Ecological Preserve, Virgin Islands National Park; Kemp's Ridley, Loggerhead: Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park – Sea turtles are known to nest in Dry Tortugas National Park, Virgin Islands National Park, Buck Island Reef National Monument, Canaveral National Seashore, Everglades National Park, and Biscayne National Park. Canaveral National Seashore is a primary nesting area

for loggerhead sea turtles (*Caretta caretta*) and by far the most important sea turtle nesting area of the nine parks. The other parks are not major nesting areas. The sea turtles that nest in the parks in the study area include the green (*Chelonia mydas*), loggerhead, leatherback (*Dermochelys coriacea*), and hawksbill (*Eretmochelys imbricata*). Although uncommon, Kemp's ridley (*Lepiochelys kempii*) has also been recorded nesting in Canaveral National Seashore.

As stated in the "Affected Environment" chapter, Australian pines are the primary exotic plant species affecting the sea turtles in the south Florida parks. The Australian pines have shallow root systems that interfere with nesting activities. These trees also may shade nests, causing temperature changes and associated changes in the natural sex ratio of hatchlings. Australian pines can also discourage nesting female sea turtles and trap emerging nestlings, and removal of fallen and treated Australian pines on beaches can result in increased sea turtle nesting activity (Addison et al. 1998). These impacts have occurred in Dry Tortugas National Park and Everglades National Park to some extent, but the Australian pines have since been treated in these areas, and no further impacts on sea turtles are expected in the future. However, Australian pines have the ability to germinate and grow quickly, and within 2 years, the trees could again present a problem.

The most effective way to control Australian pines is a combination of mechanical and chemical treatment. In most cases, the trees are treated and left in place to decay, but to benefit the sea turtles, the trees are cut down and removed. The herbicides that would be used have not been analyzed for toxicity on reptiles. The herbicides used by the parks are regarded as posing relatively low risk for use in natural areas because they have limited persistence in the environment and are of low toxicity to animals (Tu et al. 2001). The adverse affects on the sea turtles would be short term and negligible. Accessing the infestation sites and treating the trees may impact existing sea turtle nests. However, by implementing mitigation measures such as identifying nesting habitat and setting up buffers to avoid habitat (see table 13 in the "Alternatives" chapter), access to these areas for treatment and the treatment activities would have no impact or negligible adverse impacts on the sea turtles and their nests.

The adverse impacts of Australian pine treatments on sea turtles would continue to be short term and negligible in intensity under the no-action alternative.

Under the no-action alternative, all infested areas would be initially treated and then re-treated every 3 years. Exotic plants would be controlled, but the potential for re-infestation of the sites would still exist. The benefits of controlling the Australian pine would be long term and minor.

Exotic plants are not known to infest or currently affect sea turtle nesting in the Caribbean parks. Management activities to control exotic plants under alternative A would have no adverse effects on the sea turtles but would benefit the turtles from any future encroachment of exotic plants into the nesting areas.

Birds. The following text describes the potential impacts of alternative A on special status bird species present in the parks addressed in this draft EPMP/EIS:

Audubon's crested caracara (*Polyborus plancus audubonii)*: Everglades National Park — The crested caracara occupies open country, predominantly dry prairie with wetter areas and scattered cabbage palm (*Sabal palmetto*). They also occur in some improved pasture lands and even in lightly wooded areas with more limited stretch of open grassland. The crested caracara feeds on both carrion and living prey. The living prey are usually small turtles and turtle eggs, as well as insects, fish, frogs, lizards, snakes, birds, and small mammals.

Everglades National Park would treat approximately 10% of the potential infested habitat for the sparrow under the no-action alternative (see table 35). There is no specific distribution information available for the crested caracara in Everglades National Park; however, the caracara's typical habitat requirement of dry prairie and grasslands is in the grassland / coastal strand vegetation category, which covers less than 1% of the park and is potentially about 10% infested. The exotic plants in this area would continue to be treated with chemical, mechanical, physical, and biological methods.

Herbicides would continue to be applied to the cut stem or foliage by ground crews using backpack sprayers or to the foliage with a small pore nozzle via helicopter. The herbicides identified for continued use in the parks are known to be of low toxicity to birds and are regarded as posing relatively low risk for use in natural areas because they have limited persistence in the environment (Tu et al. 2001). Aerial spraying may have some adverse impacts to individual species the caracara may prey on; however because herbicides are used as directed by EPA labeling effects to fish and amphibians would be negligible to minor. Herbicides labeled for use above water are considered non-toxic to fish, and herbicides used above land have little potential to affect water quality due to their rapid degradation and low tendency for lateral movement. (An analysis of impacts on fish and amphibians is provided in the "Wildlife" section of the "Environmental Consequences" chapter.) The adverse effects on the crested caracara would be short term and negligible to minor.

Mechanical treatment in these types of habitats would be the hand pulling of exotic plant seedlings, which is a maintenance activity usually conducted on sites previously treated with herbicides. The use of prescribed fire as a re-treatment tool would be implemented in collaboration with the parks' fire management plan and coordination with the USFWS. Mitigation measures would be implemented, such as avoidance of sensitive nesting periods, so that nesting activities would not be disrupted. The presence of crews conducting mechanical and chemical treatments within the habitat of the caracara during non-breeding seasons, as well as the use of helicopters for treatment and monitoring, may result in the disturbance and temporary displacement or flight response of individual birds. Adverse effects from noise, presence of crews, and management activities would result in short-term minor impacts.

The biological treatment of melaleuca would not adversely affect the crested caracara because native vegetation within the habitat would not be affected.

Hand pulling melaleuca

Under the no-action alternative, the adverse impacts on the Audubon's crested caracara would continue to be short term and negligible to minor with chemical, physical and mechanical treatments. Under the no-action alternative, all infested areas would be initially treated and then re-treated every 3 years. Exotic plants would be controlled, but infested areas in crested caracara habitat would not be fully restored. Estimated potential habitat (grassland / coastal strand vegetation category) covers less than 1% of the terrestrial area of Everglades National Park, with potential infestation of about 10%. Treatment of these lands under the no-action alternative would result in long-term negligible to minor beneficial impacts.

Bald eagle (*Haliaeetus leucocephalus*): Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park — Bald eagles are currently nesting in three of the parks, and much of this habitat is infested with exotic plants. Canaveral National Seashore has 2,736 acres of potential eagle habitat, and 526 acres of this habitat are infested. Big Cypress National Preserve has 7,242 acres of potential eagle nesting habitat, and 598 acres of this habitat is infested. Everglades National Park has 4,177 acres of potential bald eagle habitat, and 144 acres of this habitat are infested. Bald eagles are also known to occur in Biscayne National Park although specific distribution information is not available. The exotic plants are not likely to be a cause for concern unless they are encroaching on a nesting tree with the potential to cause that tree to decline. A greater concern for the continued success of the bald eagle in south Florida is the disturbance caused by the crews on the ground treating and clearing the exotic plants and the crews in helicopters conducting aerial spraying.

The herbicides (Garlon 3a or 4, Arsenal, Renovate, Habitat, Escort, Stalker, Rodeo, or Roundup) would be applied by ground crews using backpack sprayers or applied by aerial spraying from helicopters. The herbicides are applied to the cut stem or foliage with the backpack applicators or, in the case of Big Cypress National Preserve and Everglades National Park, to the foliage via a helicopter equipped with a small-pore nozzle. Aerial and ground crews would not be deployed within a 750-foot to 1-mile radius of nesting bald eagles during sensitive breeding and nesting times of the year (see table 13 in the "Alternatives" chapter). Ground application of the herbicide using best management practices would reduce the potential for nontarget damage to native vegetation within the eagle habitat. The herbicides identified for continued use in the parks are known to be of low toxicity to birds and are regarded as posing relatively low risk for use in natural areas because they have limited persistence in the environment (Tu et al. 2001). Aerial application of herbicides in the eagle habitat would result in loss of some individual native plants when nonselective herbicides are applied. With implementation of best management practices, the impacts of aerial application of herbicides on native vegetation in the habitat of the eagle would be minor. Nesting eagles are extremely vulnerable and may abandon a nest if disturbance occurs, so parks would identify the locations of the nests and time the maintenance activity so that no disturbance occurs. Bald eagles feed primarily on fish, and sometimes reptiles and amphibians. Effects to the bald eagle's primary prey would be negligible to minor because herbicides are used as directed by EPA labeling. Herbicides labeled for use above water are considered non-toxic to fish, and herbicides used above land have little potential

to affect water quality due to their rapid degradation and low tendency for lateral movement into aquatic environments. (An analysis of impacts on fish and amphibians is provided in the "Wildlife" section of the "Environmental Consequences" chapter.) Therefore, the adverse effects on the bald eagle would also be negligible to minor.

Mechanical treatment in these types of habitats would continue to be the hand pulling of exotic plant seedlings. This is a maintenance activity that is usually conducted on sites previously treated with herbicides. Prescribed fire would be the use of fires to control resprouting and seedling growth after treatment with herbicides. The fires would continue to be implemented with collaboration with fire management plans for the maintenance of the bald eagle habitat. Mitigations regarding the use of prescribed fire would include performing prescribed fires outside the nesting season and creating a buffer around known nests for avoidance. Roosting sites of the bald eagle could be affected, but the eagle could temporarily relocate. Adverse effects from the use of fire would be short term and negligible to minor. Biological treatment of melaleuca and Old World climbing fern would have no impact on the native vegetation within bald eagle habitat.

Under the no-action alternative, the adverse effects to the bald eagle would continue to be short term and negligible to minor with chemical, physical, and mechanical treatments, as long as the mitigation measure of avoiding the habitat during breeding season is followed.

In Big Cypress National Preserve, Canaveral National Seashore, and Everglades National Park, alternative A would passively restore 8%, 19%, and 3% of the bald eagle habitat, respectively. The beneficial effects from exotic plant management actions would be long term and minor. Biscayne National Park would also experience similar beneficial effects.

Brown pelican (Pelecannis occidentialis): Buck Island Reef National Monument, Salt River Bay National Historic Park and Ecological Preserve, Virgin Islands National Park — The Caribbean subspecies of brown pelican, *Pelecannis occidentialis*, is a large, brown water bird that nests in colonies on coastal islands. Nests are generally built in mangrove trees, but ground nests are also used. Nest types vary from practically nothing to well-built structures of sticks, reeds, palmetto leaves, and grass.

Herbicides would continue to be applied to the cut stem or foliage of exotic plants by ground crews using backpack sprayers. The use of best management practices during ground applications of the herbicides would reduce the potential for nontarget damage to native vegetation within the habitat of the brown pelican. The herbicides identified for continued use in the parks are known to be of low toxicity to birds and are regarded as posing relatively low risk for use in natural areas because they have limited persistence in the environment (Tu et al. 2001). The diet of the brown pelican consists of fish and sometimes crustaceans. Effects to fish, the brown pelican's primary food source would be negligible because herbicides are used as directed by EPA labeling. Herbicides labeled for use above water are considered non-toxic to fish, and herbicides used above land have little potential to affect water quality due to their rapid degradation and low tendency

for lateral movement. Therefore, the adverse effects on the brown pelican would also be short term and negligible.

Mechanical treatment in these types of habitats would continue to be the hand pulling of exotic plant seedlings, which is a maintenance activity usually conducted on sites previously treated with herbicides. The presence of ground crews and noise and disruption from mechanical and chemical treatment activities could temporary disturb individuals birds or cause temporary flight response, though these effects would be short-term, and negligible to minor because the brown pelicans have, in the past, not shown much sensitivity to past treatment actions. The parks would continue to observe responses of brown pelicans and mitigate actions accordingly.

There are about 154 acres of potential habitat in Virgin Islands National Park (2% of park), about 9 acres of potential habitat in Buck Island Reef National Monument (5% of park), and 87 acres of potential habitat (20% of park) in Salt River Bay National Historic Park and Ecological Preserve, and this potential habitat is 33% infested in Buck Island and 52% infested in Salt River Bay. The potential habitat in Virgin Islands National Park is not currently infested. The beneficial effects from treatment of exotic plants in infested areas of potential brown pelican habitat under the no-action alternative would be long term and moderate.

Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*): Big Cypress National Park, Everglades National Park — The Cape Sable seaside sparrow occurs in the short hydroperiod marl prairies of Big Cypress National Preserve and Everglades National Park (USGS 2003). These areas are being invaded by melaleuca, Brazilian pepper, and native woody species, which degrade the habitat for the birds. The *South Florida Multi-Species Recovery Plan* (USFWS 1999b) identifies the control of exotic plants as one of the essential factors in the restoration and maintenance of the Cape Sable seaside sparrow. Other factors that led to the decline of the species are the artificial fluctuations of the “managed” water flows, the influx of salt-tolerant plant species, the spread of cattail due to raised nutrient levels, and the conversion of habitat to agriculture. Everglades National Park would treat approximately 10% of the potential infested habitat for the sparrow under the no-action alternative (see table 35). There is no specific distribution information available for Big Cypress National Preserve; however, the sparrow’s typical habitat requirement of marl prairie is in the sawgrass marsh / wet prairie / freshwater prairie vegetation category, which covers about 34% of the park and is potentially about 17% infested. The exotic plants in this area would continue to be treated with chemical, mechanical, and biological methods.

Herbicides would continue to be applied to the cut stem or foliage by ground crews using backpack sprayers or to the foliage with a small pore nozzle via helicopter. The herbicides identified for continued use in the parks are known to be of low toxicity to birds and are regarded as posing relatively low risk for use in natural areas because they have limited persistence in the environment (Tu et al. 2001). Aerial spraying may have some adverse impacts to individual invertebrates the sparrow may prey on; however invertebrate populations would not be affected beyond the population level and would not be expected to adversely affect the seaside sparrow’s prey base. (An analysis on invertebrate

populations in included in the "Wildlife and Wildlife Habitats" section of "Environmental Consequences" chapter.) The adverse effects on the Cape Sable seaside sparrow would be short term and negligible.

Mechanical treatment in these types of habitats would be the hand pulling of exotic plant seedlings, which is a maintenance activity usually conducted on sites previously treated with herbicides. The use of prescribed fire as a re-treatment tool to control the resprouting and seedling growth of melaleuca and woody vegetation would be implemented in collaboration with the parks' fire management plan and coordination with the USFWS. Mitigation measures would be implemented, such as avoidance of sensitive nesting periods, so that nesting activities would not be disrupted. The presence of crews and use of helicopters conducting mechanical and chemical treatments and monitoring within the habitat of the sparrow during non-breeding seasons may result in the disturbance and temporary displacement or flight response of individual birds. Adverse effects from noise, presence of crews, and management activities would result in short term minor impacts.

The biological treatment of melaleuca would not adversely affect the Cape Sable seaside sparrow because native vegetation within the habitat would not be affected. The sparrow has a generalist diet and commonly feeds on soft-bodied insects so the increase in biological control insects may provide additional prey, which would be a long-term, negligible, beneficial effect.

Under the no-action alternative, the adverse impacts on the Cape Sable seaside sparrow would continue to be short term and negligible to minor with chemical, physical and mechanical treatments. Under the no-action alternative, all infested areas would be initially treated and then re-treated every 3 years. Exotic plants would be controlled, but infested areas in Cape Sable seaside sparrow habitat would not be fully restored. Cape Sable seaside sparrow habitat covers 11% of the terrestrial area of Everglades National Park, which potential infestation of about 10%. There is no specific distribution information available for Big Cypress National Preserve; however, the sparrow's typical habitat requirement of marl prairie is in the sawgrass marsh / wet prairie / freshwater prairie vegetation category, which covers about 34% of the park and is potentially about 17% infested. Treatment of these lands under the no-action alternative would result in long-term minor beneficial impacts.

Everglade snail kite (*Rostrhamus sociabilis plumbeus*): Big Cypress National Preserve, Everglades National Park — The Everglade snail kite is an endangered raptor that inhabits the freshwater marshes and marl prairies of Everglades National Park and Big Cypress National Preserve. The *South Florida Multi-Species Recovery Plan* (USFWS 1999b) for the kite lists the preservation and restoration of nesting and foraging habitat as one of the primary actions of species recovery, and one of the key elements of that action is the control of exotic plants, especially Australian pine and Brazilian pepper. The plan lists melaleuca and Brazilian pepper specifically as species to target. The parks would continue to use chemical, physical, mechanical, and biological methods to control these species in snail kite habitat.

Herbicides (Garlon 3a or 4, Arsenal, Renovate, Habitat, Escort, Stalker, Rodeo, or Roundup) would continue to be applied to the cut stem or foliage by ground crews using backpack sprayers or to the foliage with a small pore nozzle via helicopter. The use of best management practices during ground applications of the herbicides would reduce the potential for nontarget damage to native vegetation within the habitat of the snail kite. The herbicides identified for continued use in the parks are known to be of low toxicity to birds and are regarded as posing relatively low risk for use in natural areas because they have limited persistence in the environment (Tu et al. 2001). Aerial application of herbicides in the snail kite habitat would result in loss of some individual native plants when nonselective herbicides are applied. With implementation of best management practices, the impacts of aerial application of herbicides on native vegetation in the habitat of the kite would be minor. Treatment actions would not be conducted during nesting season in order to avoid impacting the nests, chicks, and apple snails, which are the prey of the snail kite. The adverse effects of herbicide application on the kite would be short term and negligible to minor. Mechanical treatment in these types of habitats would continue to be the hand pulling of exotic plant seedlings, which is a maintenance activity usually conducted on sites previously treated with herbicides. The melaleuca are usually pulled during the dry season to prevent impacts on wetlands.

Prescribed fire would be the use of fires to control the resprouting and seedling growth of melaleuca after treatment with herbicides. The fires can be implemented in collaboration with the prescribed fire program for habitat improvement and would further benefit the snail kite when the shrubby vegetation in or near lake shores and dense growths of herbaceous vegetation (like cattail) in wetlands are burned. The use of prescribed fire could cause temporary disturbance and relocation of snail kites, a short-term, negligible to minor, adverse effect; however, prescribed fires would not be conducted near nests during the nesting season to eliminate potential effects to nesting activities.

The biological treatment of melaleuca would not adversely affect the native habitat of Everglade snail kites because native vegetation within the habitat would be minimally affected.

Treatment activities and the presence of crews, vehicles, and helicopters within the habitat of the snail kite may result in the disturbance and temporary displacement or flight response of individual birds. This level of disturbance related to these control methods would result in short-term minor impacts. With implementation of current mitigations, such as avoiding treatment of exotic plants near nests during the snail kite nesting season, effects on snail kite reproductive success in the parks would be eliminated.

Under the no-action alternative, adverse impacts on Everglade snail kites would continue to be short term and negligible to minor with chemical, physical, and mechanical actions, as described above. Treatment activities would cause temporary adverse impacts on the Everglade snail kites due to disturbance from the presence of work crews and noise associated with activities, and these effects would be short term and minor.

Under the no-action alternative, all infested areas would be initially treated and then re-treated every 3 years. Exotic plant species would be controlled, but infested areas in Everglade snail kite habitat would not be fully restored. Habitat in Big Cypress National Preserve and Everglades National Park is 28% and 30% infested, respectively. Treatment of these lands under the no-action alternative would result in long-term minor beneficial impacts on Everglade snail kites.

Florida scrub-jay (Aphelocoma coerulescens): Canaveral National Seashore — The Florida scrub-jay is found in the scrub oak habitat in Canaveral National Seashore. Although the *South Florida Multi-Species Recovery Plan* (USFWS 1999b) does not specifically list exotic plant species as one of the reasons for the decline of the scrub-jay populations, the encroachment into their habitat by Brazilian pepper is a major problem in the park. The Brazilian pepper would continue to be controlled by chemical and mechanical methods in Canaveral National Seashore.

Herbicides (Garlon 3a or 4, Arsenal, Renovate, Habitat, Escort, Stalker, Rodeo, or Roundup) would continue to be applied to the cut stem or foliage by ground crews using backpack sprayers. The use of best management practices during ground applications of the herbicides would reduce the potential for nontarget damage to native vegetation within the habitat of the scrub-jay. The herbicides identified for continued use in the parks are known to be of low toxicity to birds and are regarded as posing relatively low risk for use in natural areas because they have limited persistence in the environment (Tu et al. 2001). Chemical treatments would not be conducted during nesting season to avoid impacting the nests and chicks. The scrub jay's diet consists predominantly of insects and scrub oak acorns. Because herbicides would be applied by ground crews, nontarget damage to native scrub oaks would be minimized and would not affect this food source. The use of herbicides may have some adverse impacts to individual invertebrates the Florida scrub jay may prey on; however invertebrate populations would not be affected beyond the population level and would not be expected to adversely affect the scrub jay's prey base. (An analysis on invertebrate populations in included in the "Wildlife and Wildlife Habitats" section of the "Environmental Consequences" chapter.) The adverse affects on the scrub-jay would be short term and negligible.

Mechanical treatment in these types of habitats would continue to be the hand pulling of exotic plant seedlings, which is a maintenance activity usually conducted on sites previously treated with herbicides. The presence of crews and any noise associated with exotic plant management actions could temporarily disturb individual birds and they may temporarily relocate during treatment actions, but these actions would not occur during the nesting season to eliminate potential effects to reproductive success. Under the no-action alternative, the adverse impacts on the Florida scrub-jay would continue to be short term and minor with treatment activities.

The potential Florida scrub-jay habitat is approximately 1,744 acres (12% of park) and is potentially 17% infested. The beneficial effects from treatment of exotic plants in infested areas of potential scrub jay habitat under the no-action alternative would be long term and minor.

Piping plover (Charadrius melodus): Biscayne National Park, Everglades National Park, Virgin Islands National Park — Piping plovers use open, sandy beaches close to the primary dune of the barrier islands and coastlines of the Atlantic for breeding. They prefer sparsely vegetated open sand, gravel, or cobble for a nest site, and forage along the rack line where the tide washes up onto the beach. They are considered a rare summer migrant to the Virgin Islands.

Chemical and mechanical treatments would continue to be used in Biscayne National Park and Virgin Islands National Park. Chemical, physical, biological, and mechanical treatments would continue to be used in Everglades National Park. Herbicides would be applied by ground crews with backpack sprayers with small spray nozzles. Mitigation measures would be implemented to reduce potential for non-target damage to native plants the piping plover may use for habitat. Negligible to minor, short-term, adverse effects from the use of herbicides and associated non-target damage would be expected because the piping plover's habitat tends to be sparsely vegetated. The presence of crews and noise associated with treatment activities could cause temporary disturbance or displacement of individuals, which would be a short-term, minor, adverse effect. The piping plover feeds primarily on marine, freshwater, and terrestrial invertebrates. Herbicide use may have some adverse impacts to individual invertebrates the piping plover may prey on; however invertebrate populations would not be affected beyond the population level and would not be expected to adversely affect the piping plover's prey base. (An analysis on invertebrate populations in included in he "Wildlife and Wildlife Habitats" section of the "Environmental Consequences" chapter.)

Specific distribution information is not available for the piping plover, but there are approximately 58 acres of beach / dune in Biscayne National Park (2% infested) and 2 acres of beach / dune in Everglades National Park (50% infested) (see table 5 of appendixes A – I). Treatment of exotic plants would help protect habitat by maintaining native plant species in piping plover habitat. Treatment activities would have a long-term, negligible, beneficial effect on the piping plover.

Red-cockaded woodpecker (Picoides borealis): Big Cypress National Preserve — The red-cockaded woodpecker is a federally endangered species occurring in the pine flatwoods of the Big Cypress National Preserve. The habitat preferences of this species make it very important to manage their habitat in order to sustain the existing populations and maximize their population growth. While exotic plant species were not specifically mentioned in the *South Florida Multi-Species Recovery Plan* (USFWS 1999b), the plan stresses the importance of maintaining an open understory in the habitat by burning or manually removing the encroaching woody species. Approximately 44% of the 2,029 acres of potential habitat in Big Cypress National Preserve is infested with melaleuca and Brazilian pepper. The treatment methods used in Big Cypress National Preserve to control these species would be chemical, mechanical, physical, and biological.

Herbicides (Garlon 3a or 4, Arsenal, Renovate, Habitat, Escort, Stalker, Rodeo, or Roundup) would continue to be applied to the cut stem or foliage by ground crews using backpack sprayers or to the foliage with a small pore nozzle via helicopter. The park would implement mitigation by restricting application of

herbicides within a 1-mile buffer around red-cockaded woodpecker nests to eliminate the risk of nontarget damage to native vegetation the red-cockaded woodpecker uses for foraging and nesting. The herbicides identified for use in the parks are known to be of low toxicity to birds and are regarded as posing relatively low risk for use in natural areas because they have limited persistence in the environment (Tu et al. 2001). The adverse affects on the red-cockaded woodpecker would be short term and negligible.

Mechanical treatment in these types of habitats would be the hand pulling of exotic plant seedlings, which is a maintenance activity usually conducted on sites previously treated with herbicides. Prescribed fires would continue to be the prescribed fire used to control the resprouting and seedling growth of melaleuca after treatment with herbicides. The red-cockaded woodpecker has adapted to life in fire-dependent habitats and would not be adversely affected by a low-energy ground fire. The presence of crews conducting mechanical, chemical, and prescribed fires and use of vehicles and helicopters within the habitat of the woodpecker may result in the disturbance and temporary displacement or flight response of the birds. With implementation of mitigation measures such as avoiding treatment activities during nesting season, noise and activity associated with these control methods would result in minor short-term impacts to individuals of the species.

The biological treatment of melaleuca would not adversely affect the red-cockaded woodpecker because the controls are host specific to the exotic plants and would cause no adverse effects on native vegetation. Under the no-action alternative, the adverse impacts on the red-cockaded woodpecker would be short term and negligible to minor with chemical, physical, and mechanical treatments. Biological controls would have no adverse effects on the species or its habitat. Red-cockaded woodpeckers primarily feed on adults, eggs, and larvae of arthropods so the increase in biological control insects may provide additional prey, which would be a long-term, negligible, beneficial effect.

All infested areas would be initially treated and then re-treated every 3 years. Exotic plants would be controlled, but habitat would not be fully restored. Treatment of the 441 acres of potential habitat that is infested (22% of potential habitat) within Big Cypress National Preserve would result in long-term minor beneficial impacts.

Roseate tern (Sterna dougallii dougallii): Dry Tortugas National Park, Everglades National Park, Virgin Islands National Park — The roseate terns in Florida and Virgin Islands predominantly nest in relatively open areas, often with no cover nearby. Although they have also been known to nest with some cover (e.g., rocks, crevices, vegetation) and nesting sites are sometimes densely vegetated (USFWS 1999b). Roseate terns often fly into the wind or hover over schools of fish and then feed on fish by plunging into the water. These birds are known to occur in Dry Tortugas National Park, Everglades National Park, and Virgin Islands National Park. Potential habitat is not known to be infested in Virgin Islands National Park, and although specific distribution information is not available for Everglades National Park, habitat would likely fall in the beach / dune vegetation category which is 50% infested.

Chemical and mechanical treatments would be used to treat exotic plants in Everglades National Park, and although physical and biological treatment methods would also occur in Everglades National Park, they would not be likely to occur in habitat of the roseate tern. Herbicides would be applied by ground crews with backpack sprayers with small spray nozzles, or in the case of Everglades National Park, by helicopter. Mitigation measures would be implemented to reduce potential for non-target damage to native plants the roseate tern may use for nesting, but short-term, adverse effects could be negligible to minor. The herbicide itself would have a negligible effect on fish, the roseate tern's prey base, because herbicides are applied according to EPA labeling, and herbicides approved for use above water are considered non-toxic to fish. Therefore, effects on the roseate tern would also be short term, adverse, and negligible. (An analysis of effects on fish is included in the "Wildlife and Wildlife Habitats" section of the "Environmental Consequences" chapter.)

The presence of crews and noise associated with treatment activities, and from helicopters in Everglades National Park, could cause temporary disturbance or flight response of individuals, which would be a short-term, minor, adverse effect. Activities would not be conducted near nests during the nesting season (see table 13 in the "Alternatives" chapter). The potential habitat in Virgin Islands National Park is not currently infested with exotic plants, and observational monitoring and immediate treatment would prevent infestation. The potential adverse effects would be short term, negligible and adverse.

Although specific distribution information is not available for the roseate tern in Everglades National Park, there are approximately 2 acres of beach / dune that may include suitable habitat that is about 50% infested. There is 1 acre of potential habitat in Virgin Islands National Park that is not known to be infested. Exotic plant management actions under the no-action alternative would have a long-term, negligible, beneficial effect on the roseate tern.

Wood stork (*Mycteria americana*): Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Everglades National Park — Wood storks are found in Biscayne National Park, Big Cypress National Preserve, Canaveral National Seashore, and Everglades National Park. These areas historically supported large nesting colonies, but the manipulation of the hydrology and the encroachment of development have resulted in the decline of the species, and the wood stork is now an endangered species (USFWS 1999b). The *South Florida Multi-Species Recovery Plan* (USFWS 1999b) does not list exotic plant species as a major cause of the decline of the wood stork, but does mention that the birds often use Brazilian pepper, melaleuca, and Australian pine for nesting and roosting sites. Wood storks would abandon habitat in response to aircraft overflights, and studies show that wildlife responds more strongly to helicopters (NPS 1994a). It is therefore vital to the survival of these species that the aerial spraying not be conducted near rookeries or nesting areas, especially during breeding season.

Wood storks use a variety of habitat types for foraging, including marshes, ponds, ditches, creeks, tidal pools, cypress heads, and swamp sloughs, and the three exotic species (Brazilian pepper, melaleuca, and Australian pine) occur in all of those habitat types, which are treated with chemical, physical, mechanical,

and biological method. The treatment and removal of exotic plants in infested areas would pose short-term, adverse effects because of the potential loss of nesting or roosting sites. For those parks we have distribution information, potential habitat in Big Cypress National Preserve, Canaveral National Seashore, and Everglades National Parks is 19%, 25%, and 16% infested, respectively. Therefore, adverse effects would be of negligible intensity because there is plenty of available potential habitat that is not infested within the parks

Herbicides (Garlon 3a or 4, Arsenal, Renovate, Habitat, Escort, Stalker, Rodeo, or Roundup) would continue to be applied to the cut stem or foliage by ground crews with backpack sprayers or to the foliage with a small pore nozzle via helicopter. Best management practices would be employed during ground application of the herbicides so as to reduce the potential for nontarget damage to native vegetation within the habitat of the wood stork. The herbicides identified for use in the parks are known to be of low toxicity to birds. In addition, the herbicides that would continued to be used by the parks are regarded as posing relatively low risk for use in natural areas because they have limited persistence in the environment (Tu et al. 2001). Herbicide effects on fish, the wood stork's prey, would be negligible because herbicides are applied according to EPA labeling, and therefore effects to the wood stork from consuming fish would also be considered negligible. Aerial application of herbicides in the wood stork habitat in Big Cypress National Preserve and Everglades National Park would result in loss of some individual native plants when nonselective herbicides are applied. With implementation of best management practices, the effects of aerial application of herbicides on native vegetation in the habitat of the stork would be minor.

Mechanical treatment in these types of habitats would continue to be the hand pulling of exotic plant seedlings, which is a maintenance activity usually conducted on sites previously treated with herbicides. Prescribed fire would be the use of fires to control the resprouting and seedling growth of melaleuca after treatment with herbicides. There would be no effects to individual woods storks from prescribed fire because adult wood storks can easily fly away from fire activities and easily change foraging areas within the park. Also, prescribed fire activities would not be conducted near nests during the wood stork nesting season. The melaleuca are usually pulled during the dry season to reduce turbidity impacts on wetlands. The biological treatment of melaleuca would not affect wood stork habitat.

The presence of crews conducting mechanical, physical, and chemical treatments within the habitat of the wood stork may result in the disturbance and temporary displacement of individual birds, resulting in short-term minor impacts. With implementation of current mitigations, including avoiding treatment of exotic plants during wood stork nesting season and not applying herbicides aerially in areas of known nesting or rookery sites, would eliminate effects on the wood stork reproductive success in the parks.

Under the no-action alternative, the adverse impacts on the wood stork would continue to be short term and negligible to minor with chemical, physical, and mechanical treatments. The treatments would continue to cause temporary adverse impacts on wood storks due to the intrusive nature of the treatment

activity, but with implementation of a mitigation measure to avoid activities near nests during the nesting period, these effects would be short term and negligible to minor.

Under the no-action alternative, all infested areas initially would initially be treated and then be re-treated every 3 years. Exotic plants would be controlled, but infested areas in wood stork habitat would not be fully restored. Habitat in Big Cypress National Preserve, Canaveral National Seashore, and Everglades National Park is 19%, 25%, and 16% infested, respectively, and although there is no specific information on wood stork habitat in Biscayne National Park, there is low infestation mangroves and freshwater marsh vegetation categories. Considering the relatively low effect that exotic plants have on wood storks, treatment of these lands under the no-action alternative would result in long-term minor beneficial impacts.

Invertebrates. The following text describes potential impacts of alternative A on special status invertebrate species present in the parks addressed in this draft EPMP/EIS:

Miami blue butterfly (*Cyclargus thomasi bethunebakeri*): Biscayne National Park, Everglades National Park — The Miami blue butterfly is known to inhabit tropical coastal hammocks, pinelands, pine rocklands, and open coastal areas. Populations of this butterfly have been reintroduced into selected areas of Biscayne National Park and Everglades National Park. The areas the Miami blue butterfly have been reintroduced include areas that were previously infested with exotic plants, but since have been treated and native vegetation has returned (NPS 2004n). These areas were selected for reintroduction because of suitable habitat and sufficient nectar sources in close proximity. Because the Miami blue butterfly is known to exhibit colonial and sedentary behaviors (USFWS 2005j), the reintroduced population is not expected to travel a considerable distance to areas of the park that may be infested with exotic plants. In addition, any potential future reintroductions would also be performed in areas deemed to have suitable habitat, of which infested areas would not be considered suitable. Therefore, treatment actions are not expected to occur in Miami blue butterfly habitat so no adverse effects would be anticipated. Removing the exotic plants in the infested areas of the park would slow the potential spread of exotic plants into the habitat of the Miami blue butterfly, and with the observational monitoring that would occur under alternative A, infestations into this habitat could be controlled, which would result in no adverse effects and beneficial effects that would be long term and minor in intensity.

Schaus swallowtail butterfly (Papilio aristodemus): Biscayne National Park — Schaus swallowtail butterfly is a resident of the tropical hardwood hammocks of Biscayne National Park. The *South Florida Multi-Species Recovery Plan* (USFWS 1999b) lists the elimination of exotic plants as one of the elements in its proposed species recovery actions. The primary species impacting the butterfly's habitat are Brazilian pepper and lather leaf. These species are treated at the park by chemical and mechanical treatment methods.

Chemical treatment is performed using an herbicide (such as Garlon 3a and 4, Habitat, Renovate, Arsenal, Roundup, Rodeo, Escort, and/or Stalker) that is

applied by ground crews using a backpack sprayer to the foliage or cut stem of the exotic plants. The Schaus swallowtail butterfly primarily uses citrus, torchwood, and wild lime (*Zanthoxylum fagara*) as host plants in their larval form, and nectar from blossoms of cheese shrub (*Morinda royoc*), blue porterweed (*Stachytarpheta jamaicensis*), sea grape (*Coccoloba uvifera*), wild sage (*Lantana involucrata*), wild coffee (*Psychotria nervosa*), or guava (*Psidium guajava*) along the margins of the hardwood hammocks. Because the application of herbicides on the ground is precise with minimal drift, there would be little nontarget damage to the native plants the butterfly uses for larval development or as a food source. Therefore adverse impacts on the Schaus swallowtail butterfly would be short term and negligible.

Mechanical treatment in the hardwood hammocks is limited to the hand pulling of exotic plant seedlings when possible. This is a low-impact method in that it does negligible damage to native vegetation and would have no effect on the butterfly. Some trampling of vegetation would continue to occur during treatment activities, but the trampled vegetation would recover quickly.

Under the no-action alternative, there would continue to be negligible adverse impacts on the Schaus swallowtail butterfly. The passive restoration that results from exotic plant treatment increases opportunities for the native hammock species to flourish, which would continue to provide minor long-term benefits to the Schaus swallowtail butterfly.

Stock Island tree snail (*Orthalicus reses*): Big Cypress National Preserve, Everglades National Park — The Stock Island tree snail was introduced into Everglades National Park and Big Cypress National Preserve in the 1980s in tropical hardwood hammocks, although their status is considered to be declining or extirpated (completely gone). The *South Florida Multi-Species Recovery Plan* (USFWS 1999b) identified Brazilian pepper and Australian pine as the species most detrimental to the survival of the tree snail and removal of exotic plants key to the survival of this species. These species would continue to be treated by chemical and mechanical method. The chemical treatments would continue to include herbicides such as Garlon 3a and 4, Habitat, Renovate, Arsenal, Roundup, Rodeo, Escort, and/or Stalker applied by with a backpack sprayer to the foliage or cut stem of the exotic plant. Because the application of herbicides on the ground is accurate with minimal drift, there would be little nontarget damage to the native plants used by the tree snail or contact of herbicide to individual snails if they are present in the parks. The adverse impacts to the snail and its habitat would be short-term and negligible.

Mechanical treatment of exotic plants within the hardwood hammocks would continue to be limited to the pulling of seedlings when possible. This is a low-impact method that would have negligible adverse impacts on the native plants used by the tree snail. Many of these areas are surrounded by wet prairie or sawgrass marsh, and accessing them on the ground may cause adverse impacts on native vegetation through crushing by vehicle or trampling underfoot. Thus, access to the site may result in damage to the native vegetation used by the snail. Loss of individual plants would have a negligible adverse impact on the snail.

Under the no-action alternative, the passive restoration that would occur as a result of treatment of tropical hardwood hammocks would produce long-term minor beneficial impacts.

Cumulative Impacts

Through the combined actions of the parks and the various state and local programs, there is coordinated action to address the growing crisis facing the state of Florida with respect to exotic plant species. This includes state legislation (the *Everglades Forever Act*) requiring the South Florida Water Management District to establish a program for coordinating management of exotic plants with other federal, state, and local governmental entities, and to emphasize the Everglades Protection Area. Concerned agencies in Florida are taking part in a national strategic plan to develop the state invasive exotic plant management plan. Control and management of invasive exotic plants is one of the priorities established by the South Florida Ecosystem Restoration Task Force and Working Group in 1993. The Governor's Commission for a Sustainable South Florida and the *South Florida Multi-Species Recovery Plan* (USFWS 1999b) incorporate exotic plant management as a key restoration objective. Although several state agencies, particularly the Florida Department of Environmental Protection and South Florida Water Management District, have reasonably well-funded invasive plant programs, federal funding has lagged (Doren et al. 2002). The results of these actions would continue to produce long-term moderate to major beneficial effects on special status species.

Hydrologic and ecosystem restoration efforts, such as the Comprehensive Everglades Restoration Plan, would produce long-term, localized and regional, and moderate to major beneficial effects on the native vegetation communities and thus on special status species as a more natural inundation period and water balance return to Everglades National Park and Big Cypress National Preserve. Park-specific actions, such as use of prescribed fire, to manage exotic plants would also provide long-term, minor to moderate benefits to special status species.

In the Caribbean parks, the actions to manage exotic plants are relatively new and have focused on the beaches and aquatic resources. There are no other local or territorial exotic plant management plans that contribute to the efforts of the parks. Continued increases in exotic plants on lands outside the parks would result in long-term moderate adverse impacts.

In conjunction with ongoing exotic plant management actions, the actions of outside agencies and organizations, and the continued presence of exotic plants outside of the parks, cumulative long-term beneficial effects on special status species would be minor to moderate.

Past, present, and anticipated management plans in the parks are and would support improvements to special status species and habitats. Fire management plans in Florida parks are restoring natural fire regimes, reducing fuel loads, and reducing likelihood of catastrophic fires providing a moderate benefit. New general management plans that have recently been completed or are underway provide enhanced goals and frameworks for management of park resources and

would contribute to long-term moderate benefits. Invasive animal management plans are and would continue to reduce the spread of exotic plants by nonnative animal species and result in long-term minor benefits.

Miami Blue butterfly reintroduction plan would result in long-term, moderate benefits, and restoration projects such as salt marsh, Hole-in-the-Donut, and minor restoration projects such as road and trail restoration that remove exotic vegetation and allow for habitat for special status species to re-establishment are providing long-term minor to moderate benefits.

In contrast to the collective efforts of the state and federal exotic plant and resource management teams, there are private landowners with property adjacent to the parks that have not addressed exotic plant problems on their lands. These areas provide a seed source for the re-infestation of public lands. Without increased action on the part of adjacent landowners, exotic plants would produce long-term, minor to major adverse impacts on special status species.

Land development and agriculture (including hydrologic alteration) has and would continue to degrade and reduce habitats, including from the introduction of exotic plants, resulting in long-term major adverse effects. Past hunting and harvesting of special status plants and animals has resulted in reduced populations and resulted in long-term, minor adverse effects. Fire suppression has resulted in an alteration of special species habitats resulting in moderate adverse impacts. Recreational activities such as boating have and would continue to cause habitat destruction, injury and mortality to manatees and sea turtles resulting in long-term, moderate adverse impacts.

The long-term, minor to major beneficial cumulative effects that have and would result from ecosystem restoration activities and exotic plant management programs outside of the parks would mitigate some of the minor to major adverse cumulative effects of land development, agriculture, and expanding exotic plant infestations that result in losses in special status species and habitats. Cumulative regional adverse effects could be reduced to a long-term moderate adverse effect. The cumulative beneficial effect of other plans and restoration projects within the parks would additionally off-set the outside adverse effects to some degree.

The actions of alternative A would result in short-term, negligible to minor adverse effects on special status species for exotic plant management treatment activities. The effects would not measurably add to cumulative adverse effects. Benefits to special status species from treatment of exotic plants would range depending on the level of infestation in potential habitat and the effects exotic plants have on a particular species. Long-term moderate beneficial impacts would result in habitat where the pine rocklands special status plants exist, as well as habitat where the Southeastern beach mouse and brown pelican exist. Minor to moderate beneficial long-term impacts would result in habitat for the Atlantic salt marsh snake; minor, beneficial long-term impacts would result in habitat for the Florida semaphore cactus, St. Thomas lidflower and prickly ash, American crocodile, Eastern indigo snake, sea turtles, bald eagle, Cape Sable seaside sparrow, Everglade snail kite, Florida scrub-jay, red-cockaded woodpecker, wood stork, Miami blue butterfly, Schaus swallowtail butterfly, and Stock Island tree snail. Beneficial impacts to the Audubon's crested caracara,

piping plover, and roseate tern would range from negligible to minor. These actions would contribute to reducing regional long-term cumulative adverse impacts to a moderate level.

Conclusion

Under alternative A, all areas of exotic plant infestation would be treated by mechanical, chemical, physical, and/or biological methods or a combination of methods. The continued application of currently used chemicals in special status species habitats would result in long-term negligible to minor adverse impacts because of the accuracy of application and the low impact and low level of toxicity on species and nontarget vegetation in their habitat. Mechanical methods would result in short-term adverse impacts from foot traffic and vehicular access that would result from trampling of undergrowth and breaking of branches. Access to sites for treatment would disturb and displace individuals of species; however, mitigation would be implemented to avoid activities during the nesting or breeding season of special status species. The adverse impacts would be local, short term, and negligible to minor. Biological controls would have no adverse effect on special status species and their habitat and beneficial effects would be negligible. Prescribed fire would be used as a prescribed fire in vegetation communities and habitats that are fire-adapted. Adverse effects from prescribed fire on special status species would range depending on how adapted each species is to low-energy ground fires, and effects would range up to minor in intensity if a species needed to temporarily flee from fire activities.

Removing exotic plants restores the biological integrity and biodiversity of special status species habitat. Under the no-action alternative, all infested areas would be initially treated and then re-treated approximately every 3 years. Exotic plant infestations would be controlled, but habitats would not be fully restored. Benefits to special status species would range depending on the level of infestation in potential habitat and the effects exotic plants have on a particular species. Long-term moderate beneficial impacts would result in habitat where the pine rocklands special status plants exist, as well as habitat where the Southeastern beach mouse and brown pelican exist. Minor to moderate beneficial long-term impacts would result in habitat for the Atlantic salt marsh snake; minor, beneficial long-term impacts would result in habitat for the Florida semaphore cactus, St. Thomas lidflower and prickly ash, American crocodile, Eastern indigo snake, sea turtles, bald eagle, Cape Sable seaside sparrow, Everglade snail kite, Florida scrub-jay, red-cockaded woodpecker, wood stork, Miami blue butterfly, Schaus swallowtail butterfly, and Stock Island tree snail. Beneficial impacts to the Audubon's crested caracara, piping plover, and roseate tern would range from negligible to minor.

The exotic plant management actions would contribute to reducing regional long-term cumulative adverse impacts to a moderate level. There would be no impairment of special status species in the parks from implementation of alternative A.

ALTERNATIVE B — NEW FRAMEWORK FOR EXOTIC PLANT MANAGEMENT: INCREASED PLANNING, MONITORING, AND MITIGATION

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Alternative B would use the same method—chemical, physical, biological, and mechanical—for the treatment of exotic plants as described under alternative A. The impacts of these methods would be the same for alternative B as was described under alternative A. However, methods of treatment that could occur in each vegetation category under alternative B have been defined based on a decision matrix, which accounts for the exotic plants present, the vegetation category, and species of special concern. Using this decision tool, the most appropriate treatment and re-treatment method would be applied in each vegetation category. By using this tool, more protection of threatened and endangered species and their habitat would be provided, and the impacts would be reduced further than under alternative A. Under alternative B, there would be an increase in the frequency of treatment and the implementation of an adaptive management program. The adaptive management program would involve an elevated level of monitoring of the effects that treatments were having on native vegetation and special status species, and activities would be assessed and revised to reduce or eliminate subsequent impacts. Mitigation measures mentioned in the "Alternatives" chapter would further minimize or prevent impacts.

In addition, alternative B would involve the establishment of a programmatic consultation agreement between the parks and the USFWS and the National Marine Fisheries Service. These agreements would outline specific measures which would include the establishment of buffer areas where treatment activities would be restricted during sensitive times of the year to ensure the protection of federally listed species that would potentially be affected by future exotic plant treatment activities. A sensitive resources field survey or assessment of the treatment areas would be conducted prior to determining the appropriate treatment method. The results of the survey or assessment would be incorporated into the decision tool matrix, results of all surveys and decisions would be documented, and treatment methods would be selected appropriate to the presence of a particular federally listed species. This would occur to ensure that the treatment method implemented would have no effect or may affect but are not likely to adversely affect the species or its habitat, as would be required by the programmatic consultation agreement.

Under alternative B, initial treatment would be followed by re-treatment every 6 months. This would result in a 50% decrease in exotic plants and a 50% reduction in chemicals used for each re-treatment. Over the course of the 10-year plan life, restoration of infested special status species habitat would be more complete than under the no-action alternative, and there would be greater achievement of the desired future conditions in each native vegetation community that supports the habitat. Under alternative B, the passive restoration of special status species habitat would occur in a shorter period of time. The

following paragraphs describe the anticipated effects of the same methodologies, but with the intensified treatment and monitoring program proposed under alternative B.

Plants

As stated in alternative A, pine rockland plants are especially vulnerable to impacts from overspray or trampling. The majority of the plants are small forb species that would be easily overlooked by ground crews and trampled or accidentally sprayed with herbicide. It would likely be necessary for a knowledgeable staff member to be available during these treatment activities.

Alternative B would provide the same treatment as proposed in alternative A, but treatment would occur on a more frequent basis to provide better management of the exotic plant species. The increased frequency would benefit the special status plants by removing the competitive exotic plants. However, with implementation of best management practices and training of crews on how to access these sensitive areas with minimal effect, and implementation of monitoring and adaptive management, the impacts would be short term, negligible, and adverse.

Under alternative B, all infested areas would be initially treated and then re-treated every 6 months. Exotic plants would be controlled. Pine rocklands would be fully restored by passive means within 7 to 12 years, which is quicker than what would occur under alternative A. Upland dry / mesic forests, of which pine rocklands are part, cover 10% of Big Cypress National Preserve. Upland dry / mesic forest represents less than 1% of the terrestrial area of Everglades National Park but total over 10,000 acres (see table 5 of appendixes A – I). Infestation is high in both parks. Treatment and passive restoration of these lands under alternative B would result in long-term moderate beneficial impacts to the habitat of these plant species.

Florida semaphore cactus (Consolea corallicola): Canaveral National Seashore Florida semaphore cactus (*Consolea corallicola*): Biscayne National Park — The increased frequency of re-treatment under alternative B would have the same short-term, negligible, adverse effects, but with the potential to occur more often. However, the increased monitoring of sensitive species habitat within the parks would identify any adverse effects and adaptively manage future activities to reduce these effects. Therefore adverse effects would still be considered negligible.

More frequent re-treatment of the 3% potentially infested upland dry / mesic forest areas in Biscayne National Park would achieve passive restoration more quickly than under alternative A and would have long-term, minor to moderate, beneficial effects on the Florida semaphore cactus.

The St. Thomas lidflower and the St. Thomas prickly ash have been reduced due to loss of habitat to development, the infestation of exotic plants, and foraging by some of the islands' animals. Currently, exotic plants are not known to be impacting these plants. However, under alternative B, with treatment of exotic plants under an optimal treatment frequency and with monitoring of sensitive species habitat within the parks, the risk of exotic plants invading the habitat of

these sensitive species would be eliminated. With more frequent monitoring of the habitat, if exotic plants do invade the habitat, management actions would be taken quickly to eliminate any impacts of the exotic plants on the sensitive plants themselves or their habitat. Therefore, alternative B would result in no adverse impacts on the sensitive plants but would have a minor long-term benefit by eliminating the potential for exotic plant spread and establishment in the habitat.

Animals (Mammals, Reptiles, Birds, and Invertebrates)

For all species discussed below, the implementation of alternative B would produce adverse impacts from an increased treatment frequency and beneficial impacts from improved monitoring and adaptive management similar to those described under special status plant species. The additional treatment activity would increase the likelihood for disturbance and displacement of animal species from the more frequent intrusion on habitat with human activity. Although the disturbance of the animals would be more frequent under alternative B, the animal species would be expected to return to the habitat once management activities of treatment and monitoring were concluded. Personnel would be trained to identify sensitive species and provide guidance on how to access sites with minimal impact on the native species. Surveys would be conducted of proposed individual treatment areas to identify nesting locations, treatment methods would be selected appropriate to the presence of a particular federally listed species, and buffer areas where treatment activities would be restricted during sensitive times would be established as determined by the programmatic consultation agreement between the parks and the USFWS and the National Marine Fisheries Service. With coordination with the USFWS, appropriate buffers would be established and activities would be conducted in a manner to ensure adverse effects do not exceed the minor level, which equates to a may affect / not likely to adversely affect a federally listed species. Mitigation measures for site-specific conditions would be implemented Treatment activities would be implemented or avoided based on site-specific conditions as identified during pre-treatment surveys. To the extent practicable, no activity would occur during the nesting season of any of the sensitive species in order to eliminate impacts on the reproductive success of the species. Any impacts to the habitat from management activities or to individuals of the species would be short term, range from negligible to minor, and adverse as described in alternative A. These effects would be the result of crews accessing sites for management actions, exotic plant treatments using herbicides, fire, or mechanical tools. The adaptive management and monitoring program would produce long-term minor beneficial impacts by improving the efficiency and effectiveness of treatment while implementing the treatment method that would have the least impact of the sensitive species.

Mammals. The following text describes potential impacts of alternative B on special status mammal species present in the parks addressed in this draft EPMP/EIS:

Florida panther — It is important that denning areas for the Florida panther be avoided, as stated in alternative A. With the majority of the panthers radio-collared, coordination between wildlife experts and the exotic plant management team would make it possible to avoid panthers during this critical time. The

adaptive management program proposed for alternative B would improve communication among staff so that any potential impacts of exotic plant control efforts are minimized or avoided. Based on the treatment decision tool, it is recommended that dead standing exotic plants be left in place. The female Florida panther dens in the dense underbrush and may remain in the same area for several months while the kittens mature. The disturbance caused by exotic plant treatment and removal activities would potentially cause the panther to abandon her cubs or would frighten potential prey animals. Many panthers are radio collared, so these areas may be easily avoided. With implementation of the appropriate treatment methods and mitigation measures to avoid dens, the adverse impacts on the panther would not exceed a minor level.

Under alternative B, all infested areas would be initially treated and then re-treated every 6 months. Exotic plants would be controlled, and infested areas in panther habitat would be more fully restored, and restoration of the habitat would be accomplished quicker than in alternative A. Panther habitat in Big Cypress National Preserve and Everglades National Park is infested at a rate of 56% and 39%, respectively. Treatment of these lands under alternative B would result in long-term minor to moderate beneficial impacts.

Southeastern beach mouse (*Peromyscus polionotus niveiventris*): Canaveral National Seashore — Adverse effects of treatment activities would be the same as alternative A, with the exception that more frequent re-treatment activities would take place. The increased monitoring and adaptive management associated with alternative B would identify adverse effects and, if necessary, actions would be adjusted to reduce or eliminate impacts. Therefore, the intensity and duration of adverse effects would be expected to be the same as alternative A and would be short-term and minor.

Under alternative B, the increased re-treatment efforts would help to passively restore native vegetation categories faster than under alternative A. Approximately 61% of beach / dune is potentially infested and would be treated and passively restored. Therefore, exotic plant management activities would have long-term, moderate to major, beneficial effects on the Southeastern beach mouse.

West Indian manatee (*Trichechus manatus*): Adverse effects of treatment activities would be the same as alternative A, with the exception that more frequent re-treatment activities would take place. The increased monitoring and adaptive management associated with alternative B would identify adverse effects and, if necessary, actions would be adjusted to reduce or eliminate impacts. Therefore, the intensity and duration of adverse effects would be expected to be the same as alternative A and would be short-term and minor. These effects would result from the use of herbicides, increases in sediment, nutrients, and turbidity in waterways from treatment actions, and damage to seagrasses from the use of motorboats and airboats.

Reptiles. The following text describes potential impacts of alternative B on special status reptile species present in the parks addressed in this draft EPMP/EIS:

American crocodile — The American crocodile would be impacted by exotic plants when the plants encroach on their nesting habitat and by the intensified exotic plant treatment activities creating a disturbance during the nesting period. As stated in alternative A, crocodiles are easily disturbed and may abandon their nests if human activity is nearby, so when implementing alternative B, it would be important to determine if nesting crocodiles are present. Under alternative B, using the treatment decision tool, it would be recommended that dead standing exotic plants be left in place in crocodile habitat near and during the nesting season. The American crocodile builds nests on upland areas adjacent to water. The crocodile tends to her nest and guards it from predators. Noise and human activity associated with treatment and removal of exotic plants could disturb the crocodile enough that she abandons her nest or moves to a location where nesting may be more optimal. With implementation of the appropriate treatment methods and the mitigation measures described in the "Alternatives" chapter and the adaptive management program, impacts on crocodiles would be minimized to a negligible level or avoided.

Under alternative B, all infested areas would be initially treated and then re-treated every 6 months. Exotic plants would be controlled, and crocodile habitat would be more fully restored, and restoration would be achieved more rapidly compared to alternative A. Crocodile habitat in Biscayne and Everglades National Parks are 2% and 3% infested, respectively. Treatment of these lands under alternative B would result in long-term minor to moderate beneficial impacts.

Atlantic salt marsh snake (Nerodia clarkii taeniata) — With the additional treatments proposed in alternative B, there is an increased potential for impacts to the habitat and prey species from increased presence of vehicles and crews in treatment areas. The mitigation measures described in the "Alternatives" chapter would be implemented, and the adaptive management program would avoid or minimize these impacts. The adverse impacts on the Atlantic salt marsh snake and its habitat from increased treatment and monitoring would not exceed a minor level.

Under alternative B, all infested areas would be initially treated and then re-treated every 6 months. Exotic plants would be controlled, and Atlantic salt marsh snake habitat would be fully restored more rapidly. There is no specific distribution information available for the Atlantic salt marsh snake in Canaveral National Seashore; however, this species typical habitat requirement of coastal marshes and mangrove swamps covers about 29% of the park (total of two vegetation categories) and is potentially about 61% infested (34% of mangroves is potentially infested and 27% of coastal marsh is potentially infested). Treatment of these lands under alternative B would result in long-term moderate beneficial impacts.

Potential indigo snake habitat is extensive throughout the south Florida parks and is between 3% and 28% infested. Depending on the quality of the habitat, treatment of these lands under alternative B would result in long-term minor to moderate beneficial impacts.

Eastern indigo snake (Drymarchon corais couperi) — With the additional treatments proposed in alternative B, there is an increased potential for impacts to the habitat and prey species from increased presence of vehicles and crews in treatment areas. The mitigation measures described in the "Alternatives" chapter would be implemented, and the adaptive management program would avoid or minimize these impacts. The adverse impacts on the snake and its habitat from increased treatment and monitoring would not exceed a minor level.

Under alternative B, all infested areas would be initially treated and then re-treated every 6 months. Exotic plants would be controlled, and eastern indigo snake habitat would be fully restored more rapidly. Potential indigo snake habitat is extensive throughout the south Florida parks and is between 3% and 28% infested. Depending on the quality of the habitat, treatment of these lands under alternative B would result in long-term minor to moderate beneficial impacts.

Sea Turtles — As described in alternative A, adverse effects from treatment activities short term and negligible. Alternative B would protect nesting beaches for sea turtles by ensuring that the beaches are assessed on a regular basis to make sure no Australian pines have become established. Timing of treatments is important in order to avoid impacting nests and hatchlings. Heavy equipment would be prohibited on certain beaches during nesting seasons, as identified in the programmatic consultation agreement. Under alternative B, more attention would be paid to the nesting areas to ensure that the Australian pines did not become reestablished, and any seedlings that are present would be removed or treated. Exotic plants would be controlled, and habitat would be more fully restored than under in alternative A. Treatment of potential habitat and more rapid passive restoration would result in long-term minor beneficial impacts.

Birds. The following text describes potential impacts of alternative B on special status bird species present in the parks addressed in this draft EPMP/EIS:

Audubon's crested caracara (*Polyborus plancus audubonii)* — As described in alternative A, the adverse effects from exotic plant management actions would range from negligible to minor, and these would result from site access, use of herbicides, and physical and mechanical treatments. Alternative B would involve more frequent re-treatment actions, but with implementation of mitigation, avoidance measures, and the adaptive management program, impacts would be of the same duration and intensity as those described in alternative A.

The exotic plants would be controlled, and habitat would be restored more rapidly than under alternative A. Estimated potential habitat (grassland / coastal strand vegetation category) covers less than 1% of the terrestrial area of Everglades National Park, with potential infestation of about 10%. Treatment of these lands under alternative B would result in long-term minor beneficial impacts.

Bald eagle (*Haliaeetus leucocephalus*) — Adverse impacts would be the same as described in alternative A (short term, minor) because, although the frequency of re-treatments would increase, parks would implement similar mitigation measures such as adequate buffers around nests. The implementation of mitigation and avoidance measures and the adaptive management program would

prevent disturbance to breeding pairs of bald eagles and other potential impacts related to the exotic plant management plan. All infested areas would be treated initially and then re-treated every 6 months. The exotic plants would be controlled, and habitat would be restored more rapidly than under alternative A. The three parks with infested bald eagle habitat are Canaveral National Seashore, Big Cypress National Preserve, and Everglades National Park; all would experience long-term minor to moderate benefits from the treatment.

Brown pelican (Pelecanus occidentalis occidentalis) — As described in alternative A, the adverse effects from exotic plant management actions would range from negligible to minor, and these would result from site access, use of herbicides, and physical and mechanical treatments. Alternative B would involve more frequent re-treatment actions, but with implementation of mitigation, avoidance measures, and the adaptive management program, impacts would be of the same duration and intensity as those described in alternative A.

The exotic plants would be controlled, and habitat would be restored more rapidly than under alternative A. There are about 154 acres of brown pelican potential habitat in Virgin Islands National Park (2% of park), about 9 acres of potential habitat in Buck Island Reef National Monument (5% of park), and 87 acres of potential habitat (20% of park) in Salt River Bay National Historic Park and Ecological Preserve, and this potential habitat is 33% infested in Buck Island and 52% infested in Salt River Bay. The potential habitat in Virgin Islands National Park is not currently infested. Treatment of these lands under alternative B would result in long-term moderate beneficial impacts.

Cape Sable seaside sparrow (Ammodramus maritimus mirabilis): Big Cypress National Park, Everglades National Park — Under alternative B, the marl prairies inhabited by the Cape Sable seaside sparrow would be treated for the encroachment of woody species. It is important that this activity be conducted when the birds are not breeding or nesting. Coordination and communication with the staff at the parks for the timing of the treatments is a criterion in the adaptive management program. Under alternative B, aerial spraying would be prohibited in sparrow habitat in order to provide further protection of the species habitat. Prescribed fire could be used as a potential re-treatment tool to maintain the habitat of the sparrow free of woody plant species. In Everglades National Park, any use of fire within Cape Sable seaside sparrow habitat would need to be approved by an interagency working group that convened to develop a wildland fire management strategy, and subsequently the USFWS before implementation. The dead vegetation would be removed to provide more opportunity for the birds to forage, breed, and nest. With implementation of best management practices and mitigations to avoid the sparrow's nesting season, adverse impacts would be short term and range from negligible to minor.

Under alternative B, all infested areas would be initially treated and then re-treated every 6 months. Exotic plants would be controlled, and infested areas in Cape Sable seaside sparrow habitat would be more fully restored than under alternative A. Treatment of infested potential habitat under alternative B and a rapid and complete restoration of the habitat would result in long-term minor to moderate beneficial impacts.

Everglade snail kite (Rostrhamus sociabilis plumbeus): Big Cypress National Preserve, Everglades National Park — The concerns for the Everglade snail kite are similar to those described for other federally listed birds in that they should not be disturbed during the breeding season. Also, the kites nest in low trees and shrubs so direct disturbance of the nest is a potential impact. In order to avoid or minimize the effects of the intensified treatment as proposed in alternative B, the treatment activity would be coordinated with the wildlife managers in the parks to ensure that effects do not exceed the minor level. Prescribed fire would include the use of fires to control the resprouting and seedling growth of melaleuca after treatment with herbicides. The fires can be incorporated into the prescribed fire plan for habitat improvement and would further benefit the snail kite if the fires included burning of the shrubby vegetation in areas along shorelines and dense growths of herbaceous vegetation like cattail in wetlands. With implementation of mitigations to avoid the nesting season of the birds, adverse effects would not exceed a minor level and the effects would be short term.

Under alternative B, all infested areas would be initially treated and then re-treated every 6 months. Exotic plants would be controlled, and infested areas in Everglade snail kite habitat would be more fully restored than in alternative A. The habitat of the kite would also be restored within 3 to 5 years, which is quicker than what would be achieved under alternative A. Habitat in Big Cypress National Preserve and Everglades National Park is infested 28% and 30%, respectively. Treatment of these lands under alternative B would result in long-term minor to moderate beneficial impacts on the Everglade snail kite.

Florida scrub-jay (Aphelocoma coerulescens) — As described in alternative A, adverse effects to the Florida scrub-jay from mechanical and chemical treatments would be short term and negligible. Treatments would not be conducted during the nesting season to avoid impacting the nests and chicks. Under alternative B, the higher frequency of re-treatment would cause these same effects to occur more often (every 6 months) but effects would still be considered short term, negligible, and adverse due to the continued ground application of herbicides and implementation of mitigation measures such as avoiding nesting season and techniques to minimize nontarget plant damage.

The potential Florida scrub-jay habitat is approximately 17% infested, and the benefits of the treatments under alternative B would be long term and minor to moderate because the restoration of scrub-jay habitat would be more rapid than under alternative A.

Piping plover (Charadrius melodus) — As described in alternative A, adverse effects to the piping plover from exotic plant management actions and the presence of crews and equipment in habitat during non-breeding seasons would be short term and minor. Under alternative B, the higher frequency of re-treatment would cause these same effects to occur more often (every 6 months) but effects would still be considered short term, negligible to minor, and adverse due to the fact that piping plovers often occur in sparsely vegetated areas and from implementation of mitigation measures such as avoiding nesting season and techniques to minimize nontarget plant damage.

Specific distribution information is not available for the piping plover, but there are approximately 58 acres of beach / dune in Biscayne National Park (2% infested) and 2 acres of beach / dune in Everglades National Park (50% infested) (see table 5 of appendixes A – I). Treatment of exotic plants under alternative B would have a long-term, minor, beneficial effect on the piping plover.

Red-cockaded woodpecker (Picoides borealis) — Big Cypress National Preserve— As described in alternative A, the red-cockaded woodpecker would experience short-term, negligible adverse effects from the use of herbicides and short-term, minor, adverse effects from noise and activities associated with treatment actions. Using the treatment decision tool, under alternative B, it is recommended that dead standing exotic plants be removed from red-cockaded woodpecker habitat. By creating an open understory, there would be increased breeding and foraging opportunity for the birds. Implementing mitigation measures (avoiding nesting season) and the adaptive management program would result in short-term adverse impacts that would be negligible to minor. Biological controls may provide additional prey for the red-cockaded woodpecker, which would be a long-term, negligible, beneficial effect.

All infested areas would be initially treated and then re-treated every 6 months. Exotic plants would be controlled, and habitat would be more fully restored than under alternative A. Treatment of potential habitat that is infested (22% of potential habitat) in Big Cypress National Preserve would result in long-term moderate beneficial impacts.

Roseate tern (Sterna dougallii dougallii) — As described in alternative A, the roseate tern would experience short-term, negligible adverse effects from chemical and mechanical treatments and the presence of crews and vehicles for treatments and monitoring. More frequent re-treatments under alternative B would have short-term, negligible to minor, adverse effects from temporary flight response or disturbances.

Under alternative B, exotic plants would be controlled, and habitat would be more fully restored than under alternative A. Exotic plant management actions in potential infested habitat (50% of potential habitat) in Everglades National Park and increased monitoring in Virgin Islands National Park would result in long-term minor beneficial impacts.

Wood stork (Mycteria americana) — As described in alternative A, the main concern for the wood stork would be the potential for disturbing the nesting activity. Wood storks nest in cypress, mangroves, and sometimes in Australian pines. In order to avoid or minimize the effects of a higher frequency of re-treatments proposed in alternative B, the treatment activity would be coordinated with the wildlife managers in the parks to ensure that no disturbance occurs. Under alternative B, the dead vegetation would be left in place to provide nesting or roosting support. The wood stork sometimes nests in exotic plants, and treatment and removal of the exotic plants would not occur around rookeries during breeding and nesting season because the disturbance may cause the birds to abandon their nests. Under alternative B, the adverse impacts would be negligible to minor.

Under alternative B, all infested areas would be initially treated and then re-treated every 6 months. Exotic plants would be controlled, and infested areas in wood stork habitat would be more fully restored than in alternative A. Habitat in Big Cypress National Preserve, Everglades National Park, and Canaveral National Seashore is infested at a rate of 19%, 16%, and 25% respectively. Considering the relatively low effect that exotic plants have on wood storks, treatment of these lands under alternative B would result in long-term minor beneficial impacts.

Invertebrates. The following text describes potential impacts of alternative B on special status invertebrate species present in the parks addressed in this draft EPMP/EIS:

Miami blue butterfly (*Cyclargus thomasi bethunebakeri*) — Just as described in alternative A, populations of the Miami blue butterfly are not known to occur in any areas of the park infested with exotic plants, therefore treatment actions would not occur in butterfly habitat. Increased re-treatment, enhanced monitoring, and adaptive management of alternative B would accelerate the removal of exotic plants in other infested areas of the park, which would slow the potential spread of exotic plants into the habitat of the Miami blue butterfly. This would result in no adverse effects and beneficial effects that would be long term and minor in intensity.

Schaus swallowtail butterfly (Papilio aristodemus) — Alternative A states that the potential impacts on the Schaus swallowtail butterfly habitat from the treatment activity would be from the ground crews trampling native vegetation upon which the butterfly may lay eggs or feed on as larva. The mitigation measures and adaptive management program presented in alternative B were created to avoid and minimize accidental impacts and would keep adverse impacts at a negligible level. The location of the hammock may determine if the dead material would be removed; easily accessed areas would be more likely to be cleared of dead vegetation than remote areas. The removal of the cut vegetation, the creation of opportunities for the native hammock species to flourish, and the more rapid restoration of native habitat under alternative B would provide long-term moderate benefits to the Schaus swallowtail butterfly.

Stock Island tree snail (Orthalicus reses) — Increased management activity under alternative B within the habitat of the snail under would not result in an increased level of effect. The re-treatment and monitoring at approximately every 6 months would likely have the same level of trampling effect on the small shrubs and seedlings within the snail's habitat as described under alternative A. The application of herbicides by ground crews allows for more precise application, and the chemical treatments would have short-term, negligible, and adverse impacts on the snails. Under alternative B, treatment of tropical hardwood hammocks and the quicker recovery of this habitat compared to alternative A would produce long-term moderate beneficial impacts on the Stock Island tree snail.

Cumulative Impacts

The effects of other past, present, and future actions would continue to produce long-term beneficial and adverse cumulative effects, as described under alternative A, the would result in net long-term, moderate, regional adverse impacts to special status species and habitats.

The impacts of alternative B would result in short-term, negligible to minor adverse effects on special status species from exotic plant management treatment activities. The effects would not measurably add to cumulative adverse effects. Beneficial effects to special status species and their habitats from the treatment of exotic plants would vary in intensity depending on the level of infestation and how affected each species is by the presence of exotic plants. Long-term moderate to major beneficial impacts would occur to the Southeastern beach mouse because of the potential high level of exotic plant infestation. Long-term, moderate beneficial impacts would occur to habitat for the pine rockland special status plant species, brown pelican, red-cockaded woodpecker, Schaus swallowtail butterfly, and Stock Island tree snail. Long-term minor to moderate beneficial impacts would result for Florida semaphore cactus, Florida panther, American crocodile, Atlantic salt marsh snake, Eastern indigo snake, bald eagle, Cape Sable seaside sparrow, Everglade snail kite, and Florida scrub jay habitat. Lastly, long-term minor beneficial impacts would occur to the habitat of the St. Thomas lidflower and prickly pear, sea turtles, Audubon's crested caracara, piping plover, roseate tern, wood stork, and Miami blue butterfly. These actions would contribute to reducing regional long-term cumulative adverse impacts to a moderate level.

Conclusion

The treatment method proposed under alternative B are the same as those described for alternative A, but with an increased frequency occurring at a minimum of every 6 months for 5 or 6 years or until the exotic plants are under control. The adverse impacts of exotic plant treatments under alternative B on the special status species and their habitats would be the same as under alternative A. These would result from ground crew accessing special status species habitat, displacement and disturbance of individuals from noise and activity, and the use of chemical treatments, where applicable. The increased frequency of treatment would result in a greater frequency of these impacts but the intensity of effects would still be the same because mitigation measures would be combined with the monitoring and adaptive management program. This would minimize the negative impacts of more frequent treatments and would result in short-term, adverse impacts that range from negligible to minor in intensity.

Removing exotic plants would restore the biological integrity and biodiversity of special status species habitat. Under alternative B, all infested areas would be initially treated and then re-treated every 6 months. Exotic plants would be controlled, and the habitats of special status species would be more fully restored than under alternative A. Beneficial effects special status species and their habitats would vary in intensity depending on the level of infestation and how affected each species is by the presence of exotic plants. Long-term moderate to major beneficial impacts would occur to the Southeastern beach mouse because of the potential high level of exotic plant infestation. Long-term, moderate

beneficial impacts would occur to habitat for the pine rockland special status plant species, brown pelican, red-cockaded woodpecker, Schaus swallowtail butterfly, and Stock Island tree snail. Long-term minor to moderate beneficial impacts would result for Florida semaphore cactus, Florida panther, American crocodile, Atlantic salt marsh snake, Eastern indigo snake, bald eagle, Cape Sable seaside sparrow, Everglade snail kite, and Florida scrub jay habitat. Lastly, long-term minor beneficial impacts would occur to the habitat of the St. Thomas lidflower and prickly pear, sea turtles, Audubon's crested caracara, piping plover, roseate tern, wood stork, and Miami blue butterfly.

Cumulative impacts would be the same as alternative A. Alternative B would not result in impairment of special status species or their habitat.

ALTERNATIVE C — NEW FRAMEWORK FOR EXOTIC PLANT MANAGEMENT: INCREASED PLANNING, MONITORING, AND MITIGATION, WITH AN EMPHASIS ON ACTIVE RESTORATION OF NATIVE PLANTS

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Under alternative C, the effects of increased treatment of exotic plants would the same as that described above for alternative B.

As in alternative B, monitoring would be conducted to determine the efficacy of the treatment and to propose an alternative treatment, if necessary, if desired future conditions of the vegetation communities were not being met, if there are impacts on sensitive species that exceed what is expected, and to determine if active restoration methods are successful. The ability to alter the treatment or the restoration techniques to provide the optimum methodology of exotic plant control and restoration is the adaptive management program described in the "Alternatives" chapter as alternative B. In alternative C, the adaptive management plan proposed in alternative B would be implemented with the addition of active restoration in selected areas within the parks. As described in alternative B, an increase in the intensity and frequency of access to infested sites would occur for both actively and passively restored areas. The impacts would be the same as alternative B. Additional effects from implementation of the active restoration component of alternative C are described below.

The benefits to special status species as a result of passive restoration of infested areas within the parks would be the same as those described under alternative B. The framework for implementing active restoration within the parks is discussed in the "Alternatives" chapter, as are the criteria used to determine which areas should be restored. Under alternative C, special status species habitat would be a high priority for active restoration, which would take place using native plants that are appropriate given the communities that occur within each vegetation category. Site monitoring would occur to ensure that restoration to the identified desired future condition for each vegetation category was occurring. If desired future conditions were not being achieved, restoration methods would be adapted to improve restoration success. Active restoration would inhibit the reestablishment of exotic plants in special status species habitat and would allow

a more rapid return of native species in these areas. The impacts of active restoration of special species habitat are described below.

Just as in alternative B, alternative C would also involve the establishment of a programmatic consultation agreement between the parks and the USFWS and the National Marine Fisheries Service. These agreements would outline specific measures which would include the establishment of buffer areas where treatment activities would be restricted during sensitive times of the year to ensure the protection of federally listed species that would potentially be affected by future exotic plant treatment activities. A sensitive resources field survey or assessment of the treatment areas would be conducted prior to determining the appropriate treatment method. This would occur to ensure that the treatment method implemented would have no effect or may affect but are not likely to adversely affect the species or its habitat, as would be required by the programmatic consultation agreement.

The following paragraphs describe the effects of active restoration proposed on the special status species in the parks.

Plants

No habitat has been specifically identified for restoration in the pine rocklands, but the habitat would likely be included in the 1,178 acres of upland dry / mesic forest that would be restored in Everglades National Park under alternative C and 1,200 acres in Big Cypress National Preserve. This would represent a long-term, moderate to major, beneficial effect to the pine rockland special status plants because habitat would be fully restored. No adverse effects would be anticipated because surveys would be conducted prior to restoration activities and areas where special status plants are known to occur would be avoided to prevent damage to the plants.

No areas where the Florida semaphore cactus is known to occur is targeted for active restoration under alternative C. However, 15 acres of upland dry / mesic forest would be actively restored in Biscayne National Park where the cactus may have potential to occur in the future. Therefore, the restoration would indirectly benefit the Florida semaphore cactus over the long term at a negligible level. Overall, alternative C would have long-term, minor to moderate benefits to the Florida semaphore cactus.

The two Virgin Islands special status plants would not be actively restored with supplemental planting under alternative C. The habitat of these plants is not infested and with monitoring and treatment of infestation within the parks, encroachment of exotic plants into the habitat is unlikely. If exotic plants do invade, frequent monitoring would allow for eradication of exotic plants from the habitat, and the areas would be able to recover with passive restoration and active restoration in the form of supplemental planting would not be required. Therefore, effects would be the same as alternative B; there would be no adverse impacts but would have a minor long-term benefit by eliminating the potential for exotic plant spread and establishment in the habitat.

Animals (Mammals, Reptiles, Birds, and Invertebrates)

Mammals. The following text describes potential impacts of alternative C on special status mammal species present in the parks addressed in this draft EPMP/EIS:

Florida panther — Areas that have been identified for active restoration would include portions of potential Florida panther habitat. Approximately 2,012 acres in Everglades National Park and 10,197 acres in Big Cypress National Preserve (see table 35) would be actively restored under alternative C. Active restoration would include the planting of trees in open areas to provide roaming corridors for the panther. As stated in alternative A, panthers do not like to cross open land and prefer a tree canopy or subcanopy for movement. Treed corridors can connect two foraging areas or allow the panther to roam for breeding purposes. The presence of crews and equipment during active restoration activities may cause short-term disturbance and displacement of individual panthers in the vicinity, and these effects would be minor and adverse. Restoration would not be conducted during the panther's breeding season to avoid impacts to denning activities.

Under alternative C, infested areas in panther habitat would be more fully restored, and restoration of the habitat would be accomplished quicker than under alternative A. Panther habitat in Big Cypress National Preserve and Everglades National Park is 24% and 16% infested, respectively. Active restoration of portions of their habitat would allow for quicker recovery, which would result in long-term moderate beneficial impacts on the panther.

Southeastern beach mouse (*Peromyscus polionotus niveiventris*) — Canaveral National Seashore — Adverse effects of treatment activities would be the same as alternative B, short-term, minor and adverse. The active restoration component of alternative C would also have short-term, minor, adverse effects, which would result from an increased presence of crews for planting of native vegetation in areas where the beach mouse may occur. Noise and activities associated with these actions could temporary disturb or displace individuals for short periods of time. Other restoration actions, such as digging with heavy equipment, would not affect the beach mouse because this would not be conducted in areas where surveys identified the presence of this species. This would be the case due to the burrowing nature of this species' activities, and the fact that digging actions could have adverse effects greater than minor intensity, which would not be permitted under this plan and the programmatic consultation agreement with the USFWS.

Planting of native vegetation would allow potential habitat of the Southeastern beach mouse to be fully restored. This would represent a long-term, moderate to major, beneficial effect on the Southeastern beach mouse.

West Indian manatee (Trichechus manatus) — Adverse effects of treatment activities would be the same as alternatives A and B. Effects from active restoration under alternative C would also create similar effects as to those previously described. These effects would result from increases in sediment, nutrients, and turbidity in waterways from restoration actions, and potential damage to seagrasses from the use of motorboats and airboats. These adverse

effects would be the same as alternatives A and B and would be short-term and minor because restoration activities would be appropriately chosen to ensure that adverse effects do not exceed the minor level (i.e., may affect / not likely to adversely affect).

Reptiles. The following text describes potential impacts of alternative C on special status reptile species present in the parks addressed in this draft EPMP/EIS:

American crocodile (Crocodylus acutus) — The American crocodile would benefit from the active restoration of 6 acres (less than 1%) in Everglades National Park under alternative C. This restoration may include some grading of slopes to make them available to the crocodile for nesting. No American crocodile potential habitat is located in areas targeted for active restoration in Biscayne National Park. Active restoration methods would be chosen depending on the presence or absence of crocodiles in the area and the nature of the site, and methods would only be implemented that would not have adverse effects greater than the minor level (i.e., may affect / not likely to adversely affect). Adverse effects with potential to occur under alternative C include noise and human presence disruptions, causing crocodiles to temporarily leave the area during project activities.

Beneficial effects, in addition to the effects described in alternatives A and B, would be long term and minor to moderate from a small area being restored in crocodile habitat.

Atlantic salt marsh snake (Nerodia clarkii taeniata) — With the addition of effects described in alternatives A and B, alternative C would have the potential to restore 363 acres of mangroves and 784 acres of coastal marshes. This is a large proportion of these vegetation categories that are potentially infested with exotic plants (see table 5 of appendixes A – I). Short-term, adverse effects from the presence of crews and vehicles would result in effects similar to those described in alternative B, and would be short-term, minor, and adverse from temporary disruption or displacement of individuals. Restoration activities would be determined based on what is most appropriate for each specific site and the potential presence of threatened or endangered species.

Under alternative C, potential Atlantic salt marsh snake habitat would be more fully and more rapidly restored. The estimated potential Atlantic salt marsh snake habitat covers 29% of the park and is 61% infested (34% of mangroves is potentially infested and 27% of coastal marsh is potentially infested). Active restoration of the infested areas in the parks would allow for rapid recovery of these areas and result in long-term, moderate, beneficial impacts.

Eastern indigo snake (Drymarchon corais couperi) — Alternative C provides for the active restoration with the following number of acres that occur in potential habitat of the Eastern indigo snake: 9,001 acres in Big Cypress National Preserve; 4,435 acres in Everglades National Park; 17 acres in Biscayne National Park; and 206 acres in Canaveral National Seashore (see table 35). Active restoration would include the planting of native vegetation, especially trees, to speed up the availability of the habitat for special status species. Adverse effects

from the presence of crews, equipment, and vehicles would be the same as those described in alternative B.

Under alternative C, eastern indigo snake habitat would be more fully and more rapidly restored. Potential indigo snake habitat is extensive throughout the south Florida parks and is from 3% to 28% infested. Active restoration of the infested areas in the parks ranges from 9% in Big Cypress National Preserve and Canaveral National Seashore to 16% and 19% in Everglades National Park and Biscayne National Park, respectively. This would allow for rapid recovery of these areas and result in long-term moderate beneficial impacts.

Sea turtles — Under alternative C, the benefits of the monitoring program would ensure that the Australian pines do not become reestablished. In addition, this alternative would provide for the restoration of the nesting beaches and dunes. Under this alternative, the trees and root systems of Australian pines would be removed, and the beaches and dunes would be planted with native species to prevent erosion and to discourage the re-occurrence of the Australian pine. Under alternative C, exotic plants would be controlled, and habitat would be restored more rapidly than under alternative A. Active restoration of the sensitive turtle habitat under this alternative could have long-term beneficial effects that range from minor to moderate. Adverse effects from restoration would be the same as those described in alternative B, which would result from noise and disturbance from the presence of crews. Just as in alternatives A and B, nesting areas would be avoided during nesting periods.

Birds. The following text describes potential impacts of alternative C on special status bird species present in the parks addressed in this draft EPMP/EIS:

Audubon's crested caracara (*Polyborus plancus audubonii)* — As described in alternative B, the adverse effects from exotic plant management actions would range from negligible to minor, and these would result from site access, use of herbicides, and physical and mechanical treatments and re-treatments. No potential habitat for the brown pelican in Buck Island Reef National Monument or Virgin Islands National Park was identified for active restoration under Alternative C; therefore, beneficial effects would also be the same as described for alternative B, which would be long-term, and moderate in intensity. In Salt River Bay National Historic Park and Ecological Preserve, all of the potentially infested potential habitat has been identified for active restoration, which would be a long-term, moderate to major, beneficial effect. Restoration activities would involve access, presence of crews, and use of vehicles, which would have the same temporary disturbance and displacement effects as those described in alternatives A and B. These effects would also be short-term, minor, and adverse.

Bald eagle (*Haliaeetus leucocephalus*) — The bald eagle habitat at Canaveral National Seashore and Everglades National Park would not be actively restored. Only 35 acres of habitat within Big Cypress National Preserve would be actively restored (see table 35). The long-term benefits from passive restoration and the minimal active restoration of bald eagle habitat would be minor to moderate. Adverse effects would be the same as described in alternative B, short-term and range from negligible to minor in intensity.

Brown pelican (Pelecanus occidentalis occidentalis) — As described in alternative B, the adverse effects from exotic plant management actions would be short-term and minor in intensity, and these would result from site access, use of herbicides, and physical and mechanical treatments. None of the infested acres of potential habitat in Buck Island Reef National Monument or Virgin Islands National Park have been identified for active restoration; therefore, adverse and beneficial effects would be the same as those described in alternative B. All of the infested acres of potential habitat in Salt River Bay Historic Park and Ecological Preserve have been identified as suitable for active restoration. Restoration of these infested lands (52% of potential habitat) would have a long-term, moderate, beneficial effect.

Cape Sable seaside sparrow (Ammodramus maritimus mirabilis) — In addition to the effects described in alternatives A and B, alternative C would have the potential to restore 316 acres of infested potential habitat in Everglades National Park and no specific amount has been identified in Big Cypress National Preserve. Short-term, adverse effects from the presence of crews and vehicles would result in effects similar to those described in alternative B. Adverse effects would be short term, and range from negligible to minor, due to temporary disruption or displacement of individuals. Restoration activities would be determined based on what is most appropriate for each specific site and the potential presence of threatened or endangered species.

Under alternative C, potential Cape Sable seaside sparrow habitat would be more fully and more rapidly restored. The estimated potential habitat in Everglades National Park covers 11% of the park and is 10% infested. Active restoration of the infested areas in the park would allow for rapid recovery of these areas and result in long-term, moderate, beneficial impacts.

Everglade snail kite (Rostrhamus sociabilis plumbeus) — As described in alternative B, adverse effects from exotic plant management actions would be short term and minor in intensity from the use of herbicides and noise associated with treatment activities and presence of crews. Actions associated with active restoration would produce similar effects, and would also involve mitigation such as avoidance of work during nesting seasons. Alternative C would provide for the active restoration of all of the infested snail kite habitat in Big Cypress National Preserve, 3,690 acres (28% of potential habitat), and in Everglades National Park, 7,859 acres (30% of potential habitat) (see table 35). The recovery of the habitat would be expected to occur within 1 to 2 years of initial treatment, which would have a long-term moderate to major beneficial effect on the kite.

Florida scrub-jay (Aphelocoma coerulescens) — In addition to the adverse effects described in alternative B, actions associated with active restoration would involve similar effects. The presence of crews and use of equipment and vehicles in and near Florida scrub-jay habitat could cause individual birds to temporarily relocate during project activities. Actions would be appropriately chosen to minimize effects and to ensure that no adverse effects occur at an intensity greater than a minor level. Thus, active restoration would also have short-term, minor, adverse effects. In addition, the Florida scrub-jay at Canaveral National Seashore would benefit from 36 acres, or 12% of the infested area of actively restored habitat (see table 35). The more rapid recovery of the habitat

under this alternative as a result of passive and active restoration would have long-term moderate beneficial effects on the species.

Piping plover (Charadrius melodus) — As described in alternative B, adverse effects to the piping plover from exotic plant management actions and the presence of crews and equipment in habitat during non-breeding seasons would be short term and minor. If active restoration were to occur in beach / dunes it would be less than 1 acre, and similar adverse effects would occur from temporary disturbance or displacement of individuals while crews or vehicles were at a site.

Specific distribution information is not available for the piping plover, but there are approximately 58 acres of beach / dunes in Biscayne National Park (2% infested) and 2 acres of beach / dunes in Everglades National Park (50% infested) (see table 5 of appendixes A – I). Alternative C would have a long-term, minor, beneficial effect on the piping plover.

Red-cockaded woodpecker (Picoides borealis) — In addition to the adverse effects described in alternative B, actions associated with active restoration would involve similar effects. The presence of crews and use of equipment and vehicles in and near red-cockaded woodpecker habitat could cause individual birds to temporarily relocate during project activities. Actions would be appropriately chosen to minimize effects and to ensure that no adverse effects occur at an intensity greater than a minor level. Thus, active restoration would also have short-term, minor, adverse effects. Under alternative C, all of the red-cockaded woodpecker habitat that is infested in Big Cypress National Preserve, 441 acres or 22% of the total potential habitat, would be actively restored (see table 5 of appendixes A – I). This would result in more rapid restoration than under alternatives A or B and would be a moderate long-term benefit to the woodpecker.

Roseate tern (Sterna dougallii dougallii) — No areas of potential roseate tern habitat have been identified for active restoration under alternative C. Therefore, effects would be the same as described for alternative B, which would be short-term, negligible to minor, and adverse and long-term, minor and beneficial.

Wood stork (Mycteria americana) — In addition to the adverse effects described in alternative B, actions associated with active restoration would involve similar effects. The presence of crews and use of equipment and vehicles in and near wood stork habitat could cause individual birds to temporarily relocate during project activities. Actions would be appropriately chosen to minimize effects and to ensure that no adverse effects occur at an intensity greater than a minor level. Thus, active restoration would also have short-term, minor, adverse effects. Under alternative C, active restoration of 25,575 acres, 10% of the infested area in Everglades National Park; and 9,201 acres, 3% in Big Cypress National Preserve, would be undertaken to provide habitat for the wood stork (see table 35). The passive and active restoration of the wood stork habitat would result in minor to moderate long-term beneficial effects.

Invertebrates. The following text describes potential impacts of alternative C on special status invertebrate species present in the parks addressed in this draft EPMP/EIS:

Miami blue butterfly (*Cyclargus thomasi bethunebakeri*) — Alternative C does not propose active restoration in Miami blue butterfly habitat because this habitat is not currently infested. Therefore, effects of alternative C would be the same as alternative B, no adverse effects would occur and beneficial effects would be long term and minor in intensity.

Schaus swallowtail butterfly (Papilio aristodemus) and Stock Island tree snail *(Orthalicus reses)* — Alternative C does not propose active restoration in areas where these two species occur. The passive restoration that would occur within their habitat would result in long-term moderate benefits to these species. Adverse effects would be the same as those that would occur in alternative B, and would be short term and negligible.

Cumulative Impacts

The effects of other past, present, and future actions would continue to produce long-term beneficial and adverse cumulative effects, as described under alternative A, the would result in net long-term, moderate, regional adverse impacts to special status species and habitats.

The impacts of alternative C would result in short-term, negligible to minor adverse effects on native vegetation categories for exotic plant management treatment activities. The effects would not measurably add to cumulative adverse effects. The active restoration of the native vegetation communities would reduce or prevent the potential for re-infestation of exotic plants and speeds restoration. This would result in long-term beneficial impacts that would range in intensity depending on the level of infestation and the amount of area restored. Alternative C would have long-term moderate to major beneficial impacts on Southeastern beach mouse and Everglade snail kite because much large portions of the infested potential habitat could undergo active restoration. Long-term moderate beneficial impacts would result for the habitat of pine rockland special status plant species, Florida panther, Atlantic salt marsh snake, Eastern indigo snake, brown pelican, Cape Sable seaside sparrow, Florida scrub-jay, red-cockaded woodpecker, Schaus swallowtail butterfly, and Stock Island tree snail. Long-term minor to moderate beneficial impacts would occur to the habitat of Florida semaphore cactus, American crocodile, sea turtles, bald eagle, and wood stork. Lastly, long-term minor beneficial impacts would occur to St. Thomas lidflower and prickly pear, Audubon's crested caracara, piping plover, roseate tern, and Miami blue butterfly habitat. These actions would contribute to reducing regional long-term cumulative adverse impacts to a moderate level.

Conclusion

Alternative C would have short-term, adverse effects that would range from negligible to minor in intensity. These would result from ground crews accessing special status species habitat, displacement and disturbance of individuals from noise and activity, and the use of chemical treatments, where applicable. Active

restoration activities would be appropriately chosen based on site-specific conditions and the presence or absence of special status species to ensure that no adverse effects occur at an intensity level greater than minor (i.e., may affect / not likely to adversely affect).

The active restoration of the native vegetation communities would reduce or prevent the potential for re-infestation of exotic plants and speeds restoration. This would result in long-term beneficial impacts that would range in intensity depending on the level of infestation and the amount of area restored. Alternative C would have long-term moderate to major beneficial impacts on Southeastern beach mouse and Everglade snail kite because much large portions of the infested potential habitat could undergo active restoration. Long-term moderate beneficial impacts would result for the habitat of pine rockland special status plant species, Florida panther, Atlantic salt marsh snake, Eastern indigo snake, brown pelican, Cape Sable seaside sparrow, Florida scrub-jay, red-cockaded woodpecker, Schaus swallowtail butterfly, and Stock Island tree snail. Long-term minor to moderate beneficial impacts would occur to the habitat of Florida semaphore cactus, American crocodile, sea turtles, bald eagle, and wood stork. Lastly, long-term minor beneficial impacts would occur to St. Thomas lidflower and prickly pear, Audubon's crested caracara, piping plover, roseate tern, and Miami blue butterfly habitat.

Cumulative impacts would be the same as alternative A. Alternative C would not result in impairment of special status species.

WILDLIFE AND WILDLIFE HABITATS

GUIDING REGULATIONS AND POLICIES

The NPS *Organic Act of 1916*, which directs parks to conserve wildlife unimpaired for future generations, is interpreted by the agency to mean that native animal life should be protected and perpetuated as part of a park's natural ecosystem. Natural processes are relied on to control populations of native species to the greatest extent possible; otherwise they are protected from harvest, harassment, or harm by human activities.

The NPS *Management Policies 2001* (NPS 2001e, 4.4.1) state that the NPS would maintain as parts of the natural ecosystems of parks all native plants and animals. The NPS would achieve this through

> preserving and restoring the natural abundance, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal populations and communities and ecosystems in which they occur
>
> restoring native plant and animal populations in parks when they have been extirpated by past human-caused actions
>
> minimizing human impacts on native plants, animal populations, communities, and ecosystems, and the processes that sustain them.

NPS *Management Policies 2001* (NPS 2001e) and Natural Resources Management Guidelines (NPS 2001a) direct the NPS to "encourage productive and enjoyable harmony between man and his environment; to promote efforts which would prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man and to enrich the understanding of the ecological systems and natural resources important to the Nation…" Policies and guidelines for natural resources direct that the park must (1) identify and complete the inventories of natural resources for baseline information; (2) minimize impacts of human activities, developments, and uses on marine and terrestrial resources; (3) continue to close areas to protect nests; and (4) manage endangered, threatened, and candidate species.

The *Fish and Wildlife Coordination Act of 1934*, as amended, requires consultation with the U.S. Fish and Wildlife Service and the fish and wildlife agencies of states where "the waters of any stream or other body of water are proposed or authorized, permitted, or licensed to be impounded, diverted . . . or otherwise controlled or modified" by any agency under a federal permit or license. Consultation is to be undertaken for the purpose of "preventing loss of and damage to wildlife resources."

The *Migratory Bird Treaty Act of 1918*, as amended, prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests except as authorized under a valid permit (50 CFR 21.11). Additionally, the act authorizes and directs the Secretary of the Interior to determine if, and by what means, the take of migratory birds should be allowed and to adopt suitable regulations permitting and governing take (for example,

hunting seasons for ducks and geese). "Take" includes pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb.

METHODOLOGY AND ASSUMPTIONS

GEOGRAPHIC AREA EVALUATED FOR IMPACTS

The area evaluated for impacts on wildlife includes the area within each park boundary or areas outside park boundaries in which wildlife could be disturbed by exotic plant treatment actions. For instance, the noise from helicopters used for aerial treatment may disturb wildlife species outside the parks. Areas adjacent to and within a reasonable range of the parks that may provide habitat for wildlife have also been considered for impacts.

IMPACT CRITERIA AND METHODOLOGY

The following issues regarding the effects of management activities on wildlife and wildlife habitat were identified during internal and public scoping meetings: The presence of exotic plants could change foraging patterns, change predator and prey interactions, displace native wildlife species, and alter wildlife habitat, including breeding areas. For example, large monocultures of melaleuca and Australian pine typically do not contain a lower level of smaller trees and shrubs (understory) that some small mammal species require for foraging and refuge from predation. Melaleuca monocultures displace native pine and cypress and are not suitable for rookery development.

Brazilian pepper on Henley Cay, Virgin Islands National Park, just before treatment

The removal of some exotic plants (such as Brazilian pepper) may directly reduce the food source for many birds. Indirect effects to wildlife may occur from the over-spray of herbicides on native habitat, use of untrained field labor, or incorrect use of prescribed fires.

Noise created during treatment activities can adversely impact wildlife resources by interfering with sounds important for animal communication, including territory establishment, courtship, nurturing, predation, avoiding predators, migration, and foraging functions. Certain types and levels of sound can cause animals to use avoidance mechanisms, especially animals that have not habituated to the sound. Avoidance, initiated as it may be by annoyance or stress, can cause individual animals to alter normal behavior, move to less preferred habitats, and unduly use energy during critical times of the year.

Prescribed Fire and Mechanical Treatments. Prescribed fire and mechanical treatments of exotic plants may remove wildlife habitat used for nesting or cover for roosting. For this reason, many of the parks leave the dead trees and shrubs in place after treatment to provide nesting and roosting areas and to allow the trees and shrubs to decay, which create additional forage opportunities.

The use of fire to treat areas infested with Old World climbing fern may result in impacts to wildlife. Fires normally stop at flooded cypress swamps, which become refuges for wildlife during wildfires. Old World climbing fern, however, forms flammable mats that allow the fire to spread over the lower levels of plants and climb into the crowns of trees. Because of Old World climbing fern, habitats that under normal environmental conditions could tolerate or even benefit from fires are now being destroyed by fires (Ferriter et al. 2003).

Noise associated with exotic plant treatments involving fire or flooding may impact wildlife nesting, feeding, or roosting. The proper timing of treatments must be considered in the planning process.

Chemical Treatment. There is potential for wildlife to be directly exposed to chemicals during preparation and application of herbicides, and native plants may be exposed to chemicals because it is especially difficult to control the spread of herbicides during aerial applications.

Although the herbicides may not impact fish directly, they may impact the food source or habitat of a species. Chemical treatments may also increase the amount of dead plant material entering adjacent water bodies, and the decaying plant material can result in short-term reductions in oxygen levels in the water.

The use of herbicides may alter the dispersal of natural chemical information and odors. Many animals can perceive these natural chemicals, and in response, would modify behaviors such as mating, migration, feeding, predator avoidance, prey selection, and the establishment of social structures.

Access. The presence of humans and use of machinery for treating exotic plants may alter wildlife behavior, disrupt mating activities, and damage nests or eggs. The timing of treatments must be carefully planned to avoid these types of impacts to wildlife.

The potential impacts on wildlife and wildlife habitat were analyzed based on the species present and their association with the exotic plant species targeted for treatment. Alternative A was used as the baseline management condition against which alternatives B and C were compared. The analysis focuses on the effects on wildlife and wildlife habitat that would result from implementing the management actions described in alternatives B and C. The conclusions reached are supported by research conducted by the U.S. Fish and Wildlife Service, the South Florida Water Management District; the University of Florida, the University of Virgin Islands, and other academia; the Florida Fish and Wildlife Conservation Commission; and the staff at the various national parks.

IMPACT THRESHOLD DEFINITIONS

Negligible — An action would result in no observable or measurable impacts on native wildlife species, their habitats, or the natural processes sustaining them.

Minor — An action would result in detectable impacts, but they would not be expected to result in substantial population fluctuations and would not be expected to have any measurable long-term effects on native species, their

habitats, or the natural processes sustaining them. Occasional responses to disturbance by some individuals could be expected but without interference to feeding, reproduction, or other factors affecting population levels.

Moderate — An action would result in detectable impacts on native wildlife, their habitats, or the natural processes sustaining them. Key ecosystem processes may experience disruptions that would be outside the natural range of fluctuation (but would return to natural conditions). Sufficient habitat would remain functional to maintain viability of native wildlife populations.

Major — An action would result in detectable impacts on native wildlife, their habitats, or the natural processes sustaining them. Key ecosystem processes would be disrupted permanently. Adverse responses to disturbance by some individuals would be expected, with negative impacts on feeding, reproduction, or other factors, resulting in a long-term decrease in population numbers and genetic variability.

IMPAIRMENT

Impairment of wildlife resources would occur when the action contributes substantially to deterioration of wildlife resources or their habitat in the parks to the extent that the wildlife would no longer survive as a viable population. In addition, the adverse impacts on wildlife in the parks and their important habitat resources and values would

contribute to the deterioration of wildlife resources and values to the extent that the purpose of the parks would not be fulfilled as established in their enabling legislation

affect resources essential to the natural and cultural integrity or opportunities for enjoyment in the various parks

affect the resource whose conservation is identified as a goal in the general management plan for each park addressed in this draft EPMP/EIS

IMPACTS OF THE ALTERNATIVES ON WILDLIFE AND WILDLIFE HABITATS

ALTERNATIVE A — NO ACTION: CONTINUE CURRENT MANAGEMENT

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Impacts caused by exotic plants on animals have been recognized since at least 1860 (Cole and Landres 1996), and since that time, virtually every wildlife habitat has become infested with exotic species at every level of biological organization. Numerous studies have shown that infestations of exotic plants in natural areas result in the degradation of wildlife habitat (Gordon 1998). Not only do the exotic plants displace native vegetation, they can alter the habitat so that

the ecosystem processes that support native wildlife are lost or degraded (Gordon 1998). The process can be slow, insidious, and almost imperceptible, but exotic plants are slowly replacing the native plants that form the basis of our natural biological systems. The essential foundations of native ecosystems are slowly being undermined and altered, perhaps irreversibly (Doren et al. 2002).

The south Florida and Caribbean national parks currently use chemical, mechanical, physical, and biological treatment methods to control exotic plants. The treatment methods and modes of access to the sites to treat exotic plants would continue to be the primary potential sources of adverse impacts on wildlife and wildlife habitat. The adverse impacts could be disturbance caused by noise or human activity, effects from accidental contact with herbicides, damage to or loss of forage material or foraging sites, loss of cover or refuge from predators, the loss of nesting, denning, or roosting sites, and mortality resulting from treatment activities.

Exotic plants are treated in the parks in order to maintain and restore native wildlife habitat, so it is essential that the herbicides are not toxic to wildlife. Before herbicides are distributed for use, wildlife risk assessments are conducted as part of the registration procedure with the U.S. Environmental Protection Agency. Risk is determined as the product of hazard and exposure. Hazard is measured as the toxicity of the herbicide to animals tested, and exposure depends on the use and persistence of the compound. Herbicides used in natural areas are of low toxicity to test animals and break down in the environment to nontoxic products. The herbicides pose very low risk to wildlife because a wide margin of safety exists between concentrations that cause mortality to laboratory test animals and the potential exposure from use (Langeland 2001). Appendix J provides a description of the herbicides that would be used and a summary of the effects these herbicides would have on plants and animals.

The contractors hired by the parks use formulations of triclopyr, imazapyr, metsulfuron methyl, or glyphosate applied by ground crews using backpack sprayers or applied by aerial spraying. The applicators are trained to efficiently treat as many exotic plants as possible with as little damage as possible, and the backpack sprayer application method is very accurate. Aerial spraying is more difficult to control. Some overspray may occur, and small amounts of any of these herbicides on nontarget plants would result in the loss of the plants. The loss of nontarget trees and other vegetation is not uncommon with aerial application of herbicides (Bowman 2004). While the direct effects of herbicide overspray on wildlife would be negligible, the loss of native vegetation in their habitat due to drift from aerial applications could be minor with implementation of mitigation measures to reduce the amount of drift and the use of small-pore nozzles. See the “Mitigation Measures” section in the “Alternatives” chapter.

Mammals

The adverse impacts of exotic plant treatments on mammals would be disturbance caused by noise or human activity, damage to or loss of forage material or foraging sites, loss of cover or refuge from predators, and loss of nesting or denning sites, and mortality resulting from treatment activities.

Chemical Treatment. Under the no-action alternative, the current chemical treatment methods for exotic plants would continue to create adverse impacts on mammals in Big Cypress National Preserve and Everglades National Park. The ground crews use trucks, all terrain vehicles, chain saws, and other noisy equipment. The noise and human activity would continue to disturb white-tailed deer, bobcats, and small mammals like rodents, raccoons, and opossums, but the noise would be temporary and isolated. Aerial applications of herbicides also result in some adverse impacts from noise and human disturbance. Mammals are motile species, and the parks are very large, so most mammals easily escape the disturbance.

When large monocultural stands of exotic plants are treated, mammals lose opportunities for cover, forage, and denning until the area regenerates with native plant species or is restored. Most mammals (such as rats, mice, raccoons, rabbits, and otters) in Everglades National Park and Big Cypress National Preserve, have adapted to an existence in the graminoid (grassy) marsh areas and use the native tree islands or areas infested with exotic plants during the wet season as cover in transit from one area to another. Other mammals, such as bats, squirrels, skunks, foxes, and feral pigs, use tree islands and stands of exotic plants on a regular basis (Dalrymple et al. 2003) and would continue to be adversely affected by the loss of cover if large stands of melaleuca or Brazilian pepper were treated and cleared.

Chemical treatment of Brazilian pepper, and Australian pine in Canaveral National Seashore and Brazilian pepper, lather leaf, and Australian pine in Biscayne National Park would continue to result in the same adverse impacts on mammals as would occur in Big Cypress National Preserve and Everglades National Park.

No mammals in Dry Tortugas National Park would be affected by chemical treatment of exotic plants. The native mammals in the Caribbean parks include only the six species of bats. Very little is known about the bats in these parks, but it is known that some bats roost in trees during the day. Tree-roosting bats would continue to be temporarily disturbed by the noise and disturbance associated with the chemical treatment of exotic plants. Since no aerial spraying of herbicides is conducted in these parks, there would be no adverse effects from herbicide use to bats.

Mechanical Treatment. The mechanical treatment of exotic plants in the south Florida and Caribbean parks would involve the removal of seedlings. The effects of this treatment would usually be limited to human disturbance and would not require large vehicles, chippers, or chain saws. The majority of the disturbance would continue to be temporary and relatively inconsequential.

Brazilian pepper has been cut and mulched in the Flamingo area of Everglades National Park. Cut and mulch activities reduce monotypic stands to wood chips which are left in place. In Florida's warm, humid environment, the mulch degrades rapidly and returns carbon and nitrogen to the soil. Adverse effects of mulching on soils at this location have not been noted (Taylor 2004). During cut and mulch activities, the use of large chipping equipment and trucks would

produce site-specific, short-term, minor, adverse impacts on mammals from disturbance created by equipment and noise.

Prescribed Fire. Prescribed fire would involve the continued use of fire in the south Florida parks to prevent the regeneration of exotic plants after herbicide treatment. The impacts of fire on mammals would depend on the season in which treatment occurs, the intensity of the fire, the type of habitat burned, and the mammals present. Most mammals in south Florida have adapted to living in fire-dependent communities and can escape properly controlled, low-intensity fires. Small mammals avoid fire by using underground burrows, stump and root holes, and spaces under rocks or caves (USGS 2000). Rabbits, wood rats, and other surface-nesting species, as well as young deer, black bear, raccoon, and other mammals, have been known to succumb to fast-moving fires (USGS 2000). This is a rare occurrence, however, especially with a controlled prescribed fire.

Biological Control. The use of biological controls would likely not impact mammals in any of the parks, although this method is currently only used in Big Cypress National Preserve and Everglades National Park. The biological controls are thoroughly tested for toxicity to native species and for host specificity prior to release. There would be no adverse impacts on mammals or their habitat as a result of continued use of biological controls in the parks.

Under the no-action alternative, prescribed fire to treat exotic plants would continue to have negligible to minor adverse impacts on mammals in the nine parks. Chemical and mechanical treatments would produce adverse impacts in the form of noise and human disturbance and loss of habitat. The impacts of noise and human disturbance would continue to be short term and minor. The habitat loss, given the quality of the habitat and size of the parks, would continue to be a short-term and minor to negligible adverse impact.

Mammals would continue to experience some adverse impacts such as the occasional loss of habitat from overspray and temporary disturbance due to the noise and activity of contractors. These effects would be short term and negligible to minor. The use of fire to control exotic plants would continue to result in a mammal fatalities; however, careful planning and timing of prescribed fires would reduce the likelihood of adverse impacts, and the effects would continue to be short term and negligible to minor.

Under the no-action alternative, all infested mammal habitat would be initially treated and then re-treated every 3 years. Exotic plants would be controlled, but the habitat would not be fully restored. Everglades National Park, Big Cypress National Preserve, and Canaveral National Seashore have large areas of potential mammal habitat in upland vegetation communities including upland dry / mesic forests, shrublands, and grasslands that are infested with exotic plants. All of the vegetation communities, however, contribute to the functioning and health of mammal habitat. Treating areas highly infested by exotic plants would have long-term, minor to moderate beneficial effects. Treating exotic plants in Biscayne National Park would result in long-term negligible to minor beneficial effects.

There are few native mammal species in the Caribbean parks and Dry Tortugas National Park, and beneficial effects on mammal populations and habitat would be negligible to minor.

Birds

The nine parks, with the exception of the Christiansted National Historic Site, support a myriad of bird species and provide some of the most important avian habitat in the western hemisphere. In many of the parks, this habitat is being overrun by exotic plant species. These species can alter the vegetative structure and composition, change foraging opportunities, interrupt nesting and breeding behavior, and increase predation. Exotic plant species can also alter the natural fire regime by increasing fuel loads so that the intensity of the fires increase, causing higher rates of wildlife mortality.

Some exotic plants are toxic to birds. The red berries of Brazilian pepper attract robins, cedar waxwings, and mocking birds; the birds have become intoxicated and have been reported to collide with buildings or become paralyzed and die (Ferriter 1997).

Treatment of exotic plants can cause the loss of nesting habitat, loss of foraging habitat, interruption of nesting activity, and startling of birds due to noise and human activity. Treatment methods include chemical, mechanical, physical, and biological.

Chemical Treatment. Chemical treatment of exotic plants in the parks would require the use of herbicides (Garlon 3a or 4, Arsenal, Renovate, Habitat, Escort, Stalker, Rodeo, or Roundup) applied by ground crews using backpack sprayers or applied by aerial spraying (used only in Everglades National Park, Canaveral National Seashore, and Big Cypress National Preserve). The ground crews use trucks, all terrain vehicles, chain saws, and other noisy equipment, and the noise and human activity may disturb birds that are nesting, foraging or roosting in the vicinity, but the noise would be temporary and isolated. Aerial applications of herbicides may also result in short-term minor adverse impacts from noise and human disturbance.

Mechanical Treatment. Mechanical treatment involves hand pulling exotic plant seedlings that return after treatment or that germinate in natural areas. Treatment would require moving through the habitat on foot and gathering the seedlings by hand. Some minor disturbance would occur due to noise and human activity. Hand pulling is a relatively benign activity, and the impacts on birds would be negligible and short term.

Following chemical and mechanical treatments of large monotypic stands of Brazilian pepper and melaleuca, cutting and mulching could occur in some of the treatment areas in the four south Florida parks, and cutting and removal of large, contiguous areas of tan tan, genip, and lime berry could occur in the Caribbean national parks. Along with the noise and disturbance involved in this treatment, birds would continue to lose foraging, roosting, and nesting habitat. Dalrymple et al. (2003) determined that even dense, closed-canopy stands of melaleuca provide habitat for birds. The study found that a freshwater marsh that had 50%

to 75% melaleuca coverage provided habitat for more bird species and individual birds compared to an undisturbed natural marsh or other combinations of densities of marsh and melaleuca vegetation. Natural sawgrass marshes supported more individual birds but fewer species, and the dense stands of mature melaleuca supported the fewest birds and the fewest species. Consequently, the loss of a large area of melaleuca or Brazilian pepper may result in a loss of habitat for some birds. However, taking the size of the parks into context and applying assumptions as to the opportunistic nature of some birds in the study, the loss of habitat would continue to be minor and short term.

Prescribed Fire. The effects of prescribed fire on birds depend on the species, type of habitat burned, season in which the habitat burned, and intensity of the fire. Bird populations respond to changes in food, cover, and nesting habitat caused by fire (USDA 2000). Fires that remove woody species from a former marsh habitat can reduce the number of bird species present but can eventually increase the number of individuals of bird species that have adapted to life in the fire-dependent habitat. This follows the Dalrymple et al. (2003) determination that the encroachment of woody exotic plant species into a natural monoculture, such as the sawgrass marshes of south Florida, actually provides some diversity to the vegetative structure of the habitat and increases the number of species present.

Fires that occur during the spring nesting season could result in minor to moderate adverse affects on nesting of surface-nesting species such as whippoorwill, wild turkey, and northern harrier.

Biological Control. As with mammals, the use of biological controls would likely not impact birds in any of the parks, although this treatment method is currently used only in Big Cypress National Preserve and Everglades National Park. The biological controls are thoroughly tested for toxicity to native species and for host specificity prior to release. There would be no adverse impacts on birds or their habitat as a result of biological control. For those birds that feed on insects, the additional food source may provide a negligible benefit as it is unlikely that any species would be preferentially feeding on biological controls alone to have a substantial effect.

All vegetation communities in the parks support bird populations and habitats. Under the no-action alternative, all bird habitat infested with exotic plants would be initially treated and then re-treated every 3 years. Exotic plants would be controlled, but the habitat would not be fully restored. Everglades National Park and Big Cypress National Preserve provide large areas of critical nesting and foraging habitat for wading birds and habitat that is essential to migratory birds. Treatment of all infested areas in these parks would result in beneficial impacts on bird species that would be long-term and minor to moderate. Biscayne National Park and Canaveral National Seashore, as well as the Caribbean national parks, also support diverse bird populations and support migratory species. Beneficial impacts from exotic plant treatment in these parks would be long term and minor.

Reptiles

The adverse impacts on reptiles from treatment of exotic plants would be from noise, disturbance by human activity, damage to or loss of forage material or foraging sites, and loss of cover or refuge from predators. Reptiles typically react to human disturbance by hiding under nearby cover rather than leaving the area, as is typically done by birds or mammals. Therefore, it can be assumed that reptiles recover from a noise or startle disturbance more quickly than birds or mammals. Reptiles are sometimes less motile than most birds or mammals, and may therefore be more highly impacted by vehicles, ground crews, or fire.

Dalrymple et al. (2003) had similar results with the reptiles as he did with birds in his study of the effects encroaching melaleuca have on a sawgrass marsh. Up to a certain point, the encroaching melaleuca provided habitat for reptiles and amphibian species not normally observed in the sawgrass marsh because the melaleuca provided a structure in the habitat that was previously missing. The number of species and individuals increased steadily until the marsh was a dense monoculture of melaleuca with a closed canopy. Once the melaleuca reaches this density, the habitat no longer supports the diversity or numbers of reptiles that it originally did.

Chemical Treatment. Under the no-action alternative, the various parks would continue to use the approved herbicides. The herbicides are mixed with water or vegetable oil, which are recommended by some manufacturers; therefore, the spray would have negligible adverse effects to the reptile species. The herbicides that are used are of low to toxicity to animals, even at concentrations higher than are used in the parks And there is little available evidence that the herbicides proposed for use in the parks are linked to endocrine disrupting activities in wildlife (Extoxnet 1996a-b; Tu et al. 2001). In addition, the majority of application of the herbicides in the parks is by ground methods which lowers the risk of exposure of reptiles to direct contact with the herbicides (table 5 of appendixes A – I). With the use of BMPs and SOPs during aerial application, the potential for exposure as result of drift is also lowered. Adverse effects would be negligible to minor for these species. The activity required for chemical treatment would possibly continue to have adverse impacts on reptiles if the ground crew inadvertently stepped on one or crushed one under a vehicle.

Mechanical treatment. The mechanical treatment of exotic plants in the south Florida and Caribbean parks would involve the removal of seedlings. The effects of this treatment method would be limited to disturbance by ground crews and would not require large vehicles, chippers, and chain saws. The majority of the disturbance would continue to be temporary and have negligible short-term adverse impacts.

Prescribed Fire. Past studies have determined that few fire-caused injuries occur to reptiles even though many of these animals have limited mobility. Only one species, the eastern glass lizard, suffers substantial population losses from fires. High mortality rates of eastern box turtles have been reported, but other reports have stated that box turtles and other turtle species burrow into the soil to escape fires. This may not be a successful escape in some areas of south Florida where the soil layer is very thin. Snakes may be vulnerable to fires during the process of shedding; other reptiles find refuge in wetlands or moist depressions (USDA

2000). Studies show that fires that occur in rapid sequence, such as every year, are more harmful to reptiles and amphibians than fires occurring every 3 to 4 years, depending on the species (USDA 2000). Fire would not be used annually and the adverse impacts would be short-term and negligible.

Biological Control. Although there is little data on the effects of biological controls on reptiles, it is doubtful that the biological agents would have any effect on native reptiles. Each control agent is thoroughly tested for toxicity and host specificity prior to release. Therefore, no adverse impacts on reptiles are expected from the continued use of biological treatment in the south Florida parks. Reptiles that feed on insects however may benefit from an increase in prey source but it is not likely that this increased forage would result in changes in populations. The benefits would be negligible.

Under the no-action alternative, the continued use of the current treatment methods would continue to result in adverse impacts that would be short term and negligible to minor.

Under the no-action alternative, all areas of exotic plant infestation would be initially treated and then re-treated every 3 years. Exotic plants would be controlled, but the habitat would not be fully restored. Everglades National Park and Big Cypress National Preserve have large areas of wetland forest and freshwater marsh that provide reptile and amphibian habitat. Treatment would result in long-term minor benefits. Treatment of infested pine flatwoods and oak scrublands in Canaveral National Seashore would result in long-term minor beneficial effects. Treatment of all infested upland forest areas in the Caribbean national parks would provide long-term minor beneficial effects. In all other infested areas in the parks, the benefits of treatment under alternative A would be long term and negligible to minor.

Aquatic Organisms and Amphibians

The adverse impacts on aquatic organisms and amphibians from treatment of exotic plants would be from potential for herbicides to enter aquatic environments, disturbance by human activity, damage to or loss of forage material or foraging sites, and loss of cover.

Chemical Treatment. Amphibians and aquatic organisms such as fish can be highly sensitive to herbicides. Amphibians in particular because of their permeable skin and complex life cycles. Most amphibian species require moisture or some form of water to complete their life cycle, and most are aquatic in their egg or larval stages. Studies have found that adult and larval amphibians are not necessarily more sensitive to chemicals than other terrestrial or aquatic invertebrates (Carey and Bryant 1995) although effects may occur as a result of increased susceptibility to disease and predation, altered growth rates, or disrupted development. They suggest endocrine-disrupting toxicants can have tissue-level effects that are below detectable levels and therefore, chemicals that are designated as safe are not necessarily free of endocrine-disrupting effects (Carey and Bryant 1995). Endocrine disruptors are chemicals that interfere with the normal function of hormones and the way hormones control growth, metabolism and body functions. However, as elaborated on in appendix J, there

is little available evidence that the herbicides proposed for use in the parks are linked to endocrine disrupting activities in wildlife (Extoxnet 1996a-b; Tu et al. 2001).

Glyphosate has been studied for effects on aquatic organisms and amphibians. What the studies have shown is that glyphosate itself is not detrimental in the aquatic environment, but rather it is the surfactants that are added to the herbicide that increases the toxicity (Tu et al. 2001). Numerous laboratory and mesocosm studies have shown that the use of Roundup®, active ingredient glyphosate plus POEA surfactant, causes mortality of tadpoles and can result in community level changes. The EPA has required some glyphosate products to be labeled "Toxic to fish" when applied directly to aquatic environments due the surfactant (EPA 1993). The glyphosate product, Rodeo, which lacks the POEA surfactant has been shown to have a low mortality rate for both fish and tadpoles and therefore has been registered for use in aquatic settings. The rapid dissipation from aquatic environments of glyphosate formulations also prevents build-up of herbicide concentrations that would be lethal to most aquatic species (Tu et al. 2001). The surfactants which cause detrimental effects to aquatic environments are the reason certain glyphosate products such as Roundup® are not registered for use in aquatic environments. As such only those glyphosate herbicides that are approved for use in aquatic setting, such as Rodeo, would be used in the parks according to label instructions.

Metsulfuron methyl and imazapyr are practically nontoxic to fish and aquatic invertebrates and do not build up (bioaccumulate) in fish. Triclopyr acid and the salt formation herbicide (Garlon 3A) are only slightly toxic to fish. The ester formulation of triclopyr (Garlon 4) however is more toxic to fish (Vencill 1994) and was also found to be toxic to some species of frog tadpoles, but under normal conditions, it rapidly breaks down in water to a less toxic form (IVI 2004d). Nevertheless, most authors have concluded that if applied properly, triclopyr would not be found in concentrations adequate to kill aquatic organisms (Tu et al. 2001). Triclopyr does not accumulate in fish and is slightly toxic to practically non-toxic to aquatic invertebrates. Triclopyr and its formulations have not been tested for chronic effects in aquatic animals. Application via ground methods and use of BMPs and SOPs during aerial application would further reduce the potential for triclopyr to have adverse effects on aquatic organisms or amphibians found near or in the aquatic environment.

Herbicides would predominantly be applied via ground treatments as only Big Cypress National Preserve and Everglades National Park uses aerial application. Application of herbicides by ground treatments would lower the risk of affecting aquatic systems and organisms because the application occurs more slowly and applicators are able to recognize potential problems and adjust their application techniques. Aquatic organisms and amphibians could be affected by herbicide use in four ways: the inadvertent entry of herbicides into aquatic systems through surface runoff, leaching through soils, accidental spills, and wind drift during aerial application.

Herbicides can potentially move through soils with rainfall, depending on soil permeability and water-holding capacity. They can subsequently enter surface water and potentially adversely affect aquatic resources if their concentrations are

high enough. As stated in "Soils" section of this chapter, the herbicides used have little potential to leach to waterways. The concentration of herbicides used would be low as the rates of active ingredient proposed for application on exotic plants within the parks are below maximum rate per acre allowed by the label. In addition, implementation of BMPs and SOPS such as not applying herbicides when there is potential for a rain event, reduces the likelihood of chemicals being leached into the environment.

Herbicides can enter the waterways through runoff. As stated in the "Water Quality and Hydrology" section, the potential for runoff into drainages or wetlands following herbicide application is low in the parks due to the rapid binding and/or breakdown of herbicides in the environment and the use BMPs and SOPs to avoid application when there is potential for extreme rain occurring after application of the herbicide.

Contamination into the aquatic environment and exposure of amphibians, fish, or aquatic organisms can occur as a result of accidental spills, leaks, or rinsing equipment in loading and handling areas. These discharges can result in localized high concentrations of herbicides. With implementation of BMPs and SOPs identified in the *Exotic Plant Management Teams Operations Handbook* (NPS 2003m), which provides detailed guidelines on the proper storage, handling, and transportation of herbicides, the risk of contamination of aquatic environments is greatly minimized.

Aerial spraying in Big Cypress National Preserve and Everglades National Park near aquatic habitats represents the greatest potential to expose aquatic organisms and amphibians to contaminants either through direct application or wind drift. With implementation of BMPs and SOPs identified in chapter 2, the risk of exposure to aquatic organisms and amphibians is greatly reduced. These include avoiding application when there is potential for extreme rain or weather events occurring during or soon after application of the herbicide to prevent drift and/or runoff into water bodies. Aerial spraying would also be prohibited during periods of wetland inundation. Spraying would only occur when wind speeds are low, guidelines regarding nozzle size and pressure would be adhered to, and an application system that involves a positive shut-off valve would all be employed to prevent accidental drift of herbicides into aquatic environments.

Under the no-action alternative, application of herbicides according to the label, application predominantly by ground crews, implementation of BMPs, and SOPs to prevent spills near aquatic environments and to prevent overspray during aerial applications would reduce the short-term adverse effects on aquatic organisms and amphibians to negligible to minor.

Mechanical Treatment. Mechanical removal of exotic plants involving hand pulling of saplings and small plants, cutting, and mulching, would have negligible effects on water quality because of the small area of disturbance, the low transport of soils to water as a result of surrounding dense vegetation and low slopes in south Florida. Therefore there would be negligible to no adverse effects on aquatic organisms from mechanical treatments. During terrestrial stages, amphibians could be trampled or run over by a vehicle, but such events would be rare.

Prescribed Fire. The use of prescribed fire would occur in fire adapted areas of Big Cypress National Preserve and Everglades National Park. Terrestrial amphibians would likely abandon areas that are being burned to avoid the heat and desiccation by burrowing underground or escaping to water bodies such as ponds or wetland areas (USDA 2000). As burns would occur in a patchy distribution across the landscape, there would be areas adjacent to burned areas that amphibians could escape to and find refuge. Few studies have addressed the effects that seasonal burns have on amphibians use of burned areas although one recent study in fire adapted long-leaf pine sandhill communities indicated no difference in amphibian use of burned versus unburned ponds (Hardy et al. cited in Greenberg 2001). Amphibians that inhabit fire adapted vegetation categories such as would be burned in the parks would be expected to escape the burns and to return to the habitats which would recover quickly from disturbance. The long-term adverse effects on amphibians therefore would be negligible to minor as loss of individuals may occur.

Fire effects on fish and aquatic organisms are indirect as result of effects on the physical and chemical environment of their habitat. Loss of vegetative cover would have localized effects on the aquatic system by increasing temperature and possibly lowering dissolved oxygen levels. An important habitat effect of fires for fish is temporary loss of cover. Absence of cover may cause fish to leave an area that has been recently burned and it may affect their behavior and reproductive success. Increases in nutrients such as nitrogen and carbon and sedimentation may occur in pulses if rain events occur soon after a burn. Sedimentation into aquatic systems degrades foraging and nesting habitat of aquatic organisms. Nutrient increases can result in changes in invertebrate densities and composition if the forage base is changed as a result and the species assemblage becomes dominated by herbivores as algal biomass increases. These community level changes however occur from substantial and chronic nutrient additions (EPA 1995) which would not result from the use of low intensity prescribed fire in the parks. The prescribed fires that would take place in the park would not be large-scale, they would be low intensity small scale burns that remove areas of exotic plants however adjacent areas would continue to support native vegetation. This native vegetation and the low slopes found in the parks would reduce or eliminate transport of sediments or nutrients to the aquatic environments. As vegetation quickly recovers, sedimentation, nutrient loading, and adverse effects as a result of a loss of cover would be reduced. The short-term adverse effects on fish and aquatic organisms would be minor.

Biological Treatment. Biological methods of exotic plant control would have no adverse impacts on amphibians or aquatic organisms and may result in negligible beneficial effects as an increased terrestrial food source.

Under the no-action alternative, all areas of exotic plant infestation would be initially treated and then re-treated every 3 years. Exotic plants would be controlled, but the habitat would not be fully restored. Treatment of habitat in the parks such as wetland forest and freshwater marsh in Everglades National Park and Big Cypress National Preserve, pine flatwoods and oak scrublands in Canaveral National Seashore, infested upland forest areas in the Caribbean national parks would provide long-term minor beneficial effects. In all other infested areas in the parks that do not support a large amount of habitat for

aquatic organisms or amphibians, the benefits of treatment under alternative A would be long term and negligible to minor.

Terrestrial Invertebrates

The sub-tropical and tropical environments of the parks support a large abundance and diversity of terrestrial invertebrates. Application of herbicides, use of biological controls, the use of prescribed fire, and mechanical removal methods could affect terrestrial invertebrates.

Chemical treatment. Terrestrial invertebrates could be affected by direct exposure to herbicides during application. Studies have shown that glyphosate based formulations are practically harmless to terrestrial insects at levels higher than would be encountered in the field (see appendix J). Studies of Roundup have indicated no mortality of beetles directly oversprayed at maximum field use rates or adverse effects on soil organisms at normal field application rates (Giesy et al. 2000). Studies of triclopyr have indicated it is toxic to terrestrial mites at typical application rates (see review in Cox 2000). Limited information is available to assess the effects of Metsulfuron methyl and Imazapyr on terrestrial invertebrates. Laboratory test indicate that Metsulfuron methyl is practically non-toxic (IVI 2004c) and imazapyr is of low toxicity (IVI 2004b) to honey bees at concentrations higher than would be applied in the field. The potential for direct exposure, which may result in a loss of individuals and even lower population numbers of some species, would be greatest during aerial treatments when larger areas are affected. Ground-based treatments may result in the direct exposure of individuals but would not be expected to result in declines in population sizes as the area affected would be small, individual plants and patchy in distribution.

Herbicides could affect terrestrial invertebrates due to a loss of habitat or through direct contact with the herbicide. Herbicides would reduce the amount of exotic plant material available to invertebrates that may use them for forage or shelter particularly those species or life-stages that are not highly mobile. It has been shown that indirect effects of glyphosate herbicides, by means of reduced amounts and cover of vegetation on insects have resulted in short-term reductions in abundance, but not in declines in species richness or species diversity (Guiseppe et al. 2006). Application of herbicides aerially could result in the reduction of habitat structure and changes in microclimate that could lead to a drop in numbers of certain species of invertebrates within localized areas (Haugton et al. 1999). Because of the rapid regeneration of native vegetation in the region, this effect on invertebrate numbers would be short-term and recovery of invertebrates within those areas would be fully expected. Ground-based treatment methods because of the patchy distribution of treatment and the availability of adjacent native vegetation would not be expected to have a noticeable effect on insect populations or communities. The adverse effect on terrestrial invertebrates from alteration of habitat as a result of chemical treatment would be short-term and negligible to minor. Both the direct and indirect effects of herbicide application would result in the loss of individuals and the potential for short-term declines in population numbers but there would not be any long-term effect on species richness or diversity. The overall adverse affect of application of the herbicides addressed in this plan/EIS would therefore be short-term and negligible to minor.

Mechanical Treatment. Mechanical removal of exotic plants involving hand pulling of saplings and small plants, cutting, and mulching, would result in the disturbance and potential loss of individuals but there would be no population level effect on terrestrial invertebrates. Therefore the effect would negligible

Prescribed Fire. The use of prescribed fire would occur in fire adapted areas of Big Cypress National Preserve and Everglades National Park. Fire can have direct mortality on some invertebrates particularly less mobile species. While most invertebrates that live in the surface soil layers and invertebrate eggs are likely to be killed by fire, some, including ants and flying surface insects, may increase in numbers after a fire. Use of fire in fire-adapted systems improves forage quality and quantity which would benefit insects which have been shown to increase after fires. Burning different areas at different intervals and in different seasons results in a diversity of landscapes, food availability, and cover sources (Long 2002). Fire may also injure trees and encourage decay, attracting a variety of wood-boring insects (NPS 2005b). The use of prescribed fire to treat exotic plants would result in the loss of individuals and potentially short-term reductions in population numbers of those less mobile species. However, populations would be expected to recover quickly as vegetation recovers. The adverse effect on terrestrial invertebrates would be short-term and minor.

Biological Treatment. The primary way in which biological controls would affect other invertebrates would be through competition for forage. Biological methods are chosen because they are specific to the targeted exotic plant and have not shown to target other native species of plants. As such, there would be no competition for forage on native plants with other terrestrial invertebrates. The effects of biological controls on other terrestrial invertebrates would therefore be negligible or would have no effects.

Under the no-action alternative, all areas of exotic plant infestation would be initially treated and then re-treated every 3 years. Exotic plants would be controlled, but the habitat would not be fully restored. Treatment of habitat in the parks would improve native habitat that would provide diverse cover and forage for terrestrial invertebrates and would provide long-term minor beneficial effects.

Cumulative Impacts

Through the combined actions of the parks and the various state and local programs, there are coordinated efforts to address the growing crisis facing the state of Florida with respect to the exotic plant species. This includes state legislation (the *Everglades Forever Act*) requiring the South Florida Water Management District to establish a program to coordinate the management of exotic plants with other federal, state, and local governmental entities, and to emphasize the Everglades Protection Area. Concerned agencies in Florida are taking part in a national strategic plan to develop the state invasive exotic plant management plan. The control and management of exotic plants is one of the priorities established by the South Florida Ecosystem Restoration Task Force and Working Group in 1993. The Governor's Commission for a Sustainable South Florida and the U.S. Fish and Wildlife Service's South Florida Multi-Species Recovery Plan (USFWS 1999) incorporate exotic plant management as a key restoration objective. Although several state agencies, particularly the Florida

Department of Environmental Protection and South Florida Water Management District, have reasonably well-funded invasive exotic plant programs, federal funding has lagged (NEWTT, Strategic Plan). As noted in the native vegetation section, the results of these actions would continue to produce long-term moderate to major beneficial effects on native vegetation communities throughout south Florida. The vegetation communities directly support and provide habitat for wildlife. While exotic plants often provide habitat for wildlife, the effects of actions by others to control exotic plants outside of the parks would continue to produce moderate benefits to wildlife.

Hydrologic and ecosystem restoration efforts, such as the Comprehensive Everglades Restoration Plan, would produce long-term, localized, moderate beneficial effects on wildlife and wildlife habitat as more natural inundation periods and water balance return to Everglades National Park and Big Cypress National Preserve.

In the Caribbean parks, the actions to manage exotic plants are relatively new and have focused on the beaches and aquatic resources. There are no other local or territorial exotic plant management plans that contribute to the parks' efforts. Continued increases in exotic plants on lands outside the parks would result in long-term minor adverse impacts.

In conjunction with ongoing exotic plant management actions, the actions of outside agencies and organizations, and the continued presence of exotic plants outside of the parks, cumulative long-term beneficial effects on wildlife would be minor.

Past, present, and anticipated management plans in the parks are and would support improvements to wildlife and wildlife habitats. Fire management plans in Florida parks are restoring natural fire regimes, reducing fuel loads, and reducing likelihood of catastrophic fires providing a moderate benefit. New general management plans that have recently been completed or are underway provide enhanced goals and frameworks for management of park resources and would contribute to long-term minor to moderate benefits. Invasive animal management plans are and would continue to reduce the spread of exotic plants by nonnative animal species and result in long-term minor benefits.

Restoration projects such as salt marsh restoration in Canaveral National Seashore and the Hole-in-the-Donut project in Everglades National Park, as well as, minor restoration projects such as road and trail restoration that remove exotic vegetation and allow for improved wildlife habitat are providing long-term minor to moderate benefits. The airboat concessions management plan in the East Everglades Addition Lands of Everglades National Park would reduce long-term disturbance and displacement of wildlife and result in long-term, minor beneficial impacts.

In contrast to the collective efforts of the state and federal agencies, there are private landowners with property adjacent to the parks that have not addressed exotic plant problems on their lands. These areas provide a seed source for the re-infestation of public lands. Without increased action on the part of adjacent

landowners, exotic plants would produce long-term, minor adverse impacts on park and regional wildlife communities.

Land development and agriculture (including hydrologic alteration) has and would continue to degrade and reduce habitats, including from the introduction of exotic plants, resulting in long-term minor to moderate adverse effects. Fire suppression has resulted in an alteration of habitats resulting in minor adverse impacts. Recreational activities such as boating, airboating, and ATVs have and would continue to cause habitat disturbance resulting in long-term, minor adverse impacts. Inside the parks, existing facilities, trail, and road development in parks would continue to disturb and displace wildlife and result in short- and long-term, minor adverse impacts.

The long-term, minor to moderate beneficial cumulative effects that have and would result from ecosystem restoration activities and exotic plant management programs outside of the parks would mitigate some of the minor to moderate adverse cumulative effects of land development, agriculture, and expanding exotic plant infestations that result in losses in wildlife and wildlife habitats. Cumulative regional adverse effects could be reduced to a long-term minor adverse effect. The cumulative beneficial effect of other plans and restoration projects within the parks would additionally off-set the outside adverse effects to some degree.

The actions of alternative A would result in short-term, negligible to minor adverse effects on wildlife from exotic plant management treatment activities. The effects would not measurably add to cumulative adverse effects. Benefits to wildlife from treatment of exotic plants would range depending on the level of infestation in potential habitat and the effects exotic plants have on a particular species. Long-term minor to moderate beneficial impacts would result in bird habitats due to the extensive presence of and the dependence of species such as wading birds and migratory birds on that habitat. In other wildlife habitat of mammals, reptiles, amphibians, and aquatic organisms, there would be long-term, negligible to minor beneficial impacts because of the lesser effect that exotic plants have on these species. These actions would contribute to reducing regional long-term cumulative adverse impacts to a minor level.

Conclusion

Under alternative A, all areas of exotic plant infestation would be treated by current methods. The continued application of currently used chemicals in all wildlife habitats would result in short-term negligible to minor adverse impacts because of the accuracy of application and the low impact and low level of toxicity on species and nontarget vegetation in their habitat. Mechanical methods would cause trampling of undergrowth and breaking of branches and disturbance and displacement of individuals from foot traffic and motorized access and result in short-term negligible to minor adverse impacts.. This impact would be local and negligible to minor. Biological controls would have no adverse effect on wildlife and wildlife habitat and may provide negligible benefits to individuals of species that feed on invertebrates.. When fire is used as a prescribed fire, it would be used in native vegetation communities and wildlife habitats that are fire-adapted, and as a result, adverse impacts would be negligible to minor.

The removal of exotic plants would restore the biological integrity and biodiversity of wildlife habitats and the native vegetation communities in which they occur. Under alternative A, exotic plants would be controlled, but habitats and native vegetation communities would not be fully restored. Long-term minor to moderate beneficial impacts would result in bird habitats due to the extensive presence of and the dependence of species such as wading birds and migratory birds on that habitat. In other wildlife habitat of mammals, reptiles, amphibians, and aquatic organisms, there would be long-term and negligible to minor beneficial impacts because of the lesser effect that exotic plants have on these species.

The exotic plant management actions would contribute to reducing regional long-term cumulative adverse impacts to a minor level. Implementation of alternative A would not result in impairment of wildlife or wildlife habitats.

ALTERNATIVE B — NEW FRAMEWORK FOR EXOTIC PLANT MANAGEMENT: INCREASED PLANNING, MONITORING, AND MITIGATION

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Alternative B would use the same methodologies, chemical, physical, biological, and mechanical, for the treatment of exotic plants as described under alternative A, and the impacts of these methods would be the same as described under alternative A. However, methods of treatment that could occur in each vegetation category under alternative B have been defined based on a decision matrix that accounts for the exotic plants present, the vegetation category, and species of special concern. Using this decision tool, the most appropriate treatment and re-treatment method would be applied in each vegetation category. By using this tool, impacts on wildlife and wildlife habitat would be reduced further than under alternative A.

Under alternative B, there would be an increase in the frequency of treatment and implementation of an adaptive management program. Although the frequency of disturbance to wildlife would increase, the disturbances to wildlife and wildlife habitat that would occur under alternative B would be the same level of intensity as described under alternative A with implementation of mitigation measures would minimize or prevent those disturbances. The adaptive management program would monitor the effects of the treatment on the native habitat and the populations of wildlife species. If an adverse impact were to occur, or if it appears that the increased activity is affecting wildlife populations, the treatment method would be assessed and revised to prevent subsequent impacts. The mitigation measures discussed in the "Alternatives" chapter would further minimize or prevent impacts.

Under alternative B, all infested wildlife habitat would be initially treated and then re-treated every 6 months. Exotic plants would be controlled, but the habitat would be more fully restored than in alternative A. Everglades National Park, Big Cypress National Preserve, and Canaveral National Seashore have large areas of

potential mammal habitat in upland vegetation communities including the upland dry / mesic forests, shrublands, and grasslands that are infested with exotic plants All of the vegetation communities contribute to the functioning and health of mammal habitat. Treatment and more frequent re-treatment of areas of high infestation by exotic plants would have beneficial effects that would be long term and moderate. Treatment of infested areas and a more rapid recovery of native vegetation in Biscayne National Park would result in long-term minor beneficial effects.

There are few native mammal species in the Caribbean national parks and Dry Tortugas National Park, and beneficial impacts on mammal populations and habitat would be negligible to minor.

Everglades National Park and Big Cypress National Preserve provide large areas of critical nesting and foraging habitat for wading birds and habitat that is essential to migratory birds. Treatment and more frequent re-treatment of all infested areas in these parks would result in beneficial impacts to bird species that would be long-term and moderate. Biscayne National Park and Canaveral National Seashore, as well as the Caribbean national parks, also support diverse bird populations and migratory bird species. Beneficial impacts from exotic plant treatments and more rapid recovery of native vegetation in these parks would be long term and minor.

Everglades National Park and Big Cypress National Preserve have large areas of wetland forest and freshwater marsh that provide habitat for reptiles, amphibians, and aquatic organisms. Treatment under alternative B would result in long-term minor benefits. Treatment of infested pine flatwoods and oak scrublands in Canaveral National Seashore would result in long-term minor beneficial effects. Treatment of all infested upland forest areas in the Caribbean national parks, and the more rapid recovery of the system would provide long-term minor beneficial effects. In all other infested areas in the parks, the benefits of treatment under alternative B would be long term and negligible to minor.

Cumulative Impacts

The effects of other past, present, and future actions would continue to produce long-term beneficial and adverse cumulative effects, as described under alternative A, which would result in net long-term, minor, regional adverse impacts to wildlife and wildlife habitats.

The actions of alternative B would result in short-term, negligible to minor adverse effects on wildlife from exotic plant management treatment activities. The effects would not measurably add to cumulative adverse effects. Benefits to wildlife from treatment of exotic plants would range depending on the level of infestation in potential habitat and the effects exotic plants have on a particular species. Long-term moderate beneficial impacts would result in bird habitats due to the extensive presence of and the dependence of species such as wading birds and migratory birds on that habitat. In other wildlife habitat of mammals, reptiles, amphibians, and aquatic organisms, there would be long-term, minor to moderate beneficial impacts because of the lesser effect that exotic plants have

on these species. These actions would contribute to reducing regional long-term cumulative adverse impacts to a minor level.

Conclusion

The treatment methodologies for alternative B are the same as those described in alternative A but with an increased frequency occurring at a minimum of every 6 months for 5 or 6 years or until the exotic plants are under control. The adverse impacts on wildlife and their habitat from treatment under alternative B would be the same as under alternative A. The increased frequency of treatment may result in some increase in the occurrences of nontarget species impacts and ground crew access impacts on wildlife species habitat. However, mitigation measures would be combined with the monitoring and adaptive management program, which would collect information to determine if the treatment methodology and frequency are appropriate to achieve desired future conditions in wildlife species habitat. This would minimize the negative effects of more frequent treatments and result in short-term negligible to minor adverse impacts.

Under alternative B, all infested wildlife habitat would be initially treated and then re-treated every 6 months. Exotic plants would be controlled, and the habitat would be more fully restored in a shorter period of time than in alternative A. There would be long-term moderate beneficial impacts on bird habitats due to the extensive presence of habitat and the dependence of species, such as wading birds and migratory birds, on vegetation communities that are heavily affected by exotic plants. In mammal, reptile, and amphibian and aquatic habitats there would be long-term and minor to moderate beneficial impacts because of the lesser effect that exotic plants have on these species.

Cumulative impacts would be the same as alternative A. Implementation of alternative B would not result in impairment of wildlife or wildlife habitats.

Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

As stated in the "Alternatives" chapter, alternative C is identical to alternative B but with the added benefit of active restoration in selected areas. The "Alternatives" chapter details the criteria for determining the areas to be actively restored. The proposed active restoration covers all habitat types, but with a focus on special status species. The locations include all the parks except Christiansted National Historic Site and Dry Tortugas National Park. The amount of wildlife habitat within each park represented by a vegetation category that would be restored is provided in table 17 in the "Alternatives" chapter. The effects of exotic plant treatments on wildlife and wildlife habitat and restoration of habitat would be the same as described under alternative B.

Active restoration of sites would entail one or a combination of methods to facilitate the recovery of native plant species. Active restoration would involve soil or site amendments, seeding sites with native seed sources, planting with native plant species or system-level alterations. During active restoration, large amounts of plant or soil material may need to be moved. Crews would use trucks, hand tools, seed drills, and earth moving equipment. Equipment and materials would need to be staged in locations within reasonable proximity to the project site. Ground crews accessing the active restoration sites would produce localized, short-term, negligible to moderate adverse impacts on wildlife and wildlife habitats. These effects would result from noise and vibration of equipment and movement of humans. Animals that can flee would experience minor short-term adverse impacts. Soil removal would displace small mammals and have moderate adverse impacts. Burrow mammals and mammals that are cursorial may be lost. Mitigation measures and best management practices to avoid large scale active restoration of sites during high precipitation periods and given the low elevation of the south Florida parks where large-scale restoration activities are most likely to occur, the degradation of water quality would be minimal as a result of soil movement to aquatic habitats although some sedimentation may occur. This may affect individuals of some species and cause some animals to be displaced, although population levels effects would not likely occur. The adverse short-term effects on aquatic organisms and habitat would be minor.

As in alternative B, monitoring would be conducted to determine the efficacy of the treatment and to propose an alternative treatment, if necessary, if desired future conditions of the vegetation communities within wildlife habitat were not being met, if there are impacts on wildlife species that exceed what was expected, and to determine if active restoration methods are successful. The ability to alter the treatment or the restoration techniques to provide the optimum methodology of exotic plant control and restoration is the adaptive management program described in the “Alternatives” section as alternative B. In alternative C, the adaptive management plan proposed in alternative B would be implemented with the addition of active restoration in selected areas within the parks. As described in alternative B, an increase in the intensity and frequency of access to infested sites would occur for both actively and passively restored areas. The impacts of this increase would be the same as alternative B.

The benefits to vegetation categories as a result of passive restoration of infested areas within the parks would be the same as those described under alternative B. The framework for implementing active restoration within the parks is discussed in the “Alternatives” chapter, as are the criteria used to determine which areas should be restored. Under this alternative, disturbed lands and sensitive species habitat would be a high priority for restoration. The active restoration of these areas within the parks would enhance the available habitat for wildlife in these locations and benefits could range up to moderate dependent on the size of the restoration site. Site monitoring would ensure that restoration of wildlife habitat was occurring. If desired future conditions were not being achieved, restoration methods would be adapted to improve restoration success. Active restoration would inhibit the reestablishment of exotic plants and would allow a more rapid return of native wildlife habitat in these areas.

The impacts of treatment of exotic plants on wildlife and wildlife habitat and restoration of habitat would be the same as described in alternative B, although the benefits of restoration would be achieved much more rapidly under alternative C. See table 18 in the "Alternatives" chapter for a comparison of the time frame for restoration of habitat to the desired future conditions. In some wildlife habitats, such as the salt marsh and freshwater marsh categories, active restoration of sites would result in native habitat being restored to stable native conditions within 1 or 2 years of initial treatment.

Cumulative Impacts

The effects of other past, present, and future actions would continue to produce long-term beneficial and adverse cumulative effects, as described under alternative A, which would result in net long-term, minor, regional adverse impacts to wildlife and wildlife habitats.

The implementation of alternative C would have the same negligible to minor adverse impacts as alternative B from exotic plant treatment methods and access to sites for treatment and monitoring. The active restoration of the native vegetation communities would reduce or prevent the potential for re-infestation of exotic plants and speed restoration. Active restoration areas would provide improved habitat for wildlife particularly in areas where large-scale restoration actions would take place. The overall long-term benefit to wildlife from passive and active restoration activities under alternative C would be minor to moderate. These actions would contribute to reducing regional long-term cumulative adverse impacts to a minor level.

Conclusion

The implementation of alternative C would have the same negligible to minor adverse impacts as alternative B from exotic plant treatment methods and access to sites for treatment and monitoring. The active restoration of the native vegetation communities would reduce or prevent the potential for re-infestation of exotic plants and speed restoration. Active restoration areas would provide improved habitat for wildlife particularly in areas where large-scale restoration actions would take place. The overall long-term benefit to wildlife from passive and active restoration activities under alternative C would be minor to moderate

Cumulative impacts would be the same as alternative A. Implementation of alternative C would not result in impairment of wildlife or wildlife habitats.

AIR QUALITY

GUIDING REGULATIONS AND POLICIES

FEDERAL GUIDANCE

The *Clean Air Act* establishes national ambient air quality standards to protect the public health and welfare from air pollution. The act also establishes a program for the prevention of significant deterioration of air quality.

The prevention of significant deterioration program was designed to protect clean air resources. The program was developed out of a May 30, 1972, decision by the U.S. District Court for the District of Columbia, in a lawsuit brought by the Sierra Club, interpreting the *Clean Air Act* as requiring the prevention of significant deterioration of air quality in all clean air areas of the country. The Supreme Court affirmed that decision on June 11, 1973. Prevention of significant deterioration thresholds are established in the *Clean Air Act* (40 CFR 51.166).

One purpose of this program is to preserve, protect, and enhance air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, scenic, or historic value (42 USC 7401 *et seq*.). The program also includes the following classification approach for controlling air pollution.

> Class I areas, which typically are national parks and wilderness areas, are afforded the greatest degree of air quality protection. Very little deterioration of air quality is allowed in these areas, and the unit manager has an affirmative responsibility to protect visibility and all other class I area air quality-related values from the adverse effects of air pollution. Everglades National Park is a designated class I area.
>
> Class II areas include all national park system areas not designated as class I. The *Clean Air Act* allows only moderate air quality deterioration in these areas. In no case, however, may pollutant concentrations violate any of the national ambient air quality standards. Big Cypress National Preserve and Salt River Bay National Historic Park and Ecological Preserve are designated class II areas.

National park system areas that do not meet the national ambient air quality standards, or whose resources have already been adversely affected by current ambient levels, require a greater degree of consideration and scrutiny by NPS managers. Areas that do not meet national ambient air quality standards for any pollutant are designated as non-attainment areas. Section 176 of the *Clean Air Act* states:

> No department, agency, or instrumentality of the federal government shall engage in, support in any way or provide financial assistance for, license or permit, or approve, any activity which does not conform to [a State] implementation plan. . . . [T]he assurance of conformity to

> such a plan shall be an affirmative responsibility of the head of such department, agency or instrumentality.

Essentially, federal agencies must ensure that any action taken does not interfere with a state's plan to attain and maintain the national ambient air quality standards in designated non-attainment and maintenance areas. Miami-Dade County is the only Florida county the parks occupy that is a designated maintenance area for the pollutant ozone. Therefore, actions conducted in Big Cypress National Preserve and Everglades National Park must be consistent with Florida's State Implementation Plan for complying with ambient ozone standards.

In 1999, the U.S. Environmental Protection Agency announced an effort to improve air quality in national parks and wilderness areas. The *Regional Haze Rule* calls for state and federal agencies to work together to improve visibility in class I areas. The rule requires the states to develop and implement air quality protection plans to reduce the pollution that causes visibility impairment. "Visibility impairment" is defined as "any human perceptible change in visibility (visual range, contrast, coloration) from that which would have existed under natural conditions" (40 CFR 51.302 (c)). The first state plans for regional haze are due in the 2003–2008 timeframe.

STATE GUIDANCE

The *Florida Prescribed Burning Act* (State Statute 590.125(3)) authorizes and promotes the use of prescribed fire for ecological, silvicultural, and wildfire management purposes. The law describes the benefits of prescribed fire by stating that prescribed fire reduces vegetative fuels, which reduces the risk and severity of wildfire; is essential to the perpetuation, restoration, and management of many plant and animal communities; prepares forest land sites for reforestation; removes undesirable competing vegetation; expedites nutrient cycling; and controls or eliminates certain forest pathogens. The *Prescribed Burning Act* requires that at least one certified prescribed fire manager must be present from ignition to completion of the prescribed fire, and an authorization to burn must be received from the Division of Forestry. In order to receive authorization, a written prescription must be prepared, which must include but not limited to: "(1) stand or site description; (2) map of the area to be burned; (3) personnel and equipment to be used on the prescribed fire; (4) desired weather factors, including, but not limited to, surface wind speed and direction, minimum mixing height, minimum relative humidity, maximum temperature, and fine-fuel moisture; (5) desired fire behavior factors such as type of burn, firing technique, flame length, and rate of spread; (6) the time and date the prescription was prepared; (7) the authorization date and the time period of the authorization; (8) an evaluation of the anticipated impact of the proposed burn on pertinent smoke-sensitive areas; and (9) the signature and number of the certified prescribed fire manager" (Brenner and Wade 2003—*Florida's Revised Prescribed Fire Law*). The law also requires that the certified prescribed fire manager screen the prescription for possible negative smoke impacts on the surrounding landscape.

NPS GUIDANCE

The *National Park Service Organic Act of 196* (16 USC 1, *et seq*.) and NPS *Management Policies 2001* (NPS 2001e) guide the protection of park and wilderness areas. The mandates of the *Organic Act* state that the NPS will

> promote and regulate the use of . . . national parks . . . by such means and measures as conform to the fundamental purpose of the said parks . . . which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.

Under NPS *Management Policies 2001,* the NPS would "seek to perpetuate the best possible air quality in parks to (1) preserve natural resources and systems; (2) preserve cultural resources; and (3) sustain visitor enjoyment, human health, and scenic vistas."

NPS *Management Policies 2001* further state that the NPS would assume an aggressive role in promoting and pursuing measures to protect air quality-related values from the adverse impacts of air pollution. In cases of doubt as to the impacts of existing or potential air pollution on park resources, the NPS "will err on the side of protecting air quality and related values for future generations."

The *Organic Act* and NPS *Management Policies 2001* apply equally to all areas of the national park system, regardless of *Clean Air Act* designation. Therefore, the NPS would protect resources at both class I and class II units. Furthermore, the *Organic Act* and NPS *Management Policies 2001* provide protection beyond that afforded by the *Clean Air Act's* national ambient air quality standards because the NPS has documented that specific park air quality-related values can be adversely affected at levels below the national standards or by pollutants for which no standards exist.

METHODOLOGY AND ASSUMPTIONS

GEOGRAPHIC AREA EVALUATED FOR IMPACTS

The analysis area includes the immediate locations where exotic plant management actions would take place and the surrounding environment where air pollutants may accumulate. For this analysis, treatment activities may occur anywhere within the boundaries of the parks. Therefore, the entire parks of Big Cypress National Preserve, Everglades National Park, Canaveral National Seashore, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park are included in the analysis for each respective park. Any air quality impacts that originate in the parks and extend to the surrounding regional environment are also addressed.

Exotic plant management activities that could measurably affect air quality include aerial spraying of herbicides and the use of prescribed fire. The use of large construction machinery employed to perform large-scale active restoration

activities would generate emissions into the environment. Under the alternatives, these actions would only occur within Everglades National Park, Big Cypress National Preserve, and Canaveral National Seashore to a degree that air quality would be affected. In addition, lands that are not fire-adapted and are infested with guinea grass (*Urochloa maxima*), a plant that can build up extensive fuel loads and increase the intensity of fire, have the potential for fire and its associated air quality effects. Salt River Bay National Historic Park and Ecological Preserve and Virgin Islands National Park are the only parks infested with guinea grass that have not been treated and would have the potential to catch fire. The four remaining parks have been dismissed from further analysis and specific rationale is provided in the "Issues and Impact Topics" section in "Chapter 1: Purpose of and Need for the Plan."

IMPACT CRITERIA AND METHODOLOGY

Potential impacts on air quality are assessed given the degree to which exotic plant management actions would change compared to existing management.

Specific issues addressed in the analysis include those developed through internal and public scoping. The following issue statement has been developed.

> Some exotic plant treatments can degrade air quality; for example, the exhaust from mechanized equipment used to access treatment sites and to treat the sites (such as for soil removal) can cause local degradation of air quality, as can the prescribed fires used for exotic plant removal.

More specifically, there are potential impacts from dust and smoke emissions from mechanized equipment, including equipment for active restoration, helicopters, fixed-wing aircraft, motorized vehicles, and chain saws that could be used for access and treatment and monitoring of exotic plants.

Prescribed fire can affect visibility and air quality through the release of emissions and smoke. Variables affecting emissions can be grouped into three categories: fuel conditions (stage of decomposition, moisture content, and physical arrangement), fire conditions (fire type, fire intensity, ignition technique), and weather conditions (wind speed and relative humidity during a fire and drying conditions before a fire) (McMahon 1983).

Prescribed fires are considered to be less intense and damaging as unplanned wildfires. An infestation of some exotic plants can fuel intense wildfires. For example, Old World climbing fern can climb into the canopy of trees and fuel a crown fire, while guinea grass would build up extensive fuel loads that increase the intensity of fire.

The use of herbicides for exotic plant treatments and the potential drift from aerial spraying is a concern, as well as the use of prescribed fire on exotic plants that have been chemically treated with herbicides.

IMPACT THRESHOLD DEFINITIONS

Negligible — No changes would occur, or changes in air quality would be below or at the level of detection. If detected, the effects would be slight.

Minor — The changes in air quality would be measurable but small and localized.

Moderate — The changes in air quality would be measurable and would have consequences, although the effect would be relatively local.

Major — The changes in air quality would be measurable, would have substantial consequences, and would be noticed regionally.

IMPAIRMENT

Impairment is defined as impacts that

have a major adverse effect on park resources and values

contribute to deterioration of the park's air quality to the extent the park's purpose could not be fulfilled as established in its enabling legislation

affect resources key to the park's natural or cultural integrity or opportunities for enjoyment

affect the resource whose conservation is identified as a goal in the park's general management plan or other park planning documents

IMPACTS OF THE ALTERNATIVES ON AIR QUALITY

ALTERNATIVE A — NO ACTION: CONTINUE CURRENT MANAGEMENT

Everglades National Park, Big Cypress National Preserve, Canaveral National Seashore, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Alternative A would continue current exotic plant management actions into the future.

In Everglades National Park Big Cypress National Preserve, Canaveral National Seashore, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park, treatments that would contribute to emissions of air pollutants from the operation of mechanical equipment include the operation of chain saws for mechanical cutting of vegetation; the operation of trucks, motorboats, airboats, off-road vehicles, and the use of fixed-wing aircraft for aerial reconnaissance of exotic plant infestations. In the case of Big Cypress National Preserve and Everglades National Park, helicopters are also used for monitoring, accessing project treatment and monitoring sites, and for aerial spraying and aerial spot treatments.

Nitrogen oxides and sulfur dioxides are both precursors for the development of ozone and are exhaust emissions from the above-listed vehicles used for access, treatment, and monitoring activities. These emissions are also criteria pollutants regulated under Florida standards and the *Clean Air Act*. The use of this equipment would generate emissions; however, these emissions would be intermittent and short term, lasting only for the duration of treatment and monitoring activities. Some treatment activities may occur simultaneously for efficiency, but locations would be scattered throughout the parks and would be transient in nature. Therefore, although emissions would occur as a result of operation of mechanical equipment and vehicles, the impacts would be short term, negligible, and adverse due to the temporary and minimal use of equipment, and they would have no influence on Miami-Dade County's maintenance status for ozone or attainment status in the remaining counties. These emissions would not have measurable impacts on any sensitive air quality-related values in the parks.

Treatment of infested sites using mechanical and ground-based methods would require accessing sites on foot or by vehicles, which would be expected to cause localized disturbance of soils and generate dust. Dust consists mainly of particulate matter (PM_{10}), which is a criteria pollutant for which ambient air quality standards are regulated. However, due to the subtropical / tropical environment of these national parks, the majority of work would be conducted in wet or moist soil conditions, thereby minimizing the amount of dust generated. The primary source of airborne dust that would be generated by exotic plant management actions would be from vehicle travel on unpaved access roads to the treatment sites. Impacts on air quality from the generation of dust under alternative A would be short term, negligible, and adverse because emissions would be localized and would not be of a magnitude that could affect receptors out of the project area.

Herbicides that would be used in the parks include metsulfuron methyl (e.g., Escort), triclopyr (e.g., Garlon), imazapyr (e.g., Arsenal), and glyphosate (e.g., Roundup, Rodeo). The volatilization of a chemical, or the conversion of the chemical substance from a liquid or solid state to a gaseous state, offers information about the impacts on air quality because it reveals how much of the herbicide would be lost to air. The "Weed Science Society of America Herbicide Handbook" defines the volatilization for metsulfuron methyl, triclopyr, imazapyr, and glyphosate as having an estimated negligible or insignificant potential for losses (Vencill 2002). These chemicals also have low "Henry's Law" constants, which indicate that they tend to partition to water versus air (Ganapathy 1997; Schuette 1998). Volatilization rates tend to increase with temperature; therefore, specific herbicide labeling instructions would be followed, especially with regard to air temperature at the time of application to prevent volatilization. Unlike aerial spraying, impacts on air quality from ground herbicide applications are primarily due to the volatilization of the chemical and are not very susceptible to spray drift because of their height above the ground and localized application.

Aerial treatments of herbicides under alternative A in Big Cypress National Preserve and Everglades National Park could result in chemical spray drift to nontarget areas if herbicides are not properly applied according to labeling instructions or if applicable mitigation measures to prevent drift are not followed.

Drift is the airborne movement of particles into nontarget areas; it can be particle drift, the off-target movement of spray particles, or vapor drift, the volatilization of the herbicide molecules and their movement off target (University of Florida 1993; Montana State University 2004). The potential for chemical drift is highly dependent on the proximity to sensitive receptors, wind speed and direction, equipment used, application height, size of treatment area, humidity, and the herbicide formulation. Research suggests that spray drift can be avoided with proper application techniques (Ganapathy 1997; University of Florida 1993). The NPS would continue to use these techniques under alternative A (see "Table 5: Mitigation Measures and Best Management Practices" in the "Alternatives" chapter). Some of these measures include only aerially spraying herbicides when appropriate meteorological conditions exist, such as when the wind speed is less than 10 miles per hour and never during a temperature inversion or when conditions are extremely dry; having the proper spray nozzle so that droplet particles are not too small or large, and there is proper spray pressure; and applying the herbicide at the proper height. The NPS would also continue to leave buffer zones between treatment areas and any particularly sensitive areas. Therefore, because NPS only uses highly trained personnel for ground and aerial spraying who employ mitigation measures, and because the specific herbicides used by the parks for exotic plant management have low volatilization, impacts on air quality from aerial herbicide applications would be short term, negligible, and adverse.

Prescribed fire is a useful tool in Big Cypress National Preserve and Everglades National Park because of their fire-adapted vegetation categories that depend on occasional fires and the large-scale nature of exotic plant infestations. Prescribed fires create potential sources of particulate matter emissions (both PM_{10} and $PM_{2.5}$) and carbon monoxide from smoke and ash. The variables that affect emissions from prescribed fires include fuel conditions (stage of decomposition, moisture content, and physical arrangement), fire conditions (fire type, fire intensity, and ignition technique), and weather conditions (wind speed and relative humidity during a fire and drying conditions before a fire).

The state of Florida allows open burning for ecosystem management but only when the appropriate conditions exist and efforts are coordinated through the Florida Division of Forestry. The Florida parks would continue to coordinate prescribed fire activities with the parks' fire management plans and Florida Division of Forestry, and would adhere to the requirements of *Florida's Prescribed Burning Act*. Prior to the execution of a prescribed fire, a written burn plan or prescription would be developed that includes such information as site description and map, the personnel and equipment that would be used, desirable weather conditions, desired fire behavior factors, and emergency protocol (Brenner and Wade 2003—*Florida's Revised Prescribed Law*). This information would help guarantee that the appropriate conditions exist during the implementation of a prescribed fire, which would reduce the likelihood for higher emission amounts and for smoke to migrate to nontreated areas.

Research has been conducted to measure herbicides in smoke when prescribed fire is implemented following a chemical treatment of an area in order to determine if air quality is further affected by herbicides. The research concluded that no herbicide residues were detected in the smoke samples from any of the

fires in the study (McMahon and Bush 1991). Therefore, with the implementation of mitigation measures and coordination through the Florida Division of Forestry, effects associated with prescribed fires would be short term, and emission levels would not affect the area's attainment status for any of the criteria air pollutants. Smoke would reduce visibility in the immediate area and be noticeable to others in surrounding areas, but these adverse impacts on visibility would be short term and would only persist during and immediately following any prescribed fire. The level of intensity would be considered minor, and could range up to moderate if a burn was conducted in a very large area. This is due to the range of smoke and reduced visibility spanning a larger area.

Salt River Bay National Historic Park and Ecological Preserve and Virgin Islands National Park have not treated the guinea grass in their parks, but under alternative A, it would be treated when funds and personnel are available. Until the time when the infestation is treated or if guinea grass recovers following treatment because exotic plant management would not occur under an optimal schedule, the guinea grass in the park would accumulate fuels that could contribute to a high-intensity fire. This could also lead to the production of elevated emission levels of particulate matter and reduced visibility from smoke. In addition, treatment activities themselves would result in short-term, adverse impacts from exhaust emissions and potential generation of dust. Therefore, alternative A would have short-term, minor adverse impacts on air quality in Salt River Bay National Historic Park and Ecological Preserve and Virgin Islands National Park. These short-term impacts could range up to moderate if a high-intensity wildfire occurred.

Cumulative Impacts

Air quality in Everglades National Park and Big Cypress National Preserve is affected predominantly by outside influences from the Miami metropolitan area, regional oil-fired power plants, and adjacent dust generation. These air pollutant sources are considered long term because emissions are relatively consistent, and are adverse effects of minor to moderate intensity. The adverse effects associated with alternative A, which would range from short-term negligible to minor, and would not contribute much cumulatively to the more perceptible emissions from off-site contributors. Both parks also participate in active fire management programs that implement prescribed fires, which generate short-term, minor to moderate, adverse cumulative impacts similar to those described above. The impacts from prescribed fire under alternative A would contribute similarly overall to the parks' air quality, which would result in short-term, minor to moderate, adverse impacts. These impacts would be offset by the longer-term, minor to moderate, beneficial effects from managing fire and ultimately reducing the threat for future intense wildfires that would have greater impacts. Other administrative, recreational, and project activities in Everglades National Park and Big Cypress National Preserve also involve operation of vehicles and construction activities associated with exhaust emissions and the generation of dust. The "Hole-in-the-Donut" wetland restoration project in Everglades National Park and the "Off-road Vehicle Trail Rehabilitation" project would result in short-term local air quality impacts from exhaust and fugitive dust emissions. These cumulative impacts would be similar to those under alternative A and would be highly localized, short term, and of negligible intensity because they

would disperse rapidly and comprise only a very small portion of very large parks. Alternative A would contribute a negligible amount of exhaust emissions to these other projects and, in combination with other activities, exhaust emissions in the park would result in short- and long-term, negligible adverse impacts.

Salt River Bay National Historic Park and Ecological Preserve is not as susceptible to outside pollution sources as the south Florida parks. Vehicle use around the park and the nearby oil refinery adversely affect air quality in the park over the long term in a negligible to minor manner. The short-term, minor, adverse impacts associated with alternative A would contribute very little to these effects; however, outside air quality influences are more consistent than those short-term effects that could result in the case of a wildfire. Therefore, overall impacts on air quality in Salt River Bay National Historic Park and Ecological Preserve would be considered short and long term, negligible to minor, and adverse.

Conclusion

Impacts on air quality from implementation of alternative A would be due to exhaust emissions from motorized vehicles and equipment, the generation of dust during project activities, ground and aerial spraying of herbicides, the use of prescribed fire, and the potential for intense fire from not immediately treating areas infested with guinea grass. The impacts from all exotic plant management actions in the applicable parks would range from negligible to minor, and impacts could increase to moderate if a large prescribed fire was implemented. Overall, management actions would result in short-term, minor, adverse impacts on air quality in Everglades National Park, Big Cypress National Preserve, Canaveral National Seashore, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park.

Alternative A would result in short-term and long-term negative adverse cumulative impacts. Alternative A would not result in impairment of air quality resources or values in the parks.

ALTERNATIVE B — NEW FRAMEWORK FOR EXOTIC PLANT MANAGEMENT: INCREASED PLANNING, MONITORING, AND MITIGATION

Everglades National Park, Big Cypress National Preserve, Canaveral National Seashore, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Similar to alternative A, air quality in Big Cypress National Preserve, Canaveral National Seashore, Everglades National Park, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park would be affected by the contribution of emissions of air pollutants from the operation of chain saws and other equipment for mechanical cutting of vegetation; operation of trucks, motorboats, airboats, off-road vehicles, fixed-wing aircraft for aerial reconnaissance. In Big Cypress National Preserve and Everglades National Park, helicopters are also used for monitoring, access to project treatment and

monitoring sites, and for aerial spraying and aerial spot treatments. Under alternative B, the parks would carry out an optimal schedule of re-treatments, which would increase the frequency of activities but would decrease the intensity and level of effort of actions implemented. For example, following initial aerial herbicide applications, re-treatment actions would no longer necessitate aerial spraying.

Exhaust emissions from vehicles used for access, initial and re-treatment efforts, and monitoring activities would have effects similar to those discussed for alternative A. Nitrogen oxides and sulfur dioxides, precursors for the development of ozone, would be emitted; however, these emissions would be intermittent and short term, lasting only for the duration of treatment and monitoring activities. The frequency of re-treatments would increase under alternative B, but activities would still be sporadic and scattered throughout the park so no individual project would emit large quantities of pollutants. The emissions would be transient in nature and would have no influence on Miami-Dade County's maintenance status for ozone or the attainment status in counties surrounding the other parks. Emissions would also have no measurable impacts on any sensitive air quality-related values in the parks. The impacts on air quality would be short term, negligible, and adverse due to the temporary and minimal use of equipment.

Treatment of infested sites using mechanical and ground-based chemical treatment methods would require accessing sites on foot or by vehicles, which would be expected to cause localized disturbance of soils and generate dust. Dust consists mainly of particulate matter (PM_{10}), which is a criteria pollutant for which ambient air quality standards are regulated. However, due to the subtropical / tropical environment of the parks, the majority of work would be conducted in wet or moist soil conditions, thereby minimizing the amount of dust generated. The primary source of airborne dust that would be generated by exotic plant management actions would be from vehicle travel on unpaved access roads to the treatment sites. Although the frequency of re-treatments would increase under alternative B, air quality effects from the generation of dust would be similar to those described under alternative A—short term, negligible, and adverse—because emissions would be so localized and would not be of a magnitude that would affect receptors out of the project area.

The herbicides that would be used under alternative B have low volatilization and Henry's Law constants, which means they would not readily transfer from a liquid or solid state to that of a gaseous state and enter the air. Effects from both ground and aerial spraying would be the same as those described in alternative A, with the exception that aerial spraying would no longer be needed after the initial treatment. The potential for chemical spray drift would therefore be reduced under all the re-treatment actions. Under alternative B, the parks would still employ those mitigation measures listed in "Table 13: Mitigation Measures and Best Management Practices" in the "Alternatives" chapter to minimize the potential for spray drift. Therefore, the impacts on air quality from herbicide applications would be short term, negligible, and adverse because for ground and aerial spraying, the NPS only uses highly trained personnel who employ mitigation measures and because the specific herbicides used by the parks for exotic plant management have low volatilization.

Exotic plant management activities that use prescribed fire are potential sources of particulate matter emissions (both PM_{10} and $PM_{2.5}$) and carbon monoxide from smoke and ash from prescribed fires. The variables that affect emissions from prescribed fires include fuel conditions (stage of decomposition, moisture content, and physical arrangement), fire conditions (fire type, fire intensity, and ignition technique), and weather conditions (wind speed and relative humidity during a fire and drying conditions before a fire). Prescribed fire would be used more regularly under alternative B, which would contribute short-term adverse impacts on local air quality and visibility. In addition to prescribed fire being used as a tool for the initial treatment of Old World climbing fern, it would also be considered for re-treatment of this same species, as well as for melaleuca, Australian pine, and Brazilian pepper. The frequency of prescribed fire would therefore increase; however, the scale of the fire would be reduced considerably with each re-treatment interval because of the reduction of fuel loads from infestation. The total acreage of potential treatment areas where fire may be appropriate in Big Cypress National Preserve and Everglades National Park combined is about 135,608 acres. These are areas identified with vegetation that could be re-treated with fire but may not necessarily be used, and it is likely if prescribed fire was used, only portions of these areas would be burned. The smoke and particulate matter emitted from each prescribed fire would temporarily degrade air quality in and around the project area during and immediately following a fire, which would result in short-term, moderate, adverse impacts.

Presently, the guinea grass in Salt River Bay National Historic Park and Ecological Preserve and Virgin Islands National Park has not been treated but would eventually be treated under the no-action alternative. Under alternative B, the park would immediately treat the guinea grass and eliminate the potential for the accumulated fuels to contribute to a high-intensity fire and associated impacts. All treatment activities would involve ground treatments under an optimal schedule that may generate a negligible amount of exhaust emissions and dust that would be highly localized and short term. Therefore, alternative B would have a long-term, minor, beneficial effect from eliminating the potential for fire and its associated impacts on emissions and visibility, and short-term, negligible, adverse impacts resulting from treatment activities.

Cumulative Impacts

As described in alternative A, air quality in Everglades National Park and Big Cypress National Preserve is affected predominantly by outside influences from the Miami metropolitan area, regional oil-fired power plants, and adjacent dust generation. These air pollutant sources are considered long term because emissions are relatively consistent, and are adverse effects of minor to moderate intensity. The adverse effects associated with alternative B, which would range from short-term negligible to minor, and would not contribute much cumulatively to the more perceptible emissions from off-site contributors. Both parks also participate in active fire management programs that implement prescribed fires, which generate short-term, minor to moderate, adverse cumulative impacts similar to those described above for alternative B. The impacts from prescribed fire under alternative B would contribute similarly overall to the parks' air quality, which would result in short-term, minor to

moderate, adverse impacts. These impacts would be offset by the longer-term, minor to moderate, beneficial effects from managing fire and ultimately reducing the threat for future intense wildfires that would have greater impacts. Other administrative, recreational, and project activities in Everglades National Park and Big Cypress National Preserve also involve operation of vehicles and construction activities associated with exhaust emissions and the generation of dust. These effects are highly localized, short term, and of negligible intensity because they would disperse rapidly and comprise only a very small portion of very large parks. Alternative B would contribute a negligible amount to these other projects and, in combination with other activities, exhaust emissions in the park would result in short- and long-term, negligible adverse cumulative impacts on air quality.

Vehicle use around Salt River Bay National Historic Park and Ecological Preserve and the nearby oil refinery would adversely affect air quality in the park over the long term in a negligible to minor manner. The short-term adverse impacts from localized exhaust emissions and dust generation associated with treatment activities would only negligibly contribute to these adverse impacts. Overall, cumulative impacts would continue to be long term, negligible to minor, and adverse from the constant air quality effects from vehicle use and outside sources.

Conclusion

Air quality effects from the implementation of alternative B would result from exhaust emissions from motorized vehicles and equipment, the generation of dust during project activities, ground and aerial spraying of herbicides, and the use of prescribed fire. The impact from all exotic plant management actions in the applicable parks would range from negligible to minor, and impacts could increase to moderate if a large prescribed fire was implemented. Overall, management actions under alternative B would result in short-term, minor, adverse impacts on air quality in Everglades National Park, Big Cypress National Preserve, Canaveral National Seashore, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park. In addition, there would be long-term, minor, beneficial effects on air quality in Salt River Bay National Historic Park and Ecological Preserve and Virgin Islands National Park by immediately treating the guinea grass and eliminating the potential for intense fire and its associated air quality impacts.

Cumulative impacts would be the same as alternative A. Alternative B would not result in impairment of air quality resources or values in the parks.

ALTERNATIVE C — NEW FRAMEWORK FOR EXOTIC PLANT MANAGEMENT: INCREASED PLANNING, MONITORING, AND MITIGATION, WITH AN EMPHASIS ON ACTIVE RESTORATION OF NATIVE PLANTS

Everglades National Park, Big Cypress National Preserve, Canaveral National Seashore, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Similar to alternatives A and B, air quality in parks would be affected by the contribution of emissions of air pollutants from the operation of chain saws and other equipment for mechanical cutting of vegetation; operation of trucks, motorboats, airboats, off-road vehicles, and the use of fixed-wing aircraft for aerial reconnaissance of exotic plant infestations. In Big Cypress National Preserve and Everglades National Park, helicopters would also be used for monitoring, access to project treatment and monitoring sites, and for aerial spraying and aerial spot treatments. Under alternative C, the parks would carry out an optimal schedule of re-treatments, which would increase the frequency of activities but would decrease the intensity and level of effort of actions that would be implemented under alternative C. Active restoration methods such as seeding, planting, and altering hydrology would be employed in areas identified as appropriate for active restoration. Exhaust emissions from vehicles used for access, initial and re-treatment efforts, and monitoring activities would have effects similar to those discussed for alternatives A and B. Similar effects would also occur when large-scale restoration efforts are undertaken that would alter site conditions. These activities would likely include large construction equipment such as bulldozers or backhoes. All of the equipment used for monitoring, treatment, and restoration would emit nitrogen oxides and sulfur dioxides, which are both precursors for the development of ozone. These emissions would be intermittent and short term, lasting only for the duration of project activities. The adverse impacts on air quality would be short term and generally of negligible intensity. These impacts would range up to minor, however, when large construction equipment is used on a large site over several days. The emissions would have no influence on Miami-Dade County's maintenance status for ozone or the attainment status in other counties and would have no measurable impacts on any sensitive air quality-related values in the parks.

Monitoring, treatment, and restoration activities would involve localized disturbance to soils and the generation of dust. Dust consists mainly of particulate matter (PM_{10}), which is a criteria pollutant for which ambient air quality standards are regulated. However, due to the subtropical / tropical environment in these national parks, the majority of work would be conducted in wet or moist soil conditions, thereby minimizing the amount of dust generated. Airborne dust would be generated from construction activities related to the active restoration method of altering site conditions. Dust would also be generated by vehicle travel on unpaved access roads to treatment sites. Impacts on air quality from the generation of dust would generally be short term, negligible, and adverse, but could range up to minor if site alteration occurred over a large area.

Effects from herbicide use would be the same as described under alternative B, except that the amount of herbicide needed would decrease over time with the

inclusion of active restoration methods. Impacts on air quality from herbicide applications would be short term, negligible, and adverse.

Exotic plant management activities that use prescribed fire are potential sources of particulate matter emissions (both PM_{10} and $PM_{2.5}$) and carbon monoxide from smoke and ash. Because the parks would actively restore certain project areas, those areas where prescribed fire could be used would be slightly less than under alternative B. The potential treatment areas within Big Cypress National Preserve and Everglades National Park where prescribed fire could potentially be used under alternative C would be about 117,758 acres. This is the estimate of lands where fire may be appropriate; it would not necessarily be used in all treatment areas and likely would only involve a portion of the treatment areas. The smoke and particulate matter emitted from each prescribed fire would temporarily degrade air quality in and around the treatment area during and immediately following a fire; this would result in short-term, moderate, adverse impacts on air quality.

Presently, the guinea grass in Salt River Bay National Historic Park and Ecological Preserve and Virgin Islands National Park has not been treated but would eventually be treated under the no-action alternative. Under alternative C, the park would immediately treat the guinea grass and eliminate the potential for the accumulated fuels to contribute to a high-intensity fire and its associated effects. Treatment activities would also involve ground treatments that may generate a negligible amount of exhaust emissions and dust that would be highly localized and short term. These same impacts would result from restoration activities and would be considered negligible because of the small size of project sites. Therefore, alternative C would have a long-term, minor, beneficial effect from eliminating the potential for fire and its associated emissions and visibility effects, and short-term, negligible, adverse impacts from treatment and restoration activities.

Cumulative Impacts

Cumulative impacts would be the same as those described for alternative B. Air quality in Everglades National Park and Big Cypress National Preserve is affected predominantly by outside influences from the Miami metropolitan area, regional oil-fired power plants, and adjacent dust generation. Impacts from these air pollutant sources are considered long term because emissions are relatively consistent, and are adverse impacts of minor to moderate intensity. The adverse impacts associated with alternative C, which would range from negligible to minor, would be short term and not contribute much cumulatively to the more perceptible emissions from off-site contributors. Both parks also participate in active fire management programs that implement prescribed fires, which generate short-term, minor to moderate, adverse impacts similar to those described above for alternative C. The impacts from prescribed fire under alternative C would contribute similarly overall to the parks' air quality, which would result in short-term, minor to moderate, adverse impacts. These impacts would be offset by the longer-term, minor to moderate, beneficial effects from managing fire and ultimately reducing the threat for future intense wildfires that would have greater impacts. Other administrative, recreational, and project activities in Everglades National Park and Big Cypress National Preserve also involve operation of

vehicles and construction activities associated with exhaust emissions and the generation of dust. These effects are highly localized, short term, and of negligible intensity because they would disperse rapidly and comprise only a very small portion of very large parks. Alternative C would contribute a negligible amount to these other projects and, in combination with other activities, exhaust emissions in the parks would be short and long term, adverse, and of negligible intensity.

Vehicle use around Salt River Bay National Historic Park and Ecological Preserve and the nearby oil refinery would adversely affect air quality in the park over the long term in a negligible to minor manner. The short-term adverse impacts from localized exhaust emissions and dust generation associated with treatment and restoration activities would only negligibly contribute to these adverse impacts. Overall, cumulative impacts would continue to be long term, negligible to minor, and adverse from the constant air quality effects from vehicle use and outside sources.

Conclusion

Impacts on air quality from the implementation of alternative C would result from exhaust emissions from motorized vehicles and equipment, the generation of dust during treatment, monitoring, and restoration activities, ground and aerial spraying of herbicides, and the use of prescribed fire. The impacts from all exotic plant management actions in the applicable parks would range from negligible to minor, and impacts could increase to moderate if a large prescribed fire was implemented. Overall, these effects would result in short-term, minor, adverse impacts on air quality in Everglades National Park, Big Cypress National Preserve, Canaveral National Seashore, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park. In addition, there would be long-term, minor, beneficial effects on air quality in Salt River Bay National Historic Park and Ecological Preserve and Virgin Islands National Park by immediately treating the guinea grass and eliminating the potential for intense fire and its associated air quality impacts.

Cumulative impacts would be the same as alternative A. Alternative C would not result in impairment of air quality resources or values in the parks.

CULTURAL RESOURCES

GUIDING REGULATIONS AND POLICIES

The fundamental purpose of the national park system is to conserve park resources and values while providing for the public enjoyment of the parks, leaving resources unimpaired for future generations. “If they [resources] are degraded or lost, so is the parks' reason for being” (NPS 1998d).

According to the NPS *Management Policies 2001*, cultural resources include archeological resources, structures, cultural landscapes, ethnographic resources, and museum objects. The term “historic properties” is an umbrella term for all prehistoric and historic sites, buildings, structures, and objects included in, or eligible for inclusion in, the National Register of Historic Places (National Register). This includes properties of traditional religious and cultural importance to Native Americans that meet National Register criteria. Finite and nonrenewable, these tangible resources begin to deteriorate almost from the moment of their creation. Once destroyed, these resources cannot be recovered. The NPS is a steward of many of America’s most important cultural resources, and its cultural resource management program involves research, planning, and stewardship.

Numerous laws and regulations mandate the stewardship of cultural resources. One of the most important of these is the *National Historic Preservation Act* (NHPA), as amended, in which Section 106 of the act requires federal agencies with direct or indirect jurisdiction over undertakings consider the effects of those undertakings on properties that are listed in, or eligible for listing in, the National Register. This *National Historic Preservation Act* and its implementing regulations (36 CFR 800) provide guidance for deciding whether cultural resources are of sufficient importance to be determined eligible for listing in the National Register.

The *National Environmental Policy Act* (NEPA) declared a federal policy to preserve important historic, cultural, and natural aspects of our national heritage. It required federal agencies to employ a systematic, interdisciplinary approach to ensure the integrated use of the natural and social sciences in planning and decision-making activities that may affect the human environment. Implementing regulations for NEPA are contained in 40 CFR 1500.

Numerous other laws, executive orders, regulations, policies, directives, and guidelines provide for identification, documentation, evaluation, and treatment of cultural resources. These legal mandates and guidance documents established the basic foundation for management of cultural resources in the national parks. Direction for implementing the above laws and regulations is outlined in NPS *Management Policies 2001* (NPS 2001e); *Director’s Order 28: Cultural Resource Management* (NPS 2002d); and *NPS-28: Cultural Resource Management Guideline* (NPS 1998d).

METHODOLOGY AND ASSUMPTIONS

GEOGRAPHIC AREA EVALUATED FOR IMPACTS

For the parks surrounded by large bodies of water (such as Buck Island Reef National Monument, Dry Tortugas National Park, and Christiansted National Historic Site), the area of potential effect for this draft EPMP/EIS are defined by the parks' boundaries. In some of the other parks, impacts of implementing the management actions proposed in this draft EPMP/EIS could extend to neighboring resources as well. For example, boundaries for parks such as Everglades National Park may be more difficult to identify on the ground. Culturally significant plants on adjacent properties could be treated inadvertently, either on the ground or by aerial spraying, resulting in an unintended impact on cultural resources.

ISSUES

Issues identified during internal and public scoping relate to the ways that physical, mechanical, and chemical treatment of exotic plants may affect cultural resources. For example, the vegetation composition of cultural landscapes may be altered by unwanted exotic plants, or conversely, if exotic plants form an element of the landscape, by their removal. By growing into historic structures, ruins, and archeological sites, exotic plants may accelerate deterioration, and unless carefully planned, removal of exotic plants can further damage these resources.

Some exotic plants may be "markers" for cultural sites, so their removal can result in loss of vital site stratigraphic or locational information. Exotic plants may have cultural significance to traditionally associated peoples, and treatments can diminish the number and types of plants available for traditional use. Archeological sites can be damaged by exotic plant removal treatments such as fire, changes in hydrologic conditions, and physical removal; and soils, charcoal deposits, and artifacts (such as bone and shell) can be contaminated by chemical compounds.

IMPACT CRITERIA AND METHODOLOGY

Cultural Resources Evaluation Method

Cultural resources are subject to provisions of the *National Environmental Policy Act* and the *National Historic Preservation Act* and their implementing regulations. Regulations for both these acts require analysis of the impacts or effects of proposed projects on important cultural resources. Unfortunately, for each of the two acts, two different sets of definitions are used that deal with cultural resources. Impact analyses in this draft EPMP/EIS are intended, however, to comply with the requirements of both the *National Environmental Policy Act* and Section 106 of the *National Historic Preservation Act*.

In accordance with regulations of the Advisory Council on Historic Preservation (Advisory Council) that implement Section 106, the effects on archeological resources, buildings and structures, cultural landscapes, traditional cultural properties (described herein as ethnographic resources) were identified and

evaluated by (1) determining the area of potential effects; (2) identifying cultural resources present in the area of potential effects that are either listed in or eligible to be listed in the National Register of Historic Places; (3) applying the criteria of adverse effect to affected cultural resources either listed in or eligible to be listed in the National Register; and (4) considering ways to avoid, minimize, or mitigate adverse effects.

The Section 106 criteria for characterizing the severity or intensity of impacts on National Register-listed or eligible archeological resources, prehistoric or historic structures, cultural landscapes, and traditional cultural properties are the Section 106 determinations of effect: no historic properties affected, adverse effect, or no adverse effect.

> A determination of no historic properties affected means that either there are no historic properties present or there are historic properties present but the undertaking will have no effect upon them (36 CFR 800.4(d)(1)).
>
> A determination of no adverse effect means there is an effect, but the effect would not meet the criteria of an adverse effect; that is, diminish the characteristics of the cultural resource that qualify it for inclusion in the National Register (36 CFR 800.5(b)).
>
> An adverse effect occurs whenever an impact alters, directly or indirectly, any characteristic of a cultural resource that qualifies it for inclusion in the National Register; for example, diminishing the integrity (or the extent to which a resource retains its historic appearance) of its location, design, setting, materials, workmanship, feeling, or association. Adverse effects also include reasonably foreseeable effects caused by the alternatives that would occur later in time, be farther removed in distance, or be cumulative (36 CFR 800.5(a)(1)). Because cultural resources are nonrenewable, all adverse effects on National Register-eligible cultural resources in the nine parks addressed in this draft EPMP/EIS would be long term and would have a high level of concern.

The following discussion is an attempt to correlate the differing requirements of NHPS and NEPA in a way so that impacts (effects) on cultural resources are presented in a thorough, thoughtful, and meaningful manner in this document, and compliance with both laws is achieved. For these reasons, the impact criteria for archeological and other cultural resources are presented in a format that is different from the other impact topics in this environmental impact statement.

The Council on Environmental Quality regulations and *NPS Director's Order 12: Conservation Planning, Environmental Impact Analysis and Decision Making* also call for a discussion of the appropriateness of mitigation, as well as an analysis of how effective the mitigation would be in reducing the intensity of a potential impact (for example, reducing the intensity of an impact from major to moderate or minor). Any resultant reduction in intensity of impact due to mitigation, however, is an estimate of the effectiveness of mitigation under NEPA only. It does not suggest that the level of effect as defined by Section 106 is similarly reduced. Cultural resources are nonrenewable resources, and adverse effects generally consume, diminish, or destroy the original historic materials or

form, resulting in a loss in the integrity of the resource that can never be recovered. Therefore, although actions determined to have an adverse effect under Section 106 may be mitigated, the effect remains adverse.

A Section 106 summary follows the cultural resource impact analysis. The Section 106 summary is intended to meet the requirements of Section 106 and is an assessment of the effect of the undertaking (implementation of the alternative) on cultural resources, based upon the criterion of effect and criteria of adverse effect found in the Advisory Council's regulations.

Impact Threshold Definitions

Impact threshold definitions have been drafted for and are included with each of the four cultural resource topics (archeology, historic structures and districts, cultural landscapes, and ethnographic resources) to help ensure that the intent and legal requirements of both the *National Environmental Policy Act* and *National Historic Preservation Act* are met in this document.

Impairment

Within an individual park included in this draft EPMP/EIS, an adverse change would occur on one or more cultural resources whose conservation is necessary to fulfill specific purposes identified in the enabling legislation of the park, key to the cultural integrity of the park, or identified as a goal in the park's general management plan or other relevant NPS planning documents. The change would be permanent and would preclude the use and enjoyment of these cultural resource(s) by future generations.

Cumulative Effects

Cumulative effects that would occur inside and outside the boundaries of the nine parks were determined based on the "Cumulative Effects Analysis Method" section located at the beginning of this chapter.

Cumulative effects on cultural resources were determined by combining the impacts of each alternative with other past, present, and reasonably foreseeable future actions.

Other important actions that occurred in the past and would continue into the future include the deterioration of cultural sites and structures from development, wind, weather, erosion, rodent activity, vegetation, vandalism, and unauthorized collection. Cultural resources are nonrenewable, so over time these various threats cumulatively diminish the regional resource base and reduce the number and variety of cultural sites available for visitor appreciation, ethnographic heritage, and scientific study.

METHODOLOGY FOR ARCHEOLOGICAL RESOURCES

Impacts on archeological resources were evaluated using the process described earlier in the section titled "Cultural Resource Evaluation Method." The

definitions of intensity levels for analysis of archeological resources include the following:

Negligible Impact — The action would result in an impact at the lowest levels of detection, barely measurable with no perceptible consequences, either adverse or beneficial, to archeological resources. For purposes of Section 106, the determination would be no historic properties affected.

Minor Adverse Impact — The action would impact one or more archeological sites with modest data potential and no significant ties to a living community's cultural identity. The site disturbance would be confined to a small area with little, if any, loss of important information potential. For purposes of Section 106, the determination of effect would be no adverse effect.

Minor Beneficial Impact — The action would result in preservation of a site in its natural state. For purposes of Section 106, the determination of effect would be no adverse effect.

Moderate Adverse Impact — The action would impact one or more archeological sites with good data potential and possible ties to a living community's cultural identity. Site disturbance would be noticeable. For purposes of Section 106, the determination of effect would be adverse effect.

Moderate Beneficial Impact — The alternative would noticeably enhance the protection or preservation of one or more archeological sites that are listed or eligible for listing in the National Register of Historic Places. For purposes of Section 106, the determination of effect would be no adverse effect.

Major Adverse Impact — The action would impact one or more archeological sites or districts listed in, or eligible for the National Register and/or having possible ties to a living community's cultural identity, resulting in loss of site or district integrity. Site disturbance or resource degradation would be highly visible. For purposes of Section 106, the determination of effect would be adverse effect.

Major Beneficial Impact — The alternative would substantially enhance the ability to protect and interpret important archeological resources and would foster conditions under which archeological resources and modern society can exist in productive harmony and fulfill the social, economic, and other requirements of present and future generations. For purposes of Section 106, the determination of effect would be no adverse effect.

ALTERNATIVE A — NO ACTION: CONTINUE CURRENT MANAGEMENT

Archeological Resources

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

As with endangered species, cultural sites are not distributed evenly across the landscape. Exotic plants are often associated with cultural sites because the plants tend to become established in previously disturbed areas such as archeological sites, cemeteries, structures or ruins, roads, trails, and along canals. Exotic plants also may remain from prehistoric occupation or historic plantings, and as such may be indicators of buried sites.

Diverse resources provided by wetlands, hammocks, and coastal ridges enabled prehistoric populations to expand and spread throughout southern Florida. In a similar manner, differing ecological niches allowed Caribbean peoples to settle the scattered islands. Different types of cultural sites may be associated with different environments, such as the eight vegetation categories defined in the "Affected Environment" chapter. For example, prehistoric archeological sites in the south Florida parks often occur on hardwood hammocks found in upland dry / mesic forests and dry grasslands. The hammock areas provided wood, usable plants, and a raised dry area in which to camp, as well as high species diversity. In Everglades National Park, sites appear to be fairly evenly distributed between forests and grasslands. Most of the sites located in Big Cypress National Preserve are in the upland dry / mesic or wetland forests. In Canaveral National Park sites are most numerous along marsh edges and in hammocks along the shoreline of Mosquito Lagoon.

Shell middens mark food gathering and preparation areas along the coasts in what are presently defined as mangrove communities in the Florida parks. Conversely, because of high water levels and the lack of some subsistence items, other areas such as the coastal marshes may show less evidence of past human use. Waterways, such as the Miami River, Turner River, and Biscayne Bay, served as early-day highways between the different environments and were heavily used by early peoples for travel, communication, food, and fresh water; sites are often found along these corridors.

In the Caribbean parks, flatter, more open coastal zones were often used prehistorically. As an example, coastal areas at Salt River Bay National Historic Park and Ecological Preserve provided an excellent environment for prehistoric settlement, fishing, and procurement activities. Most prehistoric sites on the island of St. John occur near sheltered bays in coastal areas.

Prehistoric and historic sites often overlap because productive environments have continued to be used through time. Historic use of the land in south Florida parks often involved construction—forested areas were cleared and planted, and settlers built roads, irrigation canals, bridges, houses, and towns. Large areas were drained and leveled to create agricultural fields. The Caribbean islands suffered much the same fate when the hardwood forests were cut, roads and

ditches dug, and sugar plantations created. These efforts introduced exotic plant species and almost certainly ensured their reproduction.

Many of the early-day settlements have vanished, victim to economics and weather, but traces of foundations and fields and gardens remain in the agriculture / disturbed land / developed areas and other areas. On the one hand, exotic plants in these areas continue to thrive, out-growing native species and threatening some of the natural resource values that for which the parks were established. On the other hand, in areas defined as cultural landscapes, exotic plants contribute to the importance of the landscape and help to document prehistoric and historic Native American occupation and traditional practices. They also provide a tantalizing glimpse into the lives and struggles of the Euro-American pioneers who settled there.

Exotic plant eradication efforts on Buck Island Reef National Monument have focused on guinea grass, tan tan, ginger Thomas, wild pineapple, Boerhavia, and aloe. Genip, seaside mahoe, and noni also exhibit invasive characteristics at Buck Island. Exotic plants currently being treated at Virgin Islands National Park include tan tan, lime berry, and Brazilian pepper, although numerous other exotic plants are present. Archeological sites at Trunk Bay, Annaberg, and other areas on St. John, Virgin Islands, are infested with tan tan, and exotic plants inhabit ruins all across the island. While some of these exotic plants may have been hitchhikers and unintentionally imported, others were intentionally introduced for subsistence, medicinal, or ceremonial uses.

A number of priority exotic plant species are currently under treatment in the south Florida parks, including Big Cypress National Preserve and Everglades National Park, which have extensive stands of Australian pine, Brazilian pepper, melaleuca, and Old World climbing fern, all escapees from early-day landscaping efforts. Several of these species tend to infest shell and black earth middens and prehistoric and historic habitation sites. Edges of trails and old roads in the Florida parks, including Canaveral National Seashore and Biscayne National Park, support exotic plant species. Exotic plants at Biscayne National Park, Canaveral National Seashore, and Dry Tortugas National Park tend to grow near or along the coast, areas where archeological sites may be exposed by wind and tides.

Current exotic plant treatments include biological, chemical, physical, and mechanical methods, targeted for specific priority plants (refer to table 1 of appendixes A – I).

Biological treatments do not appear to have any known adverse impacts on archeological resources in any of the parks. However, the use of biological treatments to reduce melaleuca and Old World climbing fern in the Florida parks would indirectly benefit archeological sites by reducing monotypic stands. Monotypic stands of melaleuca tend to burn longer and hotter than a more diversified vegetation community, and Old World climbing fern's spreading form tends to encourage more destructive fires. Fires damage sites by destroying or degrading building materials; charring bone, shell, and pottery; and creating ash and charcoal that confuses dating processes. Use of biological treatments would have an indirect, long-term, negligible to minor, beneficial effect on

archeological resources in the Florida parks by helping to reduce resource damage from fires. The effects of biological treatments would be negligible to minor because, as described in the "Alternatives" chapter, biological treatments have a number of limitations in control of exotic plants such as Old World climbing fern and monotypic stands of melaleuca.

Chemical treatments include foliar (leaf) applications (on the ground or by air), basal bark, cut surface, cut stump, and soil applications. All of these treatments have the potential to adversely and directly and indirectly impact archeological resources, but in other instances, they would be beneficial by removing exotic plants whose roots have invaded archeological sites. While likely to be limited to rare occurrences, soil applications and herbicidal overspray or saturation of archeological sites could alter characteristics of shell, bone, or other archeological resources, although the effects of chemicals on these materials, including possible contamination of materials used for radiocarbon dating, are as yet undetermined. All of the treatments except Glyphosate (Roundup, Rodeo, or Accord) are active in the soil (refer to table 4 in the "Alternatives" chapter). Long-term direct and indirect adverse impacts from overspray and soil applications are, at present, impossible to quantify but could range from negligible to minor, depending on the type and vulnerability of resources found in the site, the amount of chemical saturation, and other contributing factors such as rainfall and type of soil.

Conversely, in cases where exotic plants threaten archeological sites, removal of exotic plants from sites such as shell middens, burials, occupation sites, and ruins could be crucial to site preservation if removal can be done without further impacting buried resources. Some exotic plants have extensive root systems that penetrate deep into sites, displace archeological resources and structural ruins, and hasten site deterioration. (Plant roots tend to grow into sites where soils are richer and looser, and can be invasive in burials.) Guinea grass and other exotic plants infest and may damage buried or partially buried archeological sites, structural elements, features and artifacts in Buck Island Reef National Monument, St. Johns at Virgin Islands National Park, and at Salt River Bay National Historic Park and Ecological Preserve; and exotic plants cover hammock and midden sites in the south Florida parks. Removal would have minor benefits by slowing future uncontrolled growth of intrusive roots in archeological sites. Benefits would be short term because, under alternative A, there is a strong likelihood that exotic plants would have a chance to regenerate between spraying episodes.

Chemical treatment methods in the Caribbean parks have primarily consisted of basal or foliar application of herbicides to treat the exotic plants. These and additional methods (including aerial spraying, post-treatment fire and physical modifications, and biological treatments) are being used in the south Florida parks. Chemical treatment has typically been done first before other methods are initiated.

Treatment of extensive areas of exotic plant infestations and aerial spraying of concentrations of exotic plants, such as Brazilian pepper, melaleuca, Australian pine, and Old World climbing fern in the Florida parks, could potentially expose portions of important prehistoric and historic sites, making them more vulnerable

to vandalism and unauthorized collecting. Generally, if aerial spraying was chosen as a treatment method because of difficulties in accessing the treatment area, dead or dying treated plants would be left in place, and this would help provide ground cover over exposed artifacts. Hardwood hammocks in Everglades National Park have seen many centuries of human use, so treatments in these areas would be carefully selected so as to not inadvertently expose or disturb artifacts and features. Use of best management practices would help protect sites so that removal of exotic plants on archeological sites that are vulnerable to collecting or recreational uses would have long-term, negligible to minor adverse impacts on individual sites or districts, depending on the location, site visibility following treatment, and site vulnerability.

Exotic plants can serve to stabilize sites threatened by erosion. Should a single or repeated chemical application(s) denude large areas of guinea grass or other exotic plants, heavy rains occurring before plant regrowth could cause erosion. Sites on steep slopes and along seashores and streams would be most vulnerable, and eradication of exotic plants along seashores could allow damage to sites from wave action. As the sand and soil once held by the roots of exotic plants erode away, adjacent cultural artifacts and features would be lost to the wind and tides. Archeological sites in Biscayne, Dry Tortugas, and Virgin Islands National Parks, Canaveral National Seashore, and the Thousand Islands area of Everglades National Park located near the ocean would be the most likely to be affected by wind and wave action. With use of best management practices such as erosion control, leaving dead plants in place, and treatment of large areas in a mosaic pattern, indirect damage from erosion where exotic plants have been removed would generally be negligible to minor, depending upon the type of site, location, potential for loss, and severity of erosion.

Use of all-terrain vehicles or other modes of land transportation to reach treatment areas could also inadvertently damage sites, so ATV routes would be planned in advance to avoid known sites. With resource identification and site avoidance, impacts from use of all-terrain vehicles or other modes of land transportation to reach treatment areas would be negligible.

Exotic plants may contribute positively to identification and preservation of archeological sites by serving as site “markers” for historic and prehistoric buried resources because they were purposely planted on the site as part of its landscaping or use, or because the soil was disturbed and thus vulnerable for exotic infestation. Removal of “marker” plants without appropriate and accompanying site identification, documentation, and evaluation would destroy the fragile link between the past and present, and diminish the potential for future site identification and protection. Identification of native or exotic plants that help mark locations of archeological sites gives the park the opportunity to document, evaluate, and effectively manage and protect presently unidentified cultural resources. Unfortunately, careful targeting of specific plants is difficult to accomplish with aerial spraying or widespread ground applications. Loss of site markers would generally be a minor adverse impact.

Physical treatments such as fire can damage archeological resources, particularly in areas where exotic plants occupy close-to-the surface sites such as shell or black earth middens. Fires can burn downward into the soil, following tree roots,

and can damage bones, shells, and ceramics. Fires confuse archeological findings, making documentation, dating, and identification of cultural affiliation more difficult. Elements of historic homesteads may be destroyed by burning, leaving little but charred remains to mark the site.

However, the amount of damage is dependent upon the severity and duration of the fire and whether artifacts are on the surface of the ground or buried. That is, fast-moving fires (low heat) burn through an area with minimal damage to buried resources, although some damage would likely occur to surface resources. Slow, hot fires can damage both subsurface artifacts and features.

Canaveral National Seashore and Everglades National Park have used post treatment fire as a re-treatment technique to help control melaleuca, and in Everglades, Old World climbing fern. Much of the exotic plant infestations in Dry Tortugas and Biscayne national parks have been brought under control so it is unlikely that the use of fire would be needed to treat exotic plants in these two parks. However, fire might be used for purposes of ecosystem management, unrelated to management of exotic plants. Vegetation communities in the Caribbean parks are not fire adapted, so the use of prescribed fire has not, to date, been used as an exotic plant control method.

Protective measures would be developed and appropriate archeological investigations conducted prior to use of fire to control exotic plants, resulting in minor long-term direct adverse effects on individual archeological sites.

In some parts of Everglades National Park, removal and disposal of disturbed soils is being used as an exotic plant control method. Archeological sites within disturbed soils may have lost much of their integrity, but there still may be some potential for retrieval of scientific information. Also, deeply buried prehistoric materials could be exposed by soil removal. Flooding an area to smother root systems can cause unwanted changes in the condition of buried resources, hastening deterioration of bones, wood, and shells. Changes in soil acidity or alkalinity also can impact archeological resources. Depending upon conditions at individual sites, and with prior identification and testing of buried resources, the use of these physical treatments would have minor direct and indirect adverse impacts on archeological resources.

Mechanical treatments such as hand pulling, digging, hoeing, tilling, or using heavy equipment (such as bulldozers) also can pose a very real threat to archeological resources. These treatment methods can mix soil strata and expose or fragment artifacts and features, which, in turn, can destroy the archeological context and reduce site integrity. Hand pulling, obviously, would be much less destructive than using heavy equipment, and is often the best, albeit most labor intensive, method of removal where archeological resources are present. Depending on the type of mechanical treatment used, direct adverse impacts on an individual site or district would vary from negligible to minor and would be long term.

Passive restoration under alternative A would have a range of effects on archeological resources, but generally, restoration would be slow and partial where exotic plants could be reduced and native plants returned. Natural

regrowth of native plants would have minor indirect benefits by helping to stabilize soils from erosion while making artifacts and features less visible on the ground surface. Passive restoration has been successful in some areas of Everglades and Virgin Islands National Parks, Big Cypress National Preserve, and Salt River Bay National Historic Park and Ecological Preserve. On the other hand, regrowth of large trees and vegetation with extensive root systems also could adversely affect archeological resources in the same manner as exotic plant growth (minor adverse effect). Archeological investigations and resource evaluation would be completed for areas proposed for future active restoration, so impacts of restoration would be limited in scope and would generally produce only minor direct adverse impacts. Archeological resources are non-renewable, so effects would be long-term.

At present, the frequency and amount of coordination between the Exotic Plant Management Team crews and park cultural staff vary among parks as do identification and evaluation of archeological sites and implementation of mitigation measures, so there may not always be an opportunity to fully address treatment of exotic plants where there may be known or suspected cultural sites. Lack of coordination among exotic plant crews and park cultural staff could result in long-term, localized, minor to moderate direct and indirect adverse impacts on individual sites and districts.

Cumulative Impacts

Archeological resources located on steep slopes and along seashores in the Caribbean parks are continually being eroded by wind, water, and wave action. While Florida parks lack the steep topography that can contribute to adverse effects from erosion, Florida receives a great deal of rain, flooding is common, and as in the Caribbean, loss of coastal resources is a frequent byproduct of hurricanes.

In the past, agricultural uses, construction of canals, mosquito ditches, impoundments, homesteads and settlements in areas now within both the Florida and the Caribbean parks disturbed many prehistoric and historic sites as have past recreational activities and other human activities. The Florida parks are close to major urban centers and visitors number in the millions. The Virgin Islands also are a popular vacation spot, attracting numerous visitors. The sheer number of visitors contributes to ongoing site disturbance from unauthorized collecting and inappropriate recreational use. Ongoing or proposed park projects (such as Seminole Housing and off-road trails in Big Cypress, oil and gas management in Big Cypress National Preserve, the Everglades National Park airboat management plan, development of the East End Marine Park at St Croix/Buck Island, and the North Shore Road at Virgin Islands National Park) can all have varying degrees of impact, both beneficial and adverse, on cultural resources. Once artifacts and features have been displaced from their original context, it is often impossible to determine the date or cultural affiliation of the site, and the archeological remains lose most of their original scientific value. Exposed sites also are vulnerable to unauthorized collecting, and all too often diagnostic artifacts and features have been vandalized or removed by collectors.

These losses began centuries ago, are ongoing, and are likely to continue into the foreseeable future throughout the parks. The cumulative effects of exotic plant control measures under alternative A are both beneficial and adverse but would contribute only in a minor way to the moderate cumulative effects of other past, present, and future actions and projects within the park.

Conclusion

The indirect long-term beneficial effects of biological treatments on archeological resources would be negligible to minor because of their limitations in control of exotic plants. Depending upon the type and vulnerability of archeological resources and other physical factors, long-term direct and indirect adverse impacts from overspray and soil applications could range from negligible to minor, but treatment would have minor short-term indirect benefits by killing plants whose roots have invaded archeological sites. (Benefits would be short-term because, under alternative A, roots likely would have an opportunity to regrow.)

With use of best management practices such as erosion control, leaving dead plants in place, and treatment of large areas in a mosaic pattern, individual sites vulnerable to collection or recreational uses would suffer indirect long-term, negligible to minor adverse impacts from treatment, depending on the location and site visibility. With resource identification and site avoidance, impacts from use of all-terrain vehicles or other modes of land transportation to reach treatment areas would be negligible. Loss of site markers would generally be a minor adverse impact.

Protective measures would be developed and appropriate archeological investigations conducted prior to use of fire to control exotic plants, resulting in minor long-term direct adverse effects on individual archeological sites. With prior identification and testing of buried resources, the use of physical treatments would have minor direct and indirect adverse impacts on archeological resources. Depending on the type of mechanical treatment used, direct adverse impacts on an individual site or district would vary from negligible to minor and would be long term.

Natural restoration of native plants would have minor benefits by helping to stabilize soils and making artifacts and features less visible on the ground surface. However, regrowth of vegetation with extensive root systems also could adversely affect archeological resources in the same manner as exotic plant growth (minor adverse effect).

Lack of coordination among exotic plant crews and park cultural staff could result in long-term, localized, minor to moderate indirect and direct adverse impacts on individual sites and districts.

Archeological investigations and resource evaluation would be completed for areas proposed for future active restoration, so impacts of restoration would be limited in scope and would generally produce only minor adverse impacts. The cumulative effects of exotic plant control measures under alternative A are both beneficial and adverse but would contribute only in a minor way to the moderate

cumulative effects of other past, present, and future actions and projects within the park

There would not be an impairment of archeological resources at any of the nine parks as a result of exotic plant management activities.

Section 106 Summary for Alternative A

Introduction. This draft EPMP/EIS has defined the area of potential effect as follows: in parks surrounded by large bodies of water (Buck Island Reef National Monument, Dry Tortugas National Park, and Christiansted National Historic Site), the area of potential effect is defined by the parks' boundaries. In other parks, such as Everglades National Park where boundaries may be less easily defined on the ground, effects of implementing management actions proposed in this draft EPMP/EIS could extend to areas immediately adjacent to park boundaries.

In the "Affected Environment" chapter of this draft EPMP/EIS, the current cultural resource conditions (including National Register of Historic Places properties and National Historic Landmarks) are described for each of the nine parks, and potential environmental impacts under NEPA that would result from implementation of any of the three alternatives were described earlier in the "Cultural Resources" section.

Definitions of intensity levels for cultural resources developed in the "Methodology and Assumptions" section (above) provide a basis for evaluating impacts of proposed actions on cultural resources under both NEPA and the NHPA. Mitigating measures were developed to help ensure the protection and preservation of cultural resources eligible for or listed in the National Register of Historic Places (refer to tables 5, 13, and 19 in the "Alternatives" chapter).

The Advisory Council on Historic Preservation, the state historic preservation officers in Florida and the Virgin Islands, and concerned tribes were contacted at the beginning of this process (see the "Consultation and Coordination" chapter). Traditional West Indian peoples also have been included as part of the scoping and public involvement process for the EPMP/EIS. This draft EPMP/EIS has been sent to affiliated tribes and to interested traditional groups and individuals for review and comment. This document has also been sent to the Advisory Council on Historic Preservation and to the state historic preservation officers in Florida and the Virgin Islands for their review and comment. Comments will be taken into consideration in development of the final EPMP/EIS.

The NPS finds that implementation of proposed actions in this draft EPMP/EIS would have an effect on archeological resources, historic structures and districts, ethnographic resources, and cultural landscapes. These are described below in each alternative under the various cultural resource headings. While most of the effects on archeological resources and historic structures would not be adverse, effects of implementing any of the alternatives would adversely affect cultural landscapes and ethnographic resources, because parks currently lack definitive data on these resources. Historic structures at Virgin Islands National Park also would be adversely affected because current management of exotic plants would

be unable to keep up with rampant plant growth. Until implementation of one of the alternatives for management of exotic plants, parks would continue to complete Section 106 compliance on a case-by-case basis.

Once the NPS makes its decision as to which alternative presented in this draft EPMP/EIS would be implemented, a programmatic memorandum of agreement would be developed among the parks, and others as appropriate, including tribal historic preservation officers, the state historic preservation officers of Florida and Virgin Islands, and the Advisory Council on Historic Preservation, as provided for in the implementing regulations (36 CFR 800) for Section 106 of the *National Historic Preservation Act*. This agreement would outline specific measures to ensure the identification, evaluation, and protection of National Register-eligible properties that would potentially be affected by future exotic plant treatment and restoration activities.

Section 106 Description of Effects of Alternative A on Archeological Resources. Biological treatments would have beneficial effects on archeological resources by helping to reduce resource damage from fires and root intrusion into sites. Chemical treatments would affect sites through soil applications and spraying, but these impacts would not have an adverse effect. Treatments also would be beneficial by preventing future uncontrolled growth of intrusive roots that can grow into and disturb archeological sites.

When large areas of plants are killed by chemical treatments, portions of prehistoric or historic sites could be exposed, making sites vulnerable to vandalism and unauthorized collecting. However, dead plants in large-scale treatment areas (ground applications or aerial spraying) are generally left in place, and effectively cover the ground surface until new plants take hold, minimizing potential for resource damage. Coordination between exotic plant crews and park resource staff would encourage documentation of exotic plants that serve as site “markers” for buried resources.

Removal of exotic plants that stabilize sites, especially those along coastlines, could allow unwanted erosion, so erosion control, site protection, and other best management practices would be used to minimize site damage for treatment in these areas. Routes used to access treatment sites would be carefully chosen to avoid sites.

Because physical treatments such as fire, removal of disturbed soils, and changes in hydrologic conditions have the potential to impact archeological resources by destroying site integrity and hastening deterioration, physical treatment methods would be carefully chosen for cultural site areas so archeological resources would not be adversely affected. The same is true for mechanical treatments that mix soil strata and disturb the archeological context and site integrity; these types of treatments would be used only where archeological investigations indicate no resources are present.

Passive restoration would have benefit archeological sites by helping to stabilize soils from erosion while making artifacts and features less visible on the ground surface (no adverse effect). Archeological investigations and resource evaluation would be completed for areas proposed for future active restoration, so impacts

of restoration would be limited in scope and would generally have no adverse effects on sites.

Generally, implementation of alternative A would have no adverse effects on archeological resources. However, the frequency and amount of coordination between the EPMT crews and park resource staff vary among parks, as do identification, evaluation, monitoring, and protection of archeological sites in potential treatment areas. Some parks have very limited cultural resources staff. Thus there may not always be an opportunity to fully address treatment of exotic plants where there may be known or suspected cultural sites. This situation could result in adverse impacts on individual sites and districts in selected areas.

ALTERNATIVE B — NEW FRAMEWORK FOR EXOTIC PLANT MANAGEMENT: INCREASED PLANNING, MONITORING, AND MITIGATION

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

The national parks in south Florida and the Caribbean would continue to manage exotic plants using physical, chemical, mechanical, and biological treatment and re-treatment methods as described in alternative A. However, implementation of alternative B would include use of structured decision tools, monitoring, and best management practices that would help ensure that cultural resources within project areas are identified and evaluated, and that effects on these resources are effectively addressed and resolved before treatment begins.

Archeological Resources

Impacts on archeological resources from differing treatment methods would be the same as described for alternative A. However, under alternative B, use of the decision tool along with standardized treatments, prioritized treatment areas, selection of the most appropriate treatment methods, monitoring, and an adaptive management strategy would help guide the site-specific implementation of exotic plant control projects. Priorities for treatment would take into consideration potential impacts on cultural resources and would help determine which treatment method would be the most effective, while having the least impact on cultural resources. Parks lacking cultural resource specialists would work with SEAC and/or regional specialists during pretreatment planning and development of protective strategies,

Procedures developed as part of alternative B would help parks to

- identify and evaluate potentially significant archeological resources early in the process
- help ensure that archeological resources are considered when defining appropriate treatment methods
- identify and implement protective and mitigation measures

establish a feed-back process as part of the adaptive management and monitoring strategies

complete any additional Section 106 compliance necessary

establish an effective and efficient coordination process between the Exotic Plant Management Team and cultural resources staff at the parks

As described for alternative A, biological treatments would not adversely affect archeological resources, and use of this treatment method would have a long-term, negligible to minor, beneficial effect on archeological resources in the Florida parks such as Big Cypress National Preserve and Everglades National Park by helping to reduce resource damage from fires.

It is likely that, at first, chemical treatments initiated as part of a standardized maintenance regime would occur more often in both the Florida and Caribbean parks than under alternative A, slightly increasing the potential for overspray or saturation of archeological sites. This would result in short-term, direct and indirect adverse impacts, ranging from negligible to minor (in isolated cases), depending upon the type and vulnerability of resources found in the site, the amount of chemical saturation, and other contributing factors such as rainfall and type of soil.

Over time, however, the total amount of chemicals applied would probably be less under alternative B than alternative A, so the long-term impacts would be somewhat reduced. The systematic approach proposed under alternative B would provide for monitoring the effects of large-scale spraying actions on cultural resources or of smaller projects conducted within archeological sites. An adaptive management strategy would also be used to modify future treatment choices. These mechanisms would allow effective evaluation and consideration of archeological site conditions and give park resource staff an opportunity to fine-tune protective measures to prevent damage to sites from inadvertent exposure and subsequent damage to surface archeological materials. The end result would reduce potential impacts, resulting in negligible impacts on individual sites and districts from chemical treatments.

Under alternative A, sporadic removal efforts would allow some exotic plants to become firmly reestablished, with strong root systems that invade archeological sites, displacing features and artifacts, and accelerating site deterioration. With each treatment under alternative B, however, the number of individuals and the sizes of individual plants and their root systems would tend to be reduced, and eventually the plants would be eliminated. Thus, the impact of roots growing into archeological sites would be reduced under alternative B, resulting in a minor to moderate long-term benefit.

Under alternative B, parks would be better equipped to determine which exotic plants could be left in place to stabilize sites threatened by erosion, especially those on steep slopes and along seashores and streams. Losses from erosion resulting from treatments would be reduced to negligible impacts for most individual sites, depending upon the type of site, location, potential for loss, and severity of erosion.

Impacts from use of all-terrain vehicles or other modes of land transportation to reach treatment areas would be the same as described for alternative A (negligible impacts).

The extensive pretreatment planning and the EPMT/resource staff coordination process initiated under alternative B would benefit archeological sites by providing for identification and documentation of native or exotic plant locations where certain species serve as site "markers." This would enable development of mitigation or protective strategies and aid in protection of some presently unidentified archeological sites during chemical treatments, a moderate long-term benefit. Use of the decision tool and adaptive management strategies would help reduce impacts of physical treatments such as fire, soil removal, and modification of hydrologic conditions that have the potential to impact archeological resources. Long-term adverse impacts from physical treatments under alternative B would range from negligible to minor.

Because treatments would be more carefully evaluated for potential effects on cultural resources under alternative B, and because treatments would be specifically designed to do the least possible damage to sensitive resources, mechanical treatments (hand pulling, digging, hoeing, tilling, or heavy equipment) would pose less of a threat to archeological resources than in alternative A. Impacts on an individual site or district would vary from negligible to minor (adverse) and would be long term. Long-term moderate benefits would result as well, because techniques such as basal bark/girdling and foliar ground treatment would reduce exotic plants that could impact archeological resources.

Information on noticeable changes in the condition of a treatment area recorded as part of the exotic plant monitoring records (erosion or deterioration, evidence of looting, unexpected regrowth of exotic plants, or inappropriate recreational use) would be useful to cultural resource managers. These data would help identify potential threats to cultural sites and allow staff to prioritize future management options, a long-term, minor to moderate benefit.

Site- and area-specific mitigation measures would be developed to ensure identification and protection of archeological resources in treatment areas. For example, typical mitigation measures are defined in table 13 in the "Alternatives" chapter and may include such actions as archeological monitoring, avoidance of sensitive areas, and protective measures. These mitigation measures would aid identification and protection of archeological resources. With a defined schedule and protocol for re-treatment of sites, coordination of archeological site protection with EPMT activities would be facilitated, a major benefit.

Under alternative B, passive restoration activities and resulting impacts would be more extensive and consistent than those outlined for alternative A. However, use of the decision tool, increases re-treatment frequency, and adaptive management strategies would make passive restoration more effective and reduce its potential impacts on archeological sites. Direct adverse impacts of restoration projects would generally be negligible. Restoration projects also would result in enhancement of some archeological resources by contributing positively to reductions in erosion, surface visibility of artifacts, and site stability, all long-term moderate benefits.

Cumulative Impacts

Past and present cumulative impacts on archeological resources would be much the same as those described for alternative A. Wind, water, wave action, vermin, and human activities would continue to impact regional archeological sites as they have for centuries. Implementation of alternative B would help reduce future adverse impacts on archeological sites during treatment of exotic plants, and archeological resources would receive more uniform identification and protection in the south Florida and Caribbean parks. Coordination between exotic plant treatment and archeological resource protection would help raise awareness about the vulnerability and nonrenewable nature of archeological resources. However, given the probable future impacts on archeological resources from a variety of other causes, implementation of alternative B would contribute only a small amount to the overall resource preservation efforts, and cumulative impacts would remain adverse and moderate.

Conclusion

Exotic plant treatments would have long-term, negligible to minor, adverse and beneficial effects on archeological resources, and the systematic approach, coordination, monitoring, and adaptive management strategies under alternative B would reduce potential impacts on sites and have a long-term, moderate to major benefits, both directly and indirectly.

Cumulative impacts would be the same as alternative A. There would be no impairment of archeological resources within any of the nine parks as a result of exotic plant management activities under alternative B.

Section 106 Description of Effects of Alternative B on Archeological Resources. Generally, effects of treatment methods on archeological resources would be much the same as described for alternative A except that use of the use of the decision tool, along with standardized treatments, prioritized treatment areas, selection of the most appropriate treatment methods, monitoring, and an adaptive management strategy would help guide the site-specific implementation of exotic plant control projects. Procedures would be developed to aid parks in identifying and evaluating significant archeological resources to ensure that these resources are considered during development of treatment priorities and protective and mitigative measures. Priorities for treatment would take into consideration potential impacts on archeological resources and would help determine which treatment method would be the most effective, while having the least impact on resources. Development of a monitoring and feedback process would further protect resources. Effective coordination between the EPMT and park resource staff would be a priority. Parks lacking cultural resource specialists would work with SEAC and/or regional specialists during pretreatment planning and development of protective strategies.

As described for alternative A, biological treatments would benefit archeological resources by reducing potential damage from fire used as a treatment tool. At first, chemical treatments would occur more often than in alternative A, slightly increasing the potential for overspray or saturation of archeological sites. However, over time, the total amount of chemicals applied would probably be

less under alternative B than alternative A, decreasing the potential for contamination of site materials.

Systematic approaches and adaptive management strategies would provide for monitoring the effects of large-scale spraying actions on cultural resources and on smaller projects conducted within archeological sites, and would be used to modify future treatment choices. These mechanisms would allow effective evaluation and consideration of archeological site conditions and give park resource staff an opportunity to fine-tune protective measures to prevent damage to sites from inadvertent exposure and subsequent damage to surface archeological materials.

Each treatment under alternative B would reduce the number and size of individual exotic plants, with eventual elimination of the exotic plant(s). Thus, the impact of roots growing into archeological sites would be reduced under alternative B.

Losses from erosion resulting from treatments would be reduced. Impacts from use of all-terrain vehicles or other modes of land transportation to reach treatment areas would be the same as described for alternative A.

Pretreatment planning, and EPMT/resource staff coordination process under alternative B would benefit archeological sites by providing for identification, documentation, and protection of native or exotic plant locations where certain species serve as site "markers". Use of the decision tool, adaptive management strategies, and pretreatment evaluation of potential effects would help reduce impacts of physical treatments (fire, soil removal, and modification of hydrologic conditions) and mechanical treatments (hand pulling, digging, hoeing, tilling, or heavy equipment) that have the potential to impact archeological resources. Monitoring information would help identify potential threats to cultural sites and allow staff to prioritize future management options.

Site- and area-specific mitigation measures would be developed to ensure identification and protection of archeological resources in treatment areas, and with a defined schedule and protocol for re-treatment of sites, coordination of archeological site protection with EPMT activities would be facilitated (beneficial, no adverse effect).

Under alternative B, passive restoration activities and resulting impacts would be more extensive and consistent than those outlined for alternative A but use of the decision tool, increases in re-treatment frequency, and adaptive management strategies would make passive restoration more effective and reduce its potential impacts on archeological sites. Development of cultural landscape reports would aid in the identification and preservation of individual plants and species of plants that would be preserved.

In summary, archeological sites would be affected by implementation of alternative B, but these effects would not be adverse (no adverse effect). Impacts of roots growing into archeological sites would be reduced, as would potential exposure of sites and possible erosion. Impacts from use of all-terrain vehicles or other modes of land transportation to reach treatment areas would be avoided,

and native or exotic plant locations where certain species serve as site "markers" would be recorded so sites could be recorded and managed. Treatments and passive restoration activities that could impact resources would be guided by use of the decision tool, adaptive management strategies, and pretreatment evaluation of potential effects, and monitoring information would help identify potential threats to cultural sites while allowing staff to prioritize future management options.

ALTERNATIVE C — NEW FRAMEWORK FOR EXOTIC PLANT MANAGEMENT: INCREASED PLANNING, MONITORING, AND MITIGATION, WITH AN EMPHASIS ON ACTIVE RESTORATION OF NATIVE PLANTS

Archeological Resources

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

As in alternative B, parks would manage exotic plants using a variety of physical, mechanical, chemical, and biological methods. The planning framework developed in alternative B would be used in alternative C, along with a new emphasis on active restoration of native plants. Monitoring information would be used to adjust treatment methods to ensure reestablishment of a prescribed level of native plant species. An enhanced, standardized maintenance and monitoring program would be used for treated sites, which would help determine when active restoration (replanting and seeding) would be needed to meet native plant restoration goals.

EPMT and park/regional/SEAC staff would document native or exotic plants that suggest the presence of prehistoric or historic archeological sites so that mitigation measures, including site avoidance, could be developed and implemented. Monitoring of exotic treatment areas would help ensure that archeological sites remain undisturbed by erosion or unauthorized collecting. Increased cooperation and coordination among park resource staff and EPMT staff would also help ensure resource protection through advanced planning. As described for alternative B, development of defined schedules and re-treatment protocols would enable coordination of archeological site protection with EPMT activities.

Under alternative C, most impacts on archeological resources from exotic plant treatments would be the same as described for alternative B. Soil removal to change the water level of an area and to remove the exotic plant seed bank would impact archeological resources, and would require additional mitigation and compliance measures. Obviously, the degree of ground disturbance would vary depending on the methods used to reestablish native plants. Site- and area-specific mitigation measures (refer to table 13 in the "Alternatives" chapter) would be developed to ensure identification and protection of archeological resources in treatment and restoration areas. With mitigation, impacts of active restoration would be long term, adverse, and minor.

Under alternative C, implementation of an active program of native plant restoration has the potential to disturb archeological sites, so potential restoration sites would be initially surveyed by an archeologist and then a collaborative decision would be made between resource divisions as to whether a site would be restored, when and how to restore, and what native species would be appropriate for use in the site(s). In most cases, reestablishment of native plants would help protect archeological resources from erosion and unauthorized collection. At Canaveral National Seashore, exotic plants would be carefully removed from important archeological sites like Castle Windy Midden, and native ground cover established to protect resources. Restoration areas would be monitored and mitigation measures developed, as needed, to ensure that planted native plants survive. Restoration of planted native plants in all the parks would be considered achieved once their establishment is successful.

Cumulative Impacts

The cumulative effects of past, present, and foreseeable future actions on archeological resources would be the same as described in alternative A.

Conclusion

Under alternative C, most impacts of exotic plant treatment on archeological resources would be the same as described for alternative B. With mitigation to protect sites during initial restoration, and with appropriate choices of restoration location, plant materials, and techniques, implementation of alternative C would have minor long-term adverse impacts on archeological resources.

Cumulative impacts would be the same as alternative A. There would be no impairment of archeological resources in any of the nine parks as a result of exotic plant management activities under alternative C.

Section 106 Description of Effects of Alternative C on Archeological Resources. The planning framework developed in alternative B would be used in alternative C, along with a new emphasis on active restoration of native plants. As in alternative B, parks would manage exotic plants using a variety of physical, mechanical, chemical, and biological methods. Monitoring information would be used to adjust treatment methods to ensure reestablishment of a prescribed level of native plant species. An enhanced, standardized maintenance and monitoring program would be used for treated sites, which would help determine when active restoration (replanting and seeding) would be needed to meet native plant restoration goals. As described for alternative B, development of defined schedules and re-treatment protocols would enable coordination of archeological site protection with EPMT activities.

Under alternative C, most impacts on archeological resources from exotic plant treatments would be the same as described for alternative B. Soil removal to change the water level of an area and to remove the exotic plant seed bank would impact archeological resources, and would require additional archeological investigations and possibly development of mitigating measures. Obviously, the degree of ground disturbance would vary depending on the methods used. Site- and area-specific mitigation measures (refer to table 13 in the “Alternatives”

chapter) would be developed to ensure identification and protection of archeological resources in treatment and restoration areas.

Under alternative C, implementation of an active program of native plant restoration has the potential to disturb archeological sites, so potential restoration sites would be initially surveyed by an archeologist and then a collaborative decision would be made between resource divisions as to whether a site would be restored, when and how to restore, and what native species would be appropriate for use in the site(s).

In most cases, reestablishment of native plants would help protect archeological resources from erosion and unauthorized collection. At Canaveral National Seashore, exotic plants would be carefully removed from important archeological sites like Castle Windy Midden, and native ground cover established to protect resources. Restoration areas would be monitored and mitigation measures developed, as needed, to ensure that planted native plants survive and that archeological resources are not exposed. Restoration of planted native plants in all the parks would be considered achieved once their establishment is successful. Archeological resources would be affected by implementation of alternative C, but the effects would not be adverse (no adverse effect).

METHODOLOGY FOR HISTORIC STRUCTURES, BUILDINGS, AND DISTRICTS

Impacts on historic structures and buildings were evaluated using the process described earlier in the section titled "Cultural Resource Evaluation Method" Definitions of intensity levels for historic structures and buildings include the following:

Negligible Impact — The activity would not have the potential to cause effects on historic structures, buildings, or districts that would alter any of the characteristics that would qualify the resource for inclusion in or eligibility for the National Register of Historic Places. For purposes of Section 106, the determination would be no historic properties affected.

Minor Adverse Impact — The action would alter a feature(s) of a structure, building, or district that is eligible for or listed in the National Register, but it would not alter its character-defining features, nor would the action diminish the overall integrity of the property. For purposes of Section 106, the determination of effect would be no adverse effect.

Minor Beneficial Impact — The action would maintain and improve the character-defining features of a National Register -eligible or listed structure, building, or district in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties (NPS 1995b) For purposes of Section 106, the determination of effect would be no adverse effect.

Moderate Adverse Impact — The action would alter a character-defining feature(s) of the structure, building, or district. While the overall integrity of the resource would be diminished, the property would retain its National Register eligibility. For purposes of Section 106, the determination of effect would be adverse effect.

Moderate Beneficial Impact — Positive actions would be taken to preserve and noticeably enhance character-defining elements of a structure, building, or district in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties (NPS 1995b). For purposes of Section 106, the determination of effect would be no adverse effect.

Major Adverse Impact — The action would alter character-defining features of the structure, building, or district, seriously diminishing the overall integrity of the resource to the point where its National Register eligibility may be in question. For purposes of Section 106, the determination of effect would be adverse effect.

Major Beneficial Impact — The action would enhance the character-defining features of a structure or a building that represent important components of the nation's historic heritage and would foster conditions under which these cultural foundations of the nation and modern society could exist in productive harmony and fulfill the social, economic, and other requirements of present and future generations. The Section 106 determination of effect would be no adverse effect.

ALTERNATIVE A — NO ACTION: CONTINUE CURRENT MANAGEMENT

Historic Structures, Buildings, and Districts

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Both exotic and native plants may accelerate physical destruction of historic structures by infiltrating and expanding cracks in mortar and other structural materials and by providing an avenue for moisture, rodents, and insects to further penetrate into the structure. Plant roots and limbs can grow into, over, or below structural elements such as foundations, roofs, and walls, displacing or destroying them, and opening up areas where moisture can accumulate. As large plants die or are blown over by hurricanes, they can damage adjacent historic structures. Careful removal of plants in structures is crucial to preservation of structural integrity.

Experts do not always agree on techniques for removing exotic plants from structures, although it appears that biological treatments would have a negligible to minor long-term beneficial effect on historic structures (benefits would be low because of the limitations of the treatments). The direct effects of chemical treatments sprayed onto structural materials are unknown, but some chemicals are thought to have the potential to stain masonry, resulting in minor adverse impacts. There would be isolated instances where overspray of chemical treatments and physical and mechanical treatment measures could have an adverse impact on both archeological resources and historic structures. Chemical treatments of larger vegetation species in and near ruins and standing structures could cause later, indirect, impacts should the killed plant collapse onto and damage the structure, a minor adverse effect. On the other hand, chemical treatments of plants near historic structures would help extend the life span of the

structures by minimizing root penetration and secondary damage from falling limbs and trunks, yielding a long-term major benefit.

Mechanical treatments such as pulling seedlings would prevent future deterioration from large plants growing into walls and foundations, but mechanical removal of plants also can displace mortar and open cracks to future damage from wind and moisture. In some instances, exotic plants may be providing support for standing walls, and their removal would allow the structure to collapse. Potential impacts to the structure would be reduced by careful evaluation of the relationship between the plant and the structural walls prior to treatment. Larger-scale mechanical treatments (such as bulldozers) or mechanical equipment other than chain saws generally are inappropriate in areas containing historic structures and districts and are seldom used. Heavy equipment compacts soils, can tear up subsurface foundations and other features related to the buildings, and causes vibrations that, when transmitted through the ground, can damage historic structures. Depending on the method of mechanical treatment used, and development of appropriate protective measures prior to use, long-term direct and indirect impacts on historic structures could vary from beneficial (moderate to major) to adverse (minor).

Physical treatments such as fire, manipulation of water levels, and soil removal are almost always inappropriate in historic districts or areas containing ruins and not currently being used to treat exotic plants located in/near historic structures or districts.

Regular park maintenance operations deal with most of the exotic plants that are part of the cultural landscape that encompasses Christiansted National Historic Site's historic structures, and neither Buck Island Reef National Monument nor Salt River Bay National Historic Park and Ecological Preserve has any standing historic structures or districts that are currently being affected by the presence of exotic plants or their treatments.

Virgin Islands National Park has more than 380 historic structures, and most are situated within 11 historic districts that are listed in the National Register. Currently, the most significant of the park's historic structures, including those at Annaberg and Cinnamon Bay, have been cleared of vegetation and stabilized against deterioration, a long-term major beneficial impact. However, other structures scattered throughout the park are almost uniformly inhabited by plants that have grown into cracks in walls and over and through roofs and foundations. Treatment programs have been unable to keep pace with plant growth, resulting in moderate adverse impacts on structures from growth of exotic plants. Under alternative A, these conditions are likely to continue.

While there are historic structures in all of the south Florida national parks, and historic districts in several areas, the numbers and types of historic structures vary from park to park, as do the impacts of exotic plants and plant management actions on these resources. Exotic plants (including melaleuca, Australian pine, and Brazilian pepper) within historic farmsteads in Big Cypress National Preserve, Everglades and Biscayne National Parks, and Canaveral National Seashore may have been introduced by early-day residents as part of landscaping

or farming efforts. These exotic plants grow rapidly and tend to engulf standing structures, eventually contributing to structural deterioration.

Only three historic structures are eligible for or listed in the National Register in Big Cypress National Preserve, and of these, none appear to be affected by current exotic plant management actions (a negligible effect). Most of the 54 structures in Everglades National Park are mounds related to prehistoric use of the area, but a few structures remain from early homesteads and farming ventures. The integrity of these structures is threatened, albeit gradually, by growth of exotic plants, resulting in minor adverse impacts. The integrity of other structures, such as the berms on the missile base and buried features from the Old Ingraham Highway, also would be threatened by uncontrolled growth of exotic plants, so treatment would be long-term and moderately beneficial.

At Biscayne National Park, treatment of exotic plants is closely coordinated with cultural resource staff, and Section 106 compliance is completed prior to treatment so the park's historic structures gain a long-term moderate benefit. At Canaveral National Seashore, the Eldora Historic District and Seminole Rest historic structures and the Old Haulover Canal also have moderate benefits from treatment. Dry Tortugas National Park has been working on treatment solutions for the park's historic structures so that effects would be long-term and moderately beneficial.

As described above in the "Archeological Resources" section, the choice of treatment methods and the amount of coordination between exotic plant crews and park cultural staff varies among parks. Where treatment choices are based primarily on criteria for management of exotic plant species, and there is inadequate coordination with park resource staff, protection of structures would be less than optimal, resulting in a long-term minor adverse effect.

With the continuation of treatments to remove exotic plants from historic structures, passive restoration, where it might occur under a 3-year interval of re-treatment, would generally have a minor beneficial effect.

Cumulative Effects

For almost three centuries, historic structures now included within the boundaries of the south Florida and Caribbean parks have been subject to the ravages of wind, water, vermin, fire, looting, development, and, more insidiously, invasion by plants, many of which are exotic plants. The NPS is reevaluating treatment strategies in an effort to more successfully protect and preserve historic resources, but in some parks, especially the Virgin Islands, the existing exotic plant treatment régime and ongoing preservation efforts cannot keep up with the rampant plant growth, resulting in deterioration of structures and growth of exotic plants in and among historic ruins. All of these factors have contributed to minor (Florida) to major (Caribbean) past cumulative adverse impacts on historic structures. These losses began centuries ago, are ongoing, and some are likely to continue into the foreseeable future. Under alternative A, on-going and future beneficial efforts to control exotic plants would help reduce the adverse cumulative effects exotic plants have on structures, resulting in minor cumulative effects on structures in the Florida parks. However, cumulative effects on

structures in the Virgin Islands would be moderate because eradication programs would not be able to keep up with the plant growth and structural deterioration.

Conclusion

Biological treatments would have a negligible to minor beneficial impact on historic structures (benefits would be low because of the limitations of the treatments). Some chemical treatments may stain masonry, resulting in minor direct adverse effects. Chemical treatments could cause later, indirect, minor adverse impacts should the killed trees or limbs fall on and damage the structure, but also would help extend the life span of structures by minimizing root penetration and secondary damage, resulting in long-term major benefits. Potential impacts to structures would be reduced by careful evaluation of the relationship between the plant and the structural walls prior to treatment. Some of the Virgin Islands historic structures have been cleared of vegetation and stabilized against deterioration, a long-term major beneficial effect. However, treatment programs for the rest of the structures have been unable to keep pace with plant growth, resulting in direct and indirect moderate adverse impacts. Treatment would confer long-term, moderate benefits on structures in the Florida parks.

Depending on the method of mechanical treatment used, and development of appropriate protective measures, long-term impacts on historic structures could vary from beneficial (moderate to major) to adverse (minor). Physical treatments generally are inappropriate in historic districts or areas containing ruins, so at present are not being used.

Treatment methods and amount of coordination between exotic plant crews and park resource staff varies among parks, and where treatment choices are based primarily on criteria for management of exotic plant species, protection of structures would be less than optimal, resulting in a long-term minor adverse effect. With the continuation of treatments to remove exotic plants from historic structures, passive restoration, where it might occur under a 3-year interval of re-treatment, would generally have a minor beneficial effect.

In Florida parks, cumulative impacts would be minor adverse; in Caribbean parks, cumulative impacts would be moderate adverse. There would not be an impairment of historic structures, buildings, or districts at any of the nine parks as a result of exotic plant management activities.

Section 106 Summary for Alternative A

Introduction. This draft EPMP/EIS has defined the area of potential effect as follows: in parks surrounded by large bodies of water (Buck Island Reef National Monument, Dry Tortugas National Park, and Christiansted National Historic Site), the area of potential effect is defined by the parks' boundaries. In other parks, such as Everglades National Park where boundaries may be less easily defined on the ground, effects of implementing management actions proposed in this draft EPMP/EIS could extend to areas immediately adjacent to park boundaries.

In the "Affected Environment" chapter of this draft EPMP/EIS, the current cultural resource conditions (including National Register of Historic Places properties and National Historic Landmarks) are described for each of the nine parks, and potential environmental impacts under NEPA that would result from implementation of any of the three alternatives were described earlier in the "Cultural Resources" section.

Definitions of intensity levels for cultural resources developed in the "Methodology and Assumptions" section (above) provide a basis for evaluating impacts of proposed actions on cultural resources under both NEPA and the NHPA. Mitigating measures were developed to help ensure the protection and preservation of cultural resources eligible for or listed in the National Register of Historic Places (refer to tables 5, 13, and 19 in the "Alternatives" chapter).

The Advisory Council on Historic Preservation, the state historic preservation officers in Florida and the Virgin Islands, and concerned tribes were contacted at the beginning of this process (see the "Consultation and Coordination" chapter). Traditional West Indian peoples also have been included as part of the scoping and public involvement process for the EPMP/EIS. This draft EPMP/EIS has been sent to affiliated tribes and to interested traditional groups and individuals for review and comment. This document has also been sent to the Advisory Council on Historic Preservation and to the state historic preservation officers in Florida and the Virgin Islands for their review and comment. Comments will be taken into consideration in development of the final EPMP/EIS.

The NPS finds that implementation of proposed actions in this draft EPMP/EIS would have an effect on archeological resources, historic structures and districts, ethnographic resources, and cultural landscapes. These are described below in each alternative under the various cultural resource headings. While most of the effects on archeological resources and historic structures would not be adverse, effects of implementing any of the alternatives would adversely affect cultural landscapes and ethnographic resources, because parks currently lack definitive data on these resources. Historic structures at Virgin Islands National Park also would be adversely affected because current management of exotic plants would be unable to keep up with rampant plant growth. Until implementation of one of the alternatives for management of exotic plants, parks would continue to complete Section 106 compliance on a case-by-case basis.

Once the NPS makes its decision as to which alternative presented in this draft EPMP/EIS would be implemented, a programmatic memorandum of agreement would be developed among the parks, and others as appropriate, including tribal historic preservation officers, the state historic preservation officers of Florida and Virgin Islands, and the Advisory Council on Historic Preservation, as provided for in the implementing regulations (36 CFR 800) for Section 106 of the *National Historic Preservation Act*. This agreement would outline specific measures to ensure the identification, evaluation, and protection of National Register-eligible properties that would potentially be affected by future exotic plant treatment and restoration activities.

Section 106 Description of Effects of Alternative A on Historic Structures, Buildings, and Districts. Both exotic and native plants damage historic

structures by infiltrating and expanding cracks in mortar and other structural materials and by allowing moisture, rodents, and insects to enter building elements. Plant roots and limbs grow into, over, or below structural elements and displace them, opening up areas to moisture infiltration. Biological treatments would benefit historic structures by killing exotic plants that invade structures.

Because chemicals sprayed onto structural materials could cause staining, and because some exotic plants serve to support leaning walls, treatment methods and site conditions would be carefully evaluated before choosing a treatment method. Chemical treatments of plants near historic structures would help preserve the structure by minimizing root penetration and secondary damage from falling limbs and trunks.

Mechanical treatments such as hand-pulling seedlings would be done in a manner that does not displace mortar or open up cracks. Larger-scale mechanical treatments generally would not be used because they could cause vibrations that damage historic structures. Physical treatments such as fire, manipulation of water levels, and soil removal are not currently being used to treat exotic plants located in/near historic structures or districts.

Regular park maintenance manages exotic plants at Christiansted National Historic Site, and neither Buck Island Reef National Monument nor Salt River Bay National Historic Park and Ecological Preserve has any standing historic structures or districts that are currently being affected by the presence of exotic plants or their treatments.

The most significant of Virgin Islands National Park's 380 historic structures (most are within 11 historic districts) have been cleared of vegetation and stabilized against deterioration. However, most of the rest are infested by vegetation, including exotic plants. Treatment programs have been unable to keep pace with plant growth, resulting in adverse effects for some structures.

The numbers and types of historic structures in the south Florida parks vary, as do the impacts of exotic plants and plant management actions on these resources. None of the three National Register-eligible structures in Big Cypress National Preserve appear to be affected by current exotic plant management actions. Exotic plants in Everglades National Park threaten the integrity of the park's 54 structures, including prehistoric mounds, homesteads and farming ventures, berms on the Missile Base, and features from the Old Ingraham Highway, so chemical and mechanical treatments would be beneficial.

At Biscayne National Park, EPMT treatment of exotic plants near structures within the Boca Chita Key Historic District is closely coordinated with the park's cultural staff, and Section 106 compliance is completed prior to treatment. At Canaveral National Seashore, the Eldora Historic District and Seminole Rest historic structures and the Old Haulover Canal benefit from exotic plant treatment. Dry Tortugas National Park is currently consulting with the Florida State Historic Preservation Office regarding how exotic plants are managed around historic structures. It is likely that treatment solutions would be developed so that treatments would benefit the historic structures at Dry Tortugas.

Passive restoration, where it might occur under a 3-year interval of re-treatment, would have little effect on historic structures.

Generally, implementation of alternative A would have minor effects on historic structures (no adverse effect) or would benefit historic structures and districts, a no adverse effect. However, in areas such as the Virgin Islands where treatment programs cannot keep up with exotic plant growth, the buildings would be adversely affected, and further Section 106 compliance would be necessary.

ALTERNATIVE B — NEW FRAMEWORK FOR EXOTIC PLANT MANAGEMENT: INCREASED PLANNING, MONITORING, AND MITIGATION

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

The national parks in south Florida and the Caribbean would continue to manage exotic plants using physical, chemical, mechanical, and biological treatment and re-treatment methods as described in alternative A. However, implementation of alternative B would include use of structured decision tools, monitoring, and best management practices that would help ensure that cultural resources within project areas are identified and evaluated, and that effects on these resources are effectively addressed and resolved before treatment begins.

Historic Structures, Buildings, and Districts

Removal of invasive exotic plants from historic structures is integral to resource preservation, and the choice of removal methods is crucial. Under alternative B, advance planning to determine appropriate treatments and to coordinate efforts of EPMT and park cultural staff would help ensure that cultural resources are considered during treatment of exotic plants in and near historic structures and districts. Feedback obtained from monitoring would encourage changes in treatments where needed. Exotic plant monitoring records for removal activities in historic sites could be coordinated with building conditions in the park's List of Classified Structures. This would facilitate better planning for resource protection and allow NPS staff to prioritize structural preservation and protection opportunities.

Because of its present limited effectiveness, biological treatment methods would have negligible impacts on historic structures in Florida. Chemical and mechanical treatments would not have an effect on any of the historic structures in the Caribbean parks except at Virgin Islands National Park, where implementation of alternative B would have moderate to major benefits by helping to reduce vegetation that infests historic structures. Consultation with state/territory cultural resource and NPS regional staff would be initiated to ensure that chemical treatments do not stain structures or damage structural materials.

Exotic plants have overrun some of the historic structures in Everglades National Park, and their removal using chemical and mechanical treatments would have a

moderate beneficial impact by reducing the threat of invasive roots and fallen branches. Treatment of exotic plants in the other south Florida parks would continue (as in alternative A) to have moderate long-term benefits for the same reasons. As in alternative A, use of physical treatments is inappropriate in historic structures and would not be an expected treatment method under alternative B.

Generally, passive restoration of native species in the vicinity of structures would help to slow erosion, helping to protect structures—a long-term minor benefit.

Cumulative Impacts

In the past, historic structures in the south Florida and Caribbean parks have undergone numerous impacts, ranging from hurricanes to invasion by plants. These cumulative impacts contribute to the gradual deterioration of structural materials and elements, and over time, historic districts have seen a reduction in the number of standing structures. Many of these past effects cannot be undone, and structures and districts remain vulnerable to future threats, a moderate adverse cumulative impact. However, especially in the Caribbean parks, carefully planned removal of invasive exotic plants and future monitoring would help slow structural weakening and deterioration, helping to extend the life of these structures—a long-term, minor benefit. However, the cumulative contribution of this alternative would not substantially alter the existing moderate adverse cumulative impact.

Conclusion

With implementation of alternative B, preservation of structures and historic district resources would be enhanced. Short-term adverse direct impacts from treatments would be negligible to minor in intensity and would be outweighed by long-term major benefits of removing exotic plants from historic structures.

In Florida parks, cumulative impacts would be moderate adverse; in Caribbean parks, cumulative impacts would be moderate adverse. There would be no impairment of historic structures, buildings, or districts in any of the nine parks as a result of exotic plant management activities.

Section 106 Description of Effects of Alternative B on Historic Structures, Buildings, and Districts. As described above for archeological resources, implementation of alternative B would benefit historic structures by providing for the best possible treatment choices, setting priorities for treatments, and providing data for future resource management. Passive restoration, where it might occur under a 3-year interval of re-treatment, would have little effect on historic structures. Improved management of exotic plants under alternative B would provide for future protection and preservation of historic structures, especially those in the Virgin Islands and Everglades national parks, a finding of no adverse effect.

ALTERNATIVE C — NEW FRAMEWORK FOR EXOTIC PLANT MANAGEMENT: INCREASED PLANNING, MONITORING, AND MITIGATION, WITH AN EMPHASIS ON ACTIVE RESTORATION OF NATIVE PLANTS

Historic Structures, Buildings, and Districts

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Implementation of alternative C would have the same impacts on historic structures**,** buildings, and districts as alternative B. Assuming that appropriate choices are made for restoration of native plants in proximity to historic structures, there would be no additional impact on structures above that described for alternative B. Advance planning would help ensure the appropriate types of native plants are used for restoration to discourage plants from moving into and damaging structures. Mitigation measures would be developed as needed to ensure protection of structures.

Under alternative C, preservation of structures, buildings, and historic district resources would be enhanced, and long-term adverse impacts would be minor.

Cumulative Impacts

Cumulative effects of alternative C would be the same as described in alternative B.

Conclusion

With mitigation, long-term adverse impacts of exotic plant management on historic structures, buildings, and districts would be minor.

Cumulative impacts would be the same as alternative B. There would be no impairment of historic structures, buildings, or districts in any of the nine parks as a result of exotic plant management activities under alternative C.

Section 106 Description of Effects of Alternative C on Historic Structures, Buildings, and Districts. Implementation of alternative C would have the same impacts on historic structures**,** buildings, and districts as alternative B. Assuming that appropriate choices are made for restoration of native plants in proximity to historic structures, there would be no additional impact on structures above that described for alternative B. Advance planning would help ensure the appropriate types of native plants are used for restoration to discourage plants from moving into and damaging structures. Mitigation measures would be developed as needed to ensure protection of structures.

Under alternative C, preservation of structures, buildings, and historic district resources would be enhanced, resulting in no adverse effects.

METHODOLOGY FOR ETHNOGRAPHIC RESOURCES

Impacts on historic structures and buildings were evaluated using the process described earlier in the section titled "Cultural Resource Evaluation Method." The term "ethnographic resources" has been used in this document to include both traditional cultural properties (which may be determined eligible for the National Register) and other resources valued by traditional peoples, such as plants used for religious or medicinal purposes. Impacts on ethnographic resources were evaluated using the process described earlier in the section titled "Cultural Resource Evaluation Method."

Definitions of intensity levels for ethnographic resources are as follows:

Negligible Impact — Impact(s) of the action would be barely perceptible and would neither alter resource conditions, such as traditional access or the presence of ethnographically valued plants, nor alter the relationship between the resource and the affiliated group's body of practices and beliefs. For purposes of Section 106, the determination would be no historic properties affected.

Minor Adverse Impact — Impact(s) of the action would be slight but noticeable but would neither appreciably alter resource conditions, such as traditional access or presence of ethnographically valued plants, nor alter the relationship between the resource and the affiliated group's body of practices and beliefs. For purposes of Section 106, the determination of effect would be no adverse effect.

Minor Beneficial Impact — Impacts of the action would accommodate a group's traditional beliefs and practices regarding ethnographically valued plants. For purposes of Section 106, the determination of effect would be no adverse effect.

Moderate Adverse Impact — Impacts of the action would be apparent and would alter resource conditions. Something would interfere with traditional access, site and resource preservation, or the relationship between the resource and the affiliated group's practices and beliefs, even though the group's practices and beliefs would survive. For purposes of Section 106, the determination of effect would be adverse effect.

Moderate Beneficial Impact — Impacts of the action would facilitate traditional access and resource preservation while accommodating a group's practices or beliefs. For purposes of Section 106, the determination of effect would be no adverse effect.

Major Adverse Impact — Impacts of the action would alter resource conditions. Something would block or greatly affect traditional access, site and resource preservation, or the relationship between the resource and the affiliated group's body of practices and beliefs, to the extent that the survival of some of a group's practices and/or beliefs would be jeopardized. For purposes of Section 106, the determination of effect would be adverse effect.

Major Beneficial Impact — Impacts of the action would actively encourage traditional access and preservation of resources, and/or accommodate a group's practices or beliefs. For purposes of Section 106, the determination of effect would be no adverse effect.

ALTERNATIVE A — NO ACTION: CONTINUE CURRENT MANAGEMENT

Ethnographic Resources

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Treating exotic plants, while avoiding traditionally valued plants, poses a real dilemma for park managers. The NPS has the responsibility to manage natural resources in a manner that would leave them unimpaired for the future. However, other concerns must be met as well. For example, legislation passed for Big Cypress National Preserve states that the Miccosukee and Seminole tribes would be permitted to "continue their usual and customary use and occupancy of Federal or federally acquired lands and waters within the preserve and the Addition" (Title 16 USC, Chapter 6, Section 698j). Legislation also provides for intergovernmental efforts among the National Park Service, the Miccosukee Tribe, and the Seminole Tribe of Florida to manage exotic plants in the Everglades (Public Law 105-313). Consistent with Executive Order 13007, the Park Service is (to the extent practicable) to avoid adversely affecting the physical integrity of ethnographic sites.

These are differing mandates. Traditional groups often view plants in the parks as a source of natural materials that may be used for a variety of purposes, including crafts, housing, medicine, food, and religious purposes. Plants that traditionally associated groups consider ethnographically valuable may be scattered across an entire park and may be adjacent to or within treatment areas. Some of the valued plants may be considered exotic plants by park. Tribes or traditional users may not care to reveal the names or locations of ethnographically valued resources to outsiders, so these areas and plants cannot be protected during treatment.

Some of the exotic plants designated for priority treatment in the Caribbean parks are also valued by traditional groups who use them for medicine, religious activities, crafts, fodder, fuel, or food. Exotic plants that are valued by West Indian peoples may be present at Salt River Bay National Historic Park and Ecological Preserve, Christiansted National Historic Site, and Buck Island Reef National Monument but are also readily available outside of these small parks.

Unfortunately, while exotic plants such as tan tan, mahoe, agave, aloe, guinea grass, and genip may be culturally valued, they may also have displaced other traditionally valued plants, and are considered priority species for control. Virgin Islands National Park has tried to reach a balance between eradicating the worst of the exotic plants while preserving important exotic plants such as traditionally used and valued plants. The park plans to evaluate trees in cultural landscapes and maintain those that have ethnographic value.

Exotic plants valued by West Indians are plentiful in several of the Caribbean parks, so treatment programs generally would have a negligible to minor adverse effect on these ethnographic resources. In addition, treatment of exotic plants would encourage regrowth of native plants, some of which also may be culturally valued. Impacts on ethnographically valued plants in the Caribbean parks would

be negligible to minor, long-term, direct and indirect, and both adverse and beneficial.

The Seminole and Miccosukee tribes, currently residing in south Florida (and some Seminoles in Oklahoma) have an interest in cultural sites in Everglades National Park, Canaveral National Seashore, and Big Cypress National Preserve. Many of the East Everglades tree islands that contain camps are considered by the Miccosukee Tribe to be cultural and/or sacred sites. No Native American groups have identified plants or sites at Dry Tortugas National Park as having importance to them. Two of the parks (Big Cypress National Preserve and Biscayne National Seashore) have had ethnohistory and ethnographic studies, respectively, to help define culturally valued plants. In Everglades National Park, consultation with tribes on a case-by-case basis helps NPS staff avoid ethnographic resources during exotic plant treatment activities.

Impacts of biological treatments would be negligible because biological methods would be used to treat specific plants that are plentiful in south Florida and which are not among the plants most valued by ethnographic groups. Some chemical treatments such as aerial spraying or soil applications may not only destroy exotic plants, but may inadvertently kill plants traditionally collected by tribes or West Indians, resulting in minor adverse impacts. Other types of chemical treatments (basal bark, cut surface, cut stump) are more selectively applied, and fewer adverse impacts would be expected (negligible to minor) in both the Florida and Caribbean parks.

Modest forms of mechanical treatment (such as hand pulling or hoeing) are used in all of the parks, and because of selective application, would be unlikely to affect large numbers of ethnographically valued plants. Use of bulldozers and other heavy equipment would be generally confined to previously disturbed areas that where exotic plants are concentrated, so this type of mechanical treatment would have a negligible impact on traditionally valued ethnographic resources. Also, exotic plants used by tribes are generally plentiful in parks and the surrounding areas.

Because of the nature of physical treatments, there would be more potential to adversely affect ethnographic resources, such as those that form the understory beneath taller exotic plants. Also, changes in an element of a system's ecology could reduce the number and types of traditionally valued plants available in a particular area, a minor adverse effect.

Elimination of the most invasive exotic species would give native plants an opportunity to regenerate and to spread back into former habitats. Under alternative A, the future gradual reduction of exotic plants could mean that some ethnographically valued native plants would increase in area and availability, a long-term, minor beneficial impact on ethnographic resources. However, until completion of appropriate studies and data gathering, viable information regarding the identity and location of ethnographically valued plants varies, and consultation regarding treatment of exotic plants, may or may not be consistent through time, so a range of adverse and beneficial effects on ethnographic resources (from negligible to moderate) would occur under alternative A. Further contributing to potential damage to ethnographic resources would be the lack of

systematic coordination between the Exotic Plant Management Team, traditionally associated peoples, and park resource staff prior to treatment choices and applications.

Cumulative Effects

During the 1700s and 1800s, dozens of plants and animals were introduced to Buck, St. Croix, and St. John islands. Many of these newcomers quickly became part of the culture of the islands' plantations, providing food, shelter, medicine, fuel, and fodder. As plantations were established, native trees were cut down, and fields planted to cane or other crops. Plants imported from Africa helped to maintain cultural continuity as traditional African cultures adapted to the New World.

Other exotic plants became ethnographic resources by their use. Trees that marked the locale of special occurrences became ethnographic resources, and flowering plants were valued for their beauty. Plants native to the islands also were valued, and in time, a mixture of ethnographically important plants – both exotic and native plants – became part of West Indian culture. Then, during the mid-1800s, plantations were abandoned, and fields reverted to weeds or small farms. Lacking natural enemies, the most assertive of the exotic plants began to encroach on and replace native plants, including those that were used traditionally. Over time, some traditional medicinal plants have been replaced by modern medicine, and cultural changes have made inroads into traditional societies.

A similar process occurred in south Florida as areas originally occupied by Native Americans were homesteaded by Euro-Americans, developed for farming and, in the past century, returned to a more natural state as part of one of Florida's national parks. Through time, these cumulative changes in ethnographic resources have been adverse and ranged from minor to major. Some changes in the assortment and availability of traditionally valued plants would be expected in the future as well. When the current treatment program for exotic plants is added to these past, present, and probable future cumulative changes in ethnographic resources, the resulting long-term impacts would be both moderately beneficial and somewhat adverse (negligible to minor), but would not substantively reduce or increase the overall moderate cumulative impact.

Conclusion

Under the no-action alternative, adverse impacts on ethnographically valued plants in the Caribbean parks would be minor, direct and indirect, and both adverse and beneficial from removal of traditionally used exotic plants while encouraging regrowth of ethnographically valued native plants.

Biological treatments in the Florida parks would have negligible effects because the specific exotic plants treated are plentiful and generally are not among plants most valued by tribes. Chemical treatments such as aerial spraying or soil applications could inadvertently kill ethnographically valued plants, resulting in minor adverse impacts. Negligible to minor adverse effects would occur from other types of more selectively applied chemical treatments in the Florida and

Caribbean parks (basal bark, cut surface, cut stump). Use of heavy equipment would generally be confined to previously disturbed areas with concentrations of exotic plants, so mechanical treatments would have a negligible impact on traditionally valued ethnographic resources. Physical treatments and subsequent changes in the system's ecology would have a long-term minor adverse effect on the number and types of traditionally valued plants available in a particular area.

Treatments would give native plants an opportunity to regenerate and to spread back into former habitats, a long-term minor benefit. However, lack of viable information regarding the identity and location of ethnographically valued plants and inconsistent consultation and communication would have a range of long-term, direct and indirect, adverse and beneficial effects on ethnographic resources (from negligible to moderate) under alternative A.

Cumulative impacts from treatment programs under alternative A would be both moderately beneficial and adverse (negligible to minor), but would not substantively reduce or increase the overall moderate cumulative impact of past, present, and future actions.

There would be no impairment of traditional cultural properties / ethnographic resources within the nine parks as a result of exotic plant management activities.

Section 106 Summary for Alternative A

Introduction. This draft EPMP/EIS has defined the area of potential effect as follows: in parks surrounded by large bodies of water (Buck Island Reef National Monument, Dry Tortugas National Park, and Christiansted National Historic Site), the area of potential effect is defined by the parks' boundaries. In other parks, such as Everglades National Park where boundaries may be less easily defined on the ground, effects of implementing management actions proposed in this draft EPMP/EIS could extend to areas immediately adjacent to park boundaries.

In the "Affected Environment" chapter of this draft EPMP/EIS, the current cultural resource conditions (including National Register of Historic Places properties and National Historic Landmarks) are described for each of the nine parks, and potential environmental impacts under NEPA that would result from implementation of any of the three alternatives were described earlier in the "Cultural Resources" section.

Definitions of intensity levels for cultural resources developed in the "Methodology and Assumptions" section (above) provide a basis for evaluating impacts of proposed actions on cultural resources under both NEPA and the NHPA. Mitigating measures were developed to help ensure the protection and preservation of cultural resources eligible for or listed in the National Register of Historic Places (refer to tables 5, 13, and 19 in the "Alternatives" chapter).

The Advisory Council on Historic Preservation, the state historic preservation officers in Florida and the Virgin Islands, and concerned tribes were contacted at the beginning of this process (see the "Consultation and Coordination" chapter). Traditional West Indian peoples also have been included as part of the scoping

and public involvement process for the EPMP/EIS. This draft EPMP/EIS has been sent to affiliated tribes and to interested traditional groups and individuals for review and comment. This document has also been sent to the Advisory Council on Historic Preservation and to the state historic preservation officers in Florida and the Virgin Islands for their review and comment. Comments will be taken into consideration in development of the final EPMP/EIS.

The NPS finds that implementation of proposed actions in this draft EPMP/EIS would have an effect on archeological resources, historic structures and districts, ethnographic resources, and cultural landscapes. These are described below in each alternative under the various cultural resource headings. While most of the effects on archeological resources and historic structures would not be adverse, effects of implementing any of the alternatives would adversely affect cultural landscapes and ethnographic resources, because parks currently lack definitive data on these resources. Historic structures at Virgin Islands National Park also would be adversely affected because current management of exotic plants would be unable to keep up with rampant plant growth. Until implementation of one of the alternatives for management of exotic plants, parks would continue to complete Section 106 compliance on a case-by-case basis.

Once the NPS makes its decision as to which alternative presented in this draft EPMP/EIS would be implemented, a programmatic memorandum of agreement would be developed among the parks, and others as appropriate, including tribal historic preservation officers, the state historic preservation officers of Florida and Virgin Islands, and the Advisory Council on Historic Preservation, as provided for in the implementing regulations (36 CFR 800) for Section 106 of the *National Historic Preservation Act*. This agreement would outline specific measures to ensure the identification, evaluation, and protection of National Register-eligible properties that would potentially be affected by future exotic plant treatment and restoration activities.

Section 106 Description of Effects of Alternative A on Ethnographic Resources. The Seminole and Miccosukee tribes in south Florida and some Oklahoma Seminoles have an interest in sites in Everglades National Park, Canaveral National Seashore, and Big Cypress National Preserve, including the east Everglades tree islands. No Native American groups have identified plants or sites at Dry Tortugas National Park as having importance to them. West Indian peoples have expressed an interest in resources in the Caribbean parks.

Plants that traditionally associated groups consider ethnographically valuable may be scattered across an entire park and may be adjacent to or within treatment areas. Of the parks discussed in this draft EPMP/EIS, Big Cypress has developed an ethnohistory that would help define culturally valued plants and their general locations. An ethnographic overview and assessment recently completed for Biscayne National Seashore also would enable the park to help protect ethnographic resources during treatment of exotic plants. In Everglades National Park, consultation with tribes on a case-by-case basis helps NPS staff avoid ethnographic resources during exotic plant treatment activities. Consultation also occurs in the other Florida and Caribbean parks as well, but it is difficult to protect valued plants during treatment of exotic plants because tribes or traditional users may not care to reveal the names or locations of

ethnographically valued resources to outsiders. Virgin Islands National Park has attempted to reach a balance between eradicating the worst of the exotic plants while preserving important traditionally used and valued plants.

Use of biological treatments would have a beneficial effect because biological methods would be used to treat specific plants that are plentiful and which, generally, are not among the plants most valued by ethnographic groups.

Aerial or ground applications that target large stands of exotic plants could inadvertently damage culturally valued plants that grow in the same or adjacent areas. However, these stands are largely monotypic, and by removing the exotic plants, native plant populations might be able to recover. More selective types of chemical treatments (basal bark, cut surface, cut stump) would target specific exotic plants and would, generally, have little effect on culturally valued plants.

Mechanical treatments, including hand pulling or hoeing, are used in all of the parks, and because of selective application, would be unlikely to affect large numbers of ethnographically valued plants where they have been identified. Use of bulldozers and other heavy equipment would generally be confined to previously disturbed areas with few native plants, so this type of mechanical treatment would have little effect on traditionally valued ethnographic resources.

Exotic plants used by tribes are generally plentiful in parks and the surrounding areas. Exotic plants that are valued by West Indian peoples may be present at Salt River Bay National Historic Park and Ecological Preserve, Christiansted National Historic Site, and Buck Island Reef National Monument but are also readily available outside of these small parks, so current management of exotic plants at these three parks would have neither adverse nor beneficial effects on ethnographic resources.

Under alternative A, elimination of some of the parks' exotic plants would be beneficial by encouraging increases in the number and areas of some traditionally valued plants.

Use of physical or other treatments that could impact traditionally valued plants, coupled with lack of data and/or inconsistent coordination of treatment programs with information from ethnographic studies or with data gained from consultation, would contribute to declines in other ethnographic resources.

> Continuation of existing conditions would have both beneficial effects (no adverse effect) and adverse effects requiring further Section 106 consultation. Until such time as ethnographic studies can be completed for parks with traditionally associated peoples, Section 106 compliance would be done on a case-by-case basis. A future programmatic agreement would be developed among the parks, the Florida and Virgin Islands historic preservation officers, tribal historic preservation officers, and the Advisory Council on Historic Preservation. The agreement would take into account the concerns expressed by tribes and traditional West Indian groups; reiterate the alternative treatment methods included in this DEIS; establish communication and notification protocols for tribes and park staff; develop mutually acceptable provisions for identification and protection of valued

ethnographic sites before, during and after exotic plant treatments; work out cooperative measures to reduce re-introduction of exotic species from areas outside the park; and seek to reach a balance between preservation of ethnographic resources and the urgent need to eliminate exotic plant species.

ALTERNATIVE B — NEW FRAMEWORK FOR EXOTIC PLANT MANAGEMENT: INCREASED PLANNING, MONITORING, AND MITIGATION

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

The national parks in south Florida and the Caribbean would continue to manage exotic plants using physical, chemical, mechanical, and biological treatment and re-treatment methods as described in alternative A. However, implementation of alternative B would include use of structured decision tools, monitoring, and best management practices that would help ensure that cultural resources within project areas are identified and evaluated, and that effects on these resources are effectively addressed and resolved before treatment begins.

Ethnographic Resources

Alternative B would be similar to alternative A in that parks could inadvertently eradicate plants of ethnographic value or mistakenly preserve exotic plants of dubious worth because important decisions about ethnographic resources would, too often, be made on a case-by-case basis and would generally lack supporting documentation.

Implementation of alternative B would result in a range of beneficial and adverse effects on ethnographic resources, depending upon whether ethnographic resources could be accurately identified and protected during removal of exotic plants. Advance planning under alternative B, development of future ethnographic studies, coordination of identification and protection efforts between the EPMT and park cultural staff, and continuing consultation with Native Americans would help to reduce potential impacts on ethnographic resources.

To date, only Big Cypress National Preserve and Biscayne National Park have had studies of their ethnographic resources and concerns that could provide them with assistance in determining which exotic plants should be preserved for tribal use and which ones should be treated. Use of the information from these studies and from continuing consultation would help ensure that long-term adverse impacts on ethnographic resources from biological, chemical, mechanical, and physical treatments at Big Cypress National Preserve and Biscayne National Parks would be minor.

Until such time as ethnographic studies are completed to help document plants of ethnographic value, there would be adverse effects on ethnographic resources at Everglades National Park from chemical, mechanical, and physical treatments.

Treatments for special areas such as the East Everglades tree islands would be specially tailored to preserve and protect valued species so that impacts are minimized. Although continuing consultation with Native American groups would help reduce impacts on ethnographically valued resources, direct and indirect adverse impacts ranging from minor to moderate in intensity would be likely to occur. (Most impacts would be minor while moderate adverse impacts would tend to be localized, and infrequent.)

Native Americans have been associated with lands in Canaveral National Seashore, but negligible impacts on ethnographic resources would be expected in this park. There would be no impacts on ethnographic resources in other Florida parks such as Biscayne and Dry Tortugas National Parks.

Plants of known ethnographic concern at Salt River Bay National Historic Park and Ecological Preserve and Buck Island Reef National Monument are available in other areas on the islands, so treatment in these two parks would have a negligible effect on ethnographic resources. Treatment of exotic plants on in Virgin Islands National Park on St. John would reduce the number of selected species such as tan tan and lime berry, but the treatment regimes would be tailored to specific areas, helping to preserve other species that are traditionally used. This would result in both adverse (minor) and beneficial (minor) impacts on ethnographic resources.

Potential impacts from restoration would be minor and both beneficial and adverse.

Cumulative Impacts

Cumulative impacts for alternative B would be the same as for alternative A.

Conclusion

Implementation of alternative B would result in a range (from negligible to moderate) of adverse effects on ethnographic resources, depending on whether ethnographic resources could be accurately identified and protected during removal of exotic plants. Programs outlined under alternative B, along with continuing consultation until completion of ethnographic studies would help reduce potential impacts.

Cumulative impacts would be the same as alternative A. There would be no impairment of ethnographic resources in any of the nine parks as a result of exotic plant management activities under alternative B.

Section 106 Description of Effects of Alternative B on Ethnographic Resources. Implementation of the provisions of alternative B described under "Archeological Resources" above would benefit ethnographic resources as well. Priority setting, standardization of treatments, and better communication and coordination among park staff and EPMT crews would help reduce possible impacts on plants valued by culturally affiliated groups in all parks. Of the nine parks discussed in this DEIS, only Big Cypress National Preserve and Biscayne

National Park have developed ethnographic studies that would help define culturally valued plants and their general locations. No impacts on ethnographic resources would be expected for Canaveral National Seashore, Dry Tortugas, and Biscayne National Parks. Plants at Salt River Bay National Historic Park and Ecological Preserve, Virgin Islands National Park, and Buck Island Reef National Monument could be affected, but this effect would not be adverse. Even with the additional measures for the protection of cultural resources outlined above, ethnographic resources at Everglades National Park still could be affected adversely (adverse effect) under alternative B, because data on ethnographic resources are lacking, and unknown resources cannot be easily protected. Under alternative B, better coordination and planning would help parks identify resources in treatment areas so that resource protective measures could be implemented.

Until such time as ethnographic studies can be completed for parks with traditionally associated peoples, a programmatic agreement would be developed among the nine parks, the Florida and Virgin Islands historic preservation officers, tribal historic preservation officers, and the Advisory Council on Historic Preservation. The agreement would take into account the concerns expressed by tribes and traditional West Indian groups; reiterate the alternative treatment methods included in this DEIS; establish communication and notification protocols for tribes and park staff; develop mutually acceptable provisions for identification and protection of valued ethnographic sites before, during and after exotic plant treatments; work out cooperative measures to reduce re-introduction of exotic species from areas outside the park; work towards integration of native plants that are culturally valued into the restoration process; and seek to reach a balance between preservation of ethnographic resources and the urgent need to eliminate exotic plant species.

ALTERNATIVE C — NEW FRAMEWORK FOR EXOTIC PLANT MANAGEMENT: INCREASED PLANNING, MONITORING, AND MITIGATION, WITH AN EMPHASIS ON ACTIVE RESTORATION OF NATIVE PLANTS

Ethnographic Resources

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

As in alternatives A and B, implementation of alternative C would result in a range of adverse effects on ethnographic resources, from minor to moderate, depending on whether ethnographic resources could be identified and protected during actions to remove exotic plants and restore native plants. There would be a slight benefit to ethnographic resources because restoration activities could encourage the presence and health of native plants valued by tribes and West Indian residents.

Cumulative Impacts

Cumulative impacts for alternative C would be much the same as for alternative A; that is, when the current treatment program for exotic plants is

added to these past minor to major cumulative changes in ethnographic resources, the resulting long-term impacts are both moderately beneficial and somewhat adverse (negligible to minor), but would not substantively reduce or increase the overall cumulative impact.

Conclusion

Long-range adverse effects on ethnographic resources from exotic plant management would range from minor to moderate, depending on whether ethnographic resources can be identified and protected during removal of exotic plants and restoration of native plants.

Cumulative impacts would be the same as alternative A. There would be no impairment of ethnographic resources in any of the nine parks as a result of exotic plant management activities under alternative C.

Section 106 Description of Effects of Alternative C on Ethnographic Resources. Effects of implementation of alternative C would be the same as in alternative B, except there could be a slight benefit to ethnographic resources (no adverse effect) if active restoration activities would encourage the presence and health of native plants valued by tribes and West Indian residents. There would be no ethnographic resources affected at Biscayne and Dry Tortugas national parks. Generally there would be no adverse effect on ethnographic resources for Big Cypress National Preserve, Canaveral National Seashore, Salt River Bay National Historic Park and Ecological Preserve, Canaveral National Seashore, Buck Island Reef National Monument, and Virgin Islands National Park.

However, other actions under alternative C would result in possible adverse effects on ethnographic resources in areas such as Everglades National Park because of the lack of ethnographic information needed to identify the types of plants used, who uses them, their rarity, where they are found, the frequency of use, etc. Lacking this information, it is unclear whether ethnographically valued plants could be adequately identified and protected during an exotic plant eradication activity, although under alternative C, better planning and coordination would help parks identify resources in treatment areas so that resource protective measures could be implemented. For these reasons, a programmatic agreement for ethnographic resources (as described in alternative B) would be used to complete the Section 106 compliance process under alternative C.

METHODOLOGY FOR CULTURAL LANDSCAPES

Cultural landscapes represent a complex subset of cultural resources resulting from the interaction between people and the land. Cultural landscapes reflect the influence of human beliefs and actions over time on the natural landscape. Cultural landscapes are shaped through time by historical land use and management practices, politics, property laws, levels of technology, and economic conditions. Cultural landscapes are a living record of an area's past, providing a visual chronicle of its history.

Historic cultural landscapes may be expressed in a variety of ways, such as patterns of settlement or land use, systems of circulation and transportation, buildings and structures, and parks and open space. A cultural landscape by definition occupies a geographic area that incorporates natural and cultural elements that are associated with a historic activity, event, or person. Cultural landscapes vary widely across the nine parks covered in this draft EPMP/EIS, and represent the four categories recognized by the NPS:

historic designed landscapes (incorporates a deliberate human element to the modification and use of a particular piece of land)

historic vernacular landscapes (reflects on values and attitudes about land over time)

historic sites (sites significant for their association with important events, activities, and people)

ethnographic landscapes (landscapes associated with contemporary groups that use the land in a traditional manner)

Impacts on cultural landscapes were evaluated using the process described earlier in the section titled "Cultural Resource Evaluation Method."

Definitions of intensity levels for cultural landscapes are as follows:

Negligible Impact — Impacts of the action would be barely perceptible and would not affect cultural landscape resource conditions either beneficially or adversely. For purposes of Section 106, the determination would be no historic properties affected.

Minor Adverse Impact — Impacts of the action would alter a pattern, feature, or vegetation in the cultural landscape but would not diminish the overall integrity of the landscape. For purposes of Section 106, the determination of effect would be *no adverse effect.*

Minor Beneficial Impact — Impacts of the action would help maintain existing landscape patterns and features in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes*. For purposes of Section 106, the determination of effect would be no adverse effect.

Moderate Adverse Impact — Impacts of the action would alter a pattern(s) or character-defining feature(s) of the cultural landscape. Although the landscape would still be eligible for the National Register, its overall integrity would be diminished. For purposes of Section 106, the determination of effect would be adverse effect.

Moderate Beneficial Impact — Impacts of the action would enhance the cultural landscape in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the*

Treatment of Cultural Landscapes. For purposes of Section 106, the determination of effect would be no adverse effect.

Major Adverse Impact — Impacts of the action would alter patterns or features of the cultural landscape, seriously diminishing the overall integrity of the resource to the point where its National Register eligibility may be in question. For purposes of Section 106, the determination of effect would be adverse effect.

Major Beneficial Impact — Impacts of the action would actively improve the landscape in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes*. For purposes of Section 106, the determination of effect would be no adverse effect.

ALTERNATIVE A — NO ACTION: CONTINUE CURRENT MANAGEMENT

Cultural Landscapes

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Many exotic plants were originally introduced to Florida and the Caribbean islands by early settlers who used them for food, fodder, or landscaping. In Virgin Islands National Park, some plants now considered exotic plants may have been introduced to this area as much as 1,000 years ago. In some areas, exotic species may have been planted as part of a larger cultural landscape, such as a plantation. Exotic plants such as genip and tan tan formed a vital part of the cultural landscape in colonial times, but their dramatic proliferation has drastically changed the composition of the present-day cultural landscapes, especially in former plantations and prehistoric sites.

Some of these plants may be valuable in their own right as heirloom species. On the other hand, native plants that were part of a prehistoric or historic cultural landscape may have been crowded out by exotic plants.

Under alternative A, the infrequency of treatments and the inability of parks to treat exotic plants under an optimal treatment schedule due to lack of resources and funding would allow continued spread of exotic plants, resulting in impacts on cultural landscapes. None of the parks have had formal cultural landscape studies to identify character-defining elements of their landscapes. Potential landscapes have been tentatively identified for the Florida parks and provide some indications of which exotic plants should be retained. However, the present exotic plant management program is focused on removing priority species as defined by natural resource specialists and does not deal with restoration or maintenance of the islands' cultural and historic landscapes.

This lack of information and program focus leads to inconsistencies in treatment regimes. In areas where cultural landscapes have not yet been formally

inventoried and evaluated, elimination of exotic plants could negatively impact the landscape by removing vital character-defining elements that might help qualify the landscape for the National Register, effectively diminishing the significance of that landscape.

For example, some of the exotic plants at Annaberg, Virgin Islands, were imported for food or medicinal uses. The presence and location of some of these plants within the ruins at Annaberg help illustrate the organization of this early settlement and the way the plants were used, so a few exotic trees and shrubs have been preserved for shade and as part of the demonstration garden. Virgin Islands National Park plans to preserve other representative exotic plants in a cultural landscape setting or in the park in recognition of their cultural importance. Tamarind trees dating to the 1700s are being retained as part of the landscape at Buck Island Reef National Monument, but another historic exotic plant at Buck Island, Bromelia penguin, has been part of the current exotic plant removal program.

During historic times, homesteads and small farms in south Florida introduced numerous species of ornamental and fruiting plants. However, because these introduced plants have few natural enemies and a climate well suited to their growing habits, and because they tend to multiply and spread rapidly, they have crowded out other species, changing the proportions and types of exotic and native species in landscapes.

Big Cypress National Preserve has been tentatively identified as a cultural landscape, with several component landscapes. The continued proliferation of plants such as melaleuca, Brazilian pepper, and Australian pine has reduced the variety and numbers of other plants along the Tamiami Trail, in effect replacing many of the hardwood hammocks, tropical flowers, and sawgrass with large stands of exotic plants. Continuing eradication efforts have helped to restore some of the early landscape, a minor benefit, but nonselective treatments and uneven monitoring would continue to have minor long-term adverse effects on the landscape from chemical and mechanical treatment regimes.

All of Biscayne National Park has been tentatively identified as a cultural landscape, and component landscapes are associated with developments at Boca Chita, as well as with homesteads within the park. As in the other parks that are part of this draft EPMP/EIS, problem species have invaded some of Biscayne National Park's landscapes to the determent of the original vegetation that helps to define the area's history. However, treatment has been selective, focusing on plants that are currently defined as not character defining in the landscape. Past treatment efforts have been relatively effective, and in the near future the park expects that all of the park's infested acres would have been treated for initial control. Impacts of alternative A on the cultural landscape in Biscayne National Park would be long term, beneficial, and moderate.

Cultural landscapes tentatively identified at Canaveral National Seashore include the Eldora Historic District, Haulover Canal, Indian River Citrus District, and Seminole Rest. Each of these landscapes has its own distinctive landscape features and plants, and past treatments have been coordinated with landscape concerns. Canaveral National Seashore is considering formally designating

certain exotic plants for protection (primarily century plant and citrus) that are important for interpretation of the House of Refuge, Eldora, and Seminole Rest. However, only about 60% of the park's exotic plants have received initial treatment. Under existing conditions, minor adverse impacts would continue to occur to some of Canaveral National Seashore's landscapes while, at the same time, other landscapes would have moderate benefits.

The cultural landscape tentatively defined at Dry Tortugas National Park includes the historic fort and its setting; exotic plants are a component part of this landscape. Other parts of the park such as Loggerhead Key also may contain cultural landscapes. Exotic plants have changed the composition of the park's vegetation that now requires treatment.

Areas at Everglades National Park tentatively identified as cultural landscapes include the Nike Missile Site, the Old Ingraham Highway, and other areas that may include sites related to the state park era, canals, and roads. Mounds and areas at Pine Island, Flamingo Developed Area, Nike Missile Site, and Shark Valley also may be cultural landscapes. Exotic plants have invaded a great deal of Everglades National Park, replacing both historically planted exotic plants and native plants that formed part of these landscapes.

The lack of cultural landscape studies and systematic coordination among EPMT crews and park resource staff could result in future minor to moderate adverse impacts under alternative A because treatments would continue to focus on removal of priority exotic species, and definition and protection of some character-defining species contained in cultural landscapes would be lacking.

Cumulative Impacts

Over the past three centuries, logging, farming, grazing, modern developments, and introduction of exotic plant and animal species have each contributed to incremental changes in the vegetation and built environment of the Caribbean and south Florida parks. Because cultural landscapes are dynamic, change occurs, and as with other cultural resources, many of these changes have been incremental and sometimes irreversible. At first, exotic plants were an integral part of these landscapes, but in many instances, the exotic plants have overwhelmed the character-defining features of the landscape, changing both the appearance and composition of both the landscape and of the surrounding areas.

Exotic plants and cultural landscapes pose special problems in parks. Exotic plants may be character-defining elements of a historic landscape that are vital to its significance and integrity. Removal of these exotic plants diminishes the integrity of the cultural landscape. On the other hand, exotic plants may crowd out other plants that also are important elements of historic landscapes. Also, exotic plants displace native species that provide critical habitat for threatened or endangered wildlife and plant species or that are identified as vital to the park's purpose and significance

Exotic plants in cultural landscapes have received minimal identification and consideration in the past, resulting in a wide range of treatments and corresponding impacts, from beneficial to adverse and from minor to major.

Other projects that cumulatively impact cultural landscapes include eradication of rats and pigs in Caribbean parks and continuing development and numerous changes in land use in areas within and surrounding the south Florida parks, as described for archeological resources and historic structures. Development of Cultural Landscape Plans such as the one proposed for development at Dry Tortugas National Park in the near future would identify those exotic plants that are a component part of the landscape and with coordination with resource managers performing exotic plant management actions would result in the preservation of these important landscape. The benefit to cultural landscapes from development of these plans would be beneficial, moderate, and long term. Past, present, and probable future changes in cultural landscapes in and around the parks all contribute to moderate, adverse cumulative impacts. Implementation of the no-action alternative would effect very little, if any, change in this level of impact.

Conclusion

Under alternative A, elimination of exotic plants in un-inventoried, unevaluated landscapes and inconsistent approaches to preservation would negatively impact the landscape by removing vital character-defining elements. Uncoordinated preservation efforts would continue to have negligible to moderate beneficial effects. The lack of cultural landscape studies and systematic coordination among exotic plant crews and park resource staff would result in future minor to moderate adverse impacts under alternative A.

Cumulative impacts would be moderate adverse. There would be no impairment of cultural landscapes within any of the nine parks as a result of exotic plant management activities.

Section 106 Summary for Alternative A

This draft EPMP/EIS has defined the area of potential effect as follows: in parks surrounded by large bodies of water (Buck Island Reef National Monument, Dry Tortugas National Park, and Christiansted National Historic Site), the area of potential effect is defined by the parks' boundaries. In other parks, such as Everglades National Park where boundaries may be less easily defined on the ground, effects of implementing management actions proposed in this draft EPMP/EIS could extend to areas immediately adjacent to park boundaries.

In the "Affected Environment" chapter of this draft EPMP/EIS, the current cultural resource conditions (including National Register of Historic Places properties and National Historic Landmarks) are described for each of the nine parks, and potential environmental impacts under NEPA that would result from implementation of any of the three alternatives were described earlier in the "Cultural Resources" section.

Definitions of intensity levels for cultural resources developed in the "Methodology and Assumptions" section (above) provide a basis for evaluating impacts of proposed actions on cultural resources under both NEPA and the NHPA. Mitigating measures were developed to help ensure the protection and

preservation of cultural resources eligible for or listed in the National Register of Historic Places (refer to tables 5, 13, and 19 in the "Alternatives" chapter).

The Advisory Council on Historic Preservation, the state historic preservation officers in Florida and the Virgin Islands, and concerned tribes were contacted at the beginning of this process (see the "Consultation and Coordination" chapter). Traditional West Indian peoples also have been included as part of the scoping and public involvement process for the EPMP/EIS. This draft EPMP/EIS has been sent to affiliated tribes and to interested traditional groups and individuals for review and comment. This document has also been sent to the Advisory Council on Historic Preservation and to the state historic preservation officers in Florida and the Virgin Islands for their review and comment. Comments will be taken into consideration in development of the final EPMP/EIS.

The NPS finds that implementation of proposed actions in this draft EPMP/EIS would have an effect on archeological resources, historic structures and districts, ethnographic resources, and cultural landscapes. These are described below in each alternative under the various cultural resource headings. While most of the effects on archeological resources and historic structures would not be adverse, effects of implementing any of the alternatives would adversely affect cultural landscapes and ethnographic resources, because parks currently lack definitive data on these resources. Historic structures at Virgin Islands National Park also would be adversely affected because current management of exotic plants would be unable to keep up with rampant plant growth. Until implementation of one of the alternatives for management of exotic plants, parks would continue to complete Section 106 compliance on a case-by-case basis.

Once the NPS makes its decision as to which alternative presented in this draft EPMP/EIS would be implemented, a programmatic memorandum of agreement would be developed among the parks, and others as appropriate, including tribal historic preservation officers, the state historic preservation officers of Florida and Virgin Islands, and the Advisory Council on Historic Preservation, as provided for in the implementing regulations (36 CFR 800) for Section 106 of the *National Historic Preservation Act*. This agreement would outline specific measures to ensure the identification, evaluation, and protection of National Register-eligible properties that would potentially be affected by future exotic plant treatment and restoration activities.

Section 106 Description of Effects of Alternative A on Cultural Landscapes. In both the Florida and Caribbean parks, exotic plants were once an important part of the cultural landscape in pioneer or colonial times, but these and other exotic plants have now overrun and changed the composition of the present-day cultural landscapes. Tentative identifications of potential cultural landscapes have been made for the south Florida parks, but formal cultural landscape studies are lacking for all of the parks except Dry Tortugas where a study is currently underway. This means that, under alternative A, the exotic plant management program would continue to be focused on removing priority species without specific consideration for restoration or maintenance of the parks' cultural landscapes.

All infested areas at Dry Tortugas National Park have had initial treatment, so under alternative A, continued treatment would not have adverse impacts on the cultural landscape(s). Big Cypress National Preserve has been tentatively identified as a cultural landscape with several component landscapes. All of Biscayne National Park has been tentatively identified as a cultural landscape, and component landscapes are associated with developments at Boca Chita, as well as with homesteads within the park. Problem species have invaded some of Biscayne National Park's landscapes, but selective treatment has focused on plants that are not currently identified as character defining and most of the park's infested acres would be treated in the near future.

Cultural landscapes tentatively identified at Canaveral National Seashore include the Eldora Historic District, Haulover Canal, Indian River Citrus District, and Seminole Rest. The seashore is considering formally designating certain exotic plants for protection (primarily century plant and citrus) that are important for interpretation of the House of Refuge, Eldora, and Seminole Rest. Each of these landscapes has its own distinctive landscape features and plants, and past treatments have been coordinated with landscape concerns. A little less than two-thirds of the park's exotic plants have had initial treatment.

Tentative cultural landscapes at Everglades National Park include the Nike Missile Site, the Old Ingraham Highway, and other areas that may include sites related to the state park era, canals, and roads. Mounds and areas at Pine Island, Flamingo Developed Area, Nike Missile Site, and Shark Valley also may be cultural landscapes. Exotic plants have invaded a great deal of Everglades National Park. Because of the magnitude of the infestation problems, past treatments have had to focus more on removal of priority species than on definition and protection of character-defining species contained in cultural landscapes.

The present exotic plant management program is focused on removing priority species as defined by natural resource specialists and does not deal with restoration or maintenance of the islands' cultural and historic landscapes. Until cultural landscape studies are completed, a continuation of existing conditions would have both adverse and no adverse effects on the parks' cultural landscapes. The range of impacts would be dependent upon the treatment method, potential or defined landscape, and the location of the treatment area. Treatment of exotic plants in areas where cultural landscapes have not yet been formally identified could remove vital character-defining elements that might help qualify the landscape for the National Register, effectively diminishing the significance of that landscape.

Until cultural landscape studies could be developed for the Florida and Caribbean parks, Section 106 compliance would be completed on a case-by-case basis. A future programmatic agreement (similar to the one discussed above under "Ethnographic Resources") would be developed among the parks, the Florida and Virgin Islands historic preservation officers, and the Advisory Council on Historic Preservation to outline ways to deal with the question of exotic plants in potential cultural landscapes. The agreement would set out ways to identify general categories of plants that could contribute to the various cultural landscapes, present suggestions for their management over the short-term (until

landscape inventories and evaluations are completed), and discuss cooperative ways the parks, concerned traditional groups, and the EPMT crews could work together to best control exotic species while protecting important landscape elements.

ALTERNATIVE B — NEW FRAMEWORK FOR EXOTIC PLANT MANAGEMENT: INCREASED PLANNING, MONITORING, AND MITIGATION

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

The national parks in south Florida and the Caribbean would continue to manage exotic plants using physical, chemical, mechanical, and biological treatment and re-treatment methods as described in alternative A. However, implementation of alternative B would include use of structured decision tools, monitoring, and best management practices that would help ensure that cultural resources within project areas are identified and evaluated, and that effects on these resources are effectively addressed and resolved before treatment begins.

Cultural Landscapes

Under alternative B, treatment methods and their impacts would be similar to alternative A. However, use of the various tools, provisions for advance planning and monitoring, and heightened exotic plant management staff / park resource staff interaction would allow better coordination between removal of exotic plants and preservation and protection of cultural landscapes.

Implementation of alternative B at Canaveral National Seashore and Everglades National Park would help control exotic plants that are, at present, untreated. Continuing treatments at Dry Tortugas National Park would moderately benefit the cultural landscape. Treatments of exotic plants in Biscayne National Park would continue to have long-term minor benefits.

However, virtually all of the decisions regarding which exotic plants to keep and which to remove from a landscape would continue to be made on a case-by-case basis under alternative B, without benefit of an inventory and analysis. Cultural landscape inventories and landscape plans are badly needed to help reduce potential adverse impacts by defining those exotic plants that are character defining within the landscape. Once identified, these plants could be properly managed and appropriate treatment plans chosen to protect plants that contribute to the significance of the park's landscapes while removing those that are intruders.

Impacts of alternative B would be direct and indirect, short- and long-term, and range in intensity from minor (beneficial) to moderate (beneficial and adverse). Moderate adverse effects would result primarily from the lack of cultural landscape inventories and evaluations.

Cumulative Impacts

Over the past two or three centuries, changes in land use, development of roads, canals, and residential areas, and the continuing introduction of new exotic plant species has drastically changed the appearance of lands within the Caribbean islands and south Florida. Although many of these same developments and plants now are character-defining elements of cultural landscapes, species such as Australian pine, Brazilian pepper, melaleuca, tan tan, and genip have run rampant, changing the composition and appearance of cultural landscapes and threatening to overwhelm native plants. Under alternative B, these past, present, and expected future effects on park landscapes would be adverse and moderate. However, development of cultural landscape studies would reduce adverse cumulative effects in the parks by identifying individual plants or species that would be preserved and protected during treatment efforts. Cumulative effects would still be adverse, but would be minor.

Conclusion

Most of the parks lack data on character defining cultural landscape features, so under alternative B there would be a range of long-range beneficial (minor to moderate) and adverse (negligible to moderate) impacts on cultural landscapes.

Cumulative impacts would be minor adverse. There would be no impairment of cultural landscapes in any of the nine parks as a result of exotic plant management activities under alternative B.

Section 106 Description of Effects of Alternative B on Cultural Landscapes. Most of the provisions of alternative B outlined above would greatly benefit the parks' cultural landscapes by eliminating such intrusive exotic plants such as Brazilian pepper, guinea grass, Australian pine, tan tan, genip, and melaleuca. However, as with ethnographic resources, most of the south Florida and Caribbean national parks lack cultural landscape studies. Broad landscapes within individual parks have been tentatively identified, but the significance and historic integrity of the exotic plants within these landscapes have not been defined. These unknown or undefined cultural landscape elements may, or may not, contribute to that landscape, so cannot be easily protected. Removal of exotic plants that may be contributing elements of a cultural landscape would constitute an adverse effect. However, better coordination and planning under alternative B would help parks identify resources in treatment areas so that resource protective measures could be implemented.

Until cultural landscape studies could be developed for the nine parks, parks would continue to complete Section 106 compliance on a case by case basis, and a programmatic agreement (similar to the one discussed above under "Ethnographic Resources") would be developed among the parks, the Florida and Virgin Islands historic preservation officers, and the Advisory Council on Historic Preservation to outline ways to deal with the question of exotic plants in potential cultural landscapes. The agreement would set out ways to identify general categories of plants that contribute to the various cultural landscapes, present suggestions for their management over the short-term, and discuss cooperative ways the parks and the EPMT crews could work together to best control exotic species while protecting important landscapes.

ALTERNATIVE C — NEW FRAMEWORK FOR EXOTIC PLANT MANAGEMENT: INCREASED PLANNING, MONITORING, AND MITIGATION, WITH AN EMPHASIS ON ACTIVE RESTORATION OF NATIVE PLANTS

Cultural Landscapes

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Advance planning, future cultural landscape inventories and studies, and continued exotic plant management staff / park communication would be vital during restoration of native plants in cultural landscapes containing exotic plants. Under alternative C, the effects of treatment and restoration activities on cultural landscapes, resulting in minor adverse impacts on cultural landscapes.

Those parks lacking cultural landscape inventories would continue dealing with exotic plant removal and/or replacement on a case-by-case basis, and uneven treatment of landscapes and plantings would result in a range of adverse impacts, varying from moderate adverse in some areas to negligible in others.

Cumulative Impacts

Cumulative impacts of alternative C would be the same as described for alternative B.

Conclusion

A cultural landscape study currently underway at Dry Tortugas National Park would aid the park in determining which exotic plants should be eradicated and which should be retained. For the rest of the south Florida and Caribbean parks, implementation of alternative C would result in long-term, direct and indirect, negligible to moderate adverse impacts on cultural landscapes.

Cumulative impacts would be the same as alternative B. There would be no impairment of cultural landscapes in any of the nine parks as a result of exotic plant management activities under alternative C.

Section 106 Description of Effects of Alternative C on Cultural Landscapes. Effects of implementation of alternative C would be the same as in alternative B, resulting in possible adverse effects on cultural landscapes. With the exception of the current study on-going at Dry Tortugas National Park, none of the parks covered in the DEIS have had a formal cultural landscape study. Data are lacking to identify the plants and features that are character defining in a park's cultural landscape. Without this information, reasoned decisions regarding removal of plants from an area could not be easily made. Exotic plants that are an integral part of a particular landscape and contribute to its identity and significance might be removed, while others of dubious worth might inadvertently be preserved. Plants used in active restoration might, or might not, be compatible with a defined landscape. For these reasons, until cultural landscape studies have been completed, parks would continue to complete Section 106 compliance on a case-by-case basis. However, better coordination and planning under alternative C would help parks identify resources in treatment areas so that resource protective

measures could be implemented. A programmatic agreement for cultural landscapes (as described in alternative B) would be used to complete the Section 106 compliance process under alternative C.

VISITOR USE AND EXPERIENCE

GUIDING REGULATIONS AND POLICIES

Section 8.2 of NPS *Management Policies 2001* states that the enjoyment of park resources and values by the people of the United States is "part of the fundamental purpose of all park units and that the NPS is committed to providing appropriate, high-quality opportunities for visitors to enjoy the parks" (NPS 2001e); this of course includes parks in both south Florida and the Caribbean. Because many forms of recreation can take place outside of a national park setting, the NPS therefore seeks to

> provide opportunities for forms of enjoyment that are uniquely suited and appropriate to the superlative natural and cultural resources found in a particular park unit
>
> defer to others to meet the broader spectrum of recreational needs and demands that are not dependent on a national park setting. Those others can include local, state, and other federal agencies; private industry; and nongovernmental organizations

Any closures or restrictions, other than those imposed by law, must be consistent with applicable laws, regulations, and policies, and (except in emergency situations) require a written determination by the superintendent that such measures are needed to

> protect public health and safety
>
> prevent unacceptable impacts on park resources or values
>
> carry out scientific research
>
> minimize visitor use conflicts
>
> otherwise, implement management responsibilities

Part of the purpose of each of the parks is to provide for public outdoor recreation use and enjoyment. Goals for visitor experience were provided in the NPS *Strategic Plan* for 2000 through 2005 (NPS 2000i). The goals include the following:

> *NPS Mission Goal IIa*: Visitors Safely Enjoy and Are Satisfied with Availability, Accessibility, Diversity, and Quality of Park Facilities, Services, and Appropriate Recreational Opportunities
>
> *NPS Mission Goal IIb*: Park Visitors and the General Public Understand and Appreciate the Preservation of Parks and Their Resources for This and Future Generations

METHODOLOGY AND ASSUMPTIONS

GEOGRAPHIC AREA EVALUATED FOR IMPACTS

The geographic area evaluated for visitor use and experience included the participating parks.

IMPACT CRITERIA AND METHODOLOGY

Issues were identified during internal and public scoping that relate to how physical, mechanical, and chemical treatment of exotic plants, as well as the means to access treatment sites, may affect visitor use and experience.

> The presence of exotic plants in the national parks may lead some park visitors to believe that the NPS is not fulfilling its mandate to protect and preserve park resources; yet, other visitors may not comprehend the difference between exotic and native plants, which leads to confusion about what the natural environment truly is.
>
> Exotic plants alter the natural landscape and may impact the viewshed and visitor experience of the park. During exotic plant treatment activities, the presence of crews and equipment and area closures can also impact visitor use and experience. Until native plants reestablish following exotic plant treatment, some areas of the park could be visually unattractive, which may detract from visitor experience during the transition period.
>
> Public access to some areas of a park would be blocked by the presence of exotic plants.
>
> Some visitors may be opposed to the use of chemical treatments on exotic plants. The smell of herbicides and compounds that enhance their effectiveness is offensive to many people, and although temporary, visitor experience can be affected by chemical smells.
>
> The use of mechanical, chemical, and biological methods to control exotic plants can result in numerous standing dead plants, which could detract from the natural landscape and affect visitor experience.

The purposes of this impact analysis were to determine if the management of exotic plants under each management alternative would be compatible with

> desired goals for visitor experience goals
>
> the purpose of the parks as identified in the enabling legislation and in other laws and policies affecting visitor use

To determine the effects of the alternatives on visitor experience, each issue was evaluated using the procedures described in the general methodologies section. This impact analysis evaluates several aspects of visitor experience, including visitor perception of the presence of exotic plants, perception of visual conditions following treatment of exotic plants, access to park resources, and understanding

and appreciation of park values. The programmatic nature of the alternatives necessitates qualitative analysis rather than quantitative. Consequently, professional judgment was used to reach reasonable conclusions as to the intensity and duration of potential impacts.

IMPACT THRESHOLD DEFINITIONS

The following threshold definitions were applied to determine effects on visitor use and experience of the presence of exotic plants and actions to manage the plants.

Negligible — Visitors would not be affected, or changes in visitor experience and/or understanding would be below or at the level of detection. Visitors would not likely be aware of the effects associated with the alternative.

Minor — Changes in visitor experience and/or understanding would be detectable, although the changes would be slight. Visitors could be aware of effects associated with the alternative, but only slightly.

Moderate — Changes in visitor experience and/or understanding would be readily apparent. Visitors would be aware of the effects associated with the alternative and would likely be able to express an opinion about the changes.

Major — Changes in visitor experience and/or understanding would be readily apparent and would have important consequences. Visitors would be aware of the effects associated with the alternative and would likely express a strong opinion about the changes.

IMPACTS OF THE ALTERNATIVES ON VISITOR USE AND EXPERIENCE

ALTERNATIVE A — NO ACTION: CONTINUE CURRENT MANAGEMENT

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

With the continuation of current management, visitors would continue to encounter both the presence of exotic plants and the results of treatments to remove them. Because re-treatment is determined by current funding cycles and fund availability, infested areas receive treatment every 3 to 5 years. As a result, by the time areas receive follow-up treatment, exotic plants can be re-established to an extent that their impacts on the visitor experience similar to that occurring before the initial treatment.

Where exotic plants re-occur between treatments, they would continue to block views of the surrounding park landscape and reduce visitors' opportunity to understand landscape features and resources. This would take place primarily along road shoulders and trails and around developed areas where land has been previously disturbed, such as Flamingo Road in Everglades National Park, the

loop road in Big Cypress National Preserve, and roads in Virgin Islands National Park. This would result in minor to moderate, long-term, adverse impacts on the quality of the visitor experience. Melaleuca and Australian pine grow slowly and re-treatment every 3 to 5 years results in reductions in these species. Alternative A would reduce the presence of these species in areas of visitor use and result in long-term moderate beneficial impacts.

In some places, exotic plants would screen intrusive development from view, such as the visibility of roads from beaches. Australian pines can provide shade on beaches or provide bird viewing opportunities and benefit visitors. Buck Island Reef National Monument has recognized the cultural significance of one nonnative plant species, *Tamarindus indica* (Tamarind tree). Under alternative A, the park would preserve in place several old, historic individuals of this tree species on the north and west sides of Buck Island. These actions would have long-term, minor-to-moderate beneficial effects on visitor experience.

Under alternative A, activities to manage exotic plants that would affect visitor experience include the use chainsaws, motor and off-road vehicles, and aircraft. The use of motorized equipment in the parks would occur during daylight hours. When possible, the use of helicopters and heavy equipment would be limited during heavy visitation periods and in high visitor-use areas. When control activities take place in visitor use areas, area closures may be necessary to protect the public. The results of area closures, the visual presence of activities within sight of visitor use areas, and the noise produced by management activities would have localized, short-term, minor to moderate adverse impacts on visitor experience.

Melaleuca after treatment

Following the treatment of exotic plants such as Australian pine, melaleuca, and Brazilian pepper, dead plants would continue to be left standing to fall and decay naturally. This would be unsightly to some visitors, and the resource management objectives would be misunderstood by some visitors. For these visitors, the effects on experience would be negligible for small treated areas and would be minor to moderate where large acreages of treated area are visible to the public. For visitors who understand the threats that exotic plant pose to the natural environment, stands of dead exotic plants could reflect the positive efforts of the NPS to control the problem and would result in minor, beneficial effects on visitor experience.

Some exotic plants would continue to affect recreation access. Brazilian pepper could block passage by off-road vehicles where that use is permitted in Big Cypress National Preserve. Melaleuca and Australian pine could interfere with airboat travel in Everglades National Park. If travel is delayed or if the visitor's trip has to be terminated due the presence of exotic plants, the adverse impacts would be moderate to major and short term.

Some visitors would continue to oppose the use of chemicals based on principle and on concern over perceived long-term effects of herbicides. Some visitors would also be adversely affected by chemical odors when herbicides are sprayed

or applied by hand near visitor use areas, detracting from their experience. This would also continue to result in a perception of health risks by some visitors. Effects on visitor experience would be adverse and of minor to moderate intensity. Interpretive programs and displays in visitor centers that include information about the threat posed by exotic plant species could mitigate this adverse impact. Public outreach would also include distributing brochures, submitting news releases and articles, presenting lectures to organizations, providing information about exotic plants in annual reports and park newsletters, and hosting focus-group meetings.

Visitors who understand the problems associated with exotic plants and who are not opposed to the use of herbicides would be positively affected by visible control programs because they would see tangible evidence of NPS efforts to manage the resources in the park. Where the presence of exotic plants persists, and where problems go untreated, some visitors may experience negligible to moderate adverse impacts and feel that the NPS is not being an effective steward in managing the important park resources.

Cumulative Impacts

Visitors to the south Florida and Caribbean parks are largely satisfied with their visit. National Park Service surveys indicate that the level of facilities, programs, and recreational opportunities are found to be appropriate by the public. Increased visitation is resulting in crowding and wear and tear on park facilities, but these are resulting in only minor adverse effects to visitors and their experience.

Each of the nine parks is preparing a new or amended general management plan. The general management plans establish the framework and direction for improvements to park resource conditions and improved opportunities for visitor use and experience. In addition, the south Florida parks are engaged in ecosystem restoration efforts through the Comprehensive Everglades Restoration Plan and the actions of the South Florida Ecosystem Restoration Task Force. Implementation of the general management plans and improvement and restoration of the ecosystem would provide opportunities to enhance visitor understanding and appreciation of park resources. These actions would result in long-term minor cumulative benefits to visitor experience.

Past, present and anticipated facilities and program development in the parks has provided and would provide for enhanced visitor understanding and appreciation of park resources and would result in long-term moderate benefits to visitor experience. New main visitor centers were constructed in Everglades and Biscayne National Parks in the late 1990s and have provided long-term moderate benefits to visitors. These facilities provide visitors with information and programs that interpret the significant natural and cultural resource of the parks and the effects of ecosystem restoration. The Tamiami Welcome Center to be constructed in Big Cypress National Preserve would provide additional opportunities for education and interpretation resulting in long-term minor to moderate benefits. The airboat management plan in East Everglades Addition Lands would reduce long-term disturbance and conflicts for visitors and result in long-term, minor beneficial impacts.

The past, present, and anticipated long-term minor to moderate benefits resulting from planning, development, and program activities of the parks would likely off-set much of the adverse impact from crowding and facility wear and tear. It is expected that the long-term cumulative experience of visitors to the south Florida and Caribbean parks would continue to beneficial and of minor to moderate intensity.

Management of exotic plants under alternative A would continue to provide long-term beneficial and short-term adverse impacts on visitor use and experience throughout the parks. The beneficial impacts of alternative A would contribute to the minor to moderate beneficial cumulative impacts on visitor experience and the adverse impacts would not detract from them.

Conclusion

The visitor experience in the parks would continue to be affected by the presence of exotic plants and by the methods to control exotic plants. This would result in adverse effects for some visitors and beneficial effects for others. These effects could range in intensity from negligible to major, depending on the visitor. Cumulative impacts would be minor to moderate beneficial.

ALTERNATIVE B — NEW FRAMEWORK FOR EXOTIC PLANT MANAGEMENT: INCREASED PLANNING, MONITORING, AND MITIGATION

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

The effects of treatment of exotic plants on visitor experience would generally be the same under alternative B as under alternative A, with the following differences.

Alternative B, with its more frequent and systematic re-treatment of exotic plants, in conjunction with regular monitoring, would substantially reduce the infested areas in the nine parks. Determining the priority of treatment areas involved evaluating the presence of visitor use sites, trails, and roads. Infested areas that were within 1 mile of roads or highly visited areas, such as a visitor center, campground, or marina, were given highest priority for treatment. Infested areas within 1 mile of a trail received second level of priority because they receive less visitor use than developed areas. Those areas that did not have roads, visitor use areas, or trails were given the lowest priority for treatment. In Canaveral National Seashore and Biscayne National Park, areas within 1 mile of visitor use sites, roads, or hiking trails received high priority. In small parks such as Salt River Bay National Historic Park and Ecological Preserve and Virgin Islands National Park, the distance to a road, trail, or visitor use area was reduced to 0.25 mile. Visitors would likely be aware of the reduction in exotic plants, and this would have long-term, minor to moderate beneficial effects on visitor experience.

External programs would inform and educate the public regarding exotic plant issues in and around the national parks; the effects that exotic plant species have

on native plants, animals, and other park resources; the treatment methods available to managers; the nature of exotic plant spread; and the measures people can take to reduce the spread of exotic plant species. This would include development of interpretative programs, exhibits, and public outreach programs. The parks would also develop common interpretative materials applicable throughout the region. Such materials would be used to present programs to park visitors, schools, and special interest groups. Interpretative signs could be erected at plant control programs near popular access routes. Written materials such as brochures could be available at park visitor centers and at presentations and programs. Increases in public and visitor awareness of exotic plant issues and the benefits of exotic plant treatment would have long-term minor to moderate beneficial effects on the public's ability to appreciate park resources.

Trucks, airboats, motorboats, and off-road vehicles would continue to be used in the parks to transport crews and equipment. Because there would be increased maintenance of treated sites under alternative B, the frequency with which this equipment is used would increase, and impacts on visitor experience would occur more frequently than would under alternative A. However, the intensity of the impact individual treatment projects would remain the same or similar to alternative A. The adverse impacts would be considered short term, minor to moderate, with implementation of mitigation measures, such as turning off equipment when not in use and using the quietest equipment available.

During initial treatment of exotic plants that would occur in the first few years of the plan, chainsaws and chippers would be employed when using the cut stump method to woody exotic plant species or to remove individual hazardous trees. Impacts on visitor experience would be the same as those described under alternative A. The impacts on visitor experience would be short term because impacts would only occur during operation of the equipment. This would be focused more prominently in visitor areas in the early part of the plan because of the high priority placed on treatment in these areas. As re-treatments occur within the parks, the use of chainsaws becomes unnecessary for treatment of exotic plants and impacts would not occur.

Increased monitoring activities would increase the staff activities that may be conducted in the presence of visitors. This would include monitoring staff in vehicles and in air craft. The effects of these activities would be similar to those described for treatment activities. The frequency and duration of these activities would be less than treatment activities.

Because alternative B would decrease infested areas in the parks, impacts on visitor use and experience would be similar to impacts effects of alternative A, but adverse impacts from the presence of exotic plants would be slightly lower in intensity and beneficial effects slightly higher.

Cumulative Impacts

The effects of other past, present, and future actions would continue to produce long-term beneficial and adverse effects, as described under alternative A, which would result in net long-term, minor to moderate beneficial cumulative impacts to visitor experience.

Management of exotic plants under alternative B would continue to provide long-term beneficial and short-term adverse impacts on visitor use and experience throughout the parks. The beneficial impacts of alternative A would contribute to the cumulative minor to moderate beneficial impacts on visitor experience and the adverse impacts would not detract from them.

Conclusion

Because alternative B would decrease infested areas in the parks, impacts on visitor use and experience would be similar to the impacts of alternative A, with adverse impacts slightly lower in intensity and beneficial effects slightly higher. Cumulative impacts would be the same as alternative A.

ALTERNATIVE C — NEW FRAMEWORK FOR EXOTIC PLANT MANAGEMENT: INCREASED PLANNING, MONITORING, AND MITIGATION, WITH AN EMPHASIS ON ACTIVE RESTORATION IN NATIVE PLANTS

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Alternative C adopts the same principles and methods described in alternative B, plus an active restoration plan, with some alterations also existing in the monitoring plan and the criteria used to determine success of treatment. Site-specific treatment priorities; species-specific treatment priorities; treatment method decision tool; re-treatment schedule and methods; retention of culturally significant exotic plant specimens; monitoring, collaboration, and partnership; and decision tool for NEPA compliance would be the same as under alternative B.

Treated areas within 300 feet of roads or visitor use areas, such as campgrounds or visitor centers, would receive high priority for active restoration. Quicker reestablishment of native vegetation in these areas would reduce any impacts that treatments have on visitor appreciation of the parks.

Because active restoration would decrease infested areas in the parks somewhat more quickly than under alternative B, the impacts of alternative C on visitor use and experience would be similar to the impacts of alternative B, with adverse impacts slightly lower in intensity and beneficial effects slightly higher.

The activities associated with active restoration would have adverse effects on visitor experience. Work crews and equipment used to remove large areas of vegetation and soil would be visible and audible to some visitors. Heavy equipment would use park roads to access restoration sites. This would result in short-term, minor to moderate adverse impacts.

Cumulative Impacts

The effects of other past, present, and future actions would continue to produce long-term beneficial and adverse effects, as described under alternative A, which

would result in net long-term, minor to moderate beneficial cumulative impacts to visitor experience.

Management of exotic plants under alternative C would continue to provide long-term beneficial and short-term adverse impacts on visitor use and experience throughout the parks. The beneficial impacts of alternative A would contribute to the cumulative minor to moderate beneficial impacts on visitor experience and the adverse impacts would not detract from them.

Conclusion

Because active restoration would decrease infested areas in the parks somewhat more quickly than under alternative B, impacts of alternative C on visitor use and experience would be similar to the impacts of alternative B, with adverse impacts slightly lower in intensity and beneficial effects slightly higher. Active restoration activities would result in short-term, minor to moderate adverse impacts. Cumulative impacts would be the same as alternative A.

SOUNDSCAPES

GUIDING REGULATIONS AND POLICIES

The fundamental mission of the national park system, established in law (16 USC 1 *et seq*.), is to conserve park natural and historic resources, and to provide for the enjoyment of park resources only to the extent that the resources would be left unimpaired for the enjoyment of future generations. As described in Section 1.4.6 of NPS *Management Policies 2001* (NPS 2001e), natural soundscapes are recognized and valued as a park resource in keeping with the NPS mission.

The natural soundscape, sometimes called natural quiet, is the aggregate of all of the natural sounds that occur in parks, together with the physical capacity for transmitting natural sounds. Management goals for soundscapes are included in Section 4.9 of NPS *Management Policies 2001* and in *Director's Order 47: Soundscape Preservation and Noise Management* (NPS 2000h).

NPS *Management Policies 2001* require restoration of degraded soundscapes to the natural condition whenever possible and protection of natural soundscapes from degradation. In NPS *Management Policies 2001*, Section 4.9, the NPS is directed to "take action to prevent or minimize all noise that, through frequency, magnitude, or duration, adversely affects the natural soundscape or other park resources or values, or that exceeds levels that have been identified as being acceptable to, or appropriate for, visitor uses at the sites being monitored."

Director's Order 47 requires "to the fullest extent practicable, the protection, maintenance, or restoration of the natural soundscape resource in a condition unimpaired by inappropriate or excessive noise sources." It also states, "the fundamental principle underlying the establishment of soundscape preservation objectives is the obligation to protect or restore the natural soundscape to the level consistent with park purposes, taking into account other applicable laws." Noise is generally considered appropriate if it is generated from activities consistent with park purposes and at levels consistent with those purposes.

Director's Order 47 provides the following policy direction: "Where natural soundscape conditions are currently not impacted by inappropriate noise sources, the objective must be to maintain those conditions. Where the soundscape is found to be degraded, the objective is to facilitate and promote progress toward the restoration of the natural soundscape." Where legislation provides for specific noise-making activities in parks, the soundscape management goal would be to reduce the noise to the level consistent with the best technology available, which would mitigate the noise impact but not adversely affect the authorized activity. Where a noise-generating activity is consistent with park purposes, "soundscape management goals are to reduce noise to minimum levels consistent with the appropriate service or activity."

NPS *Management Policies 2001* (NPS 2001e) acknowledge that motorized equipment and aircraft that generate noise are necessary for administrative uses in the parks to meet management objectives. Policies direct that where motorized equipment is necessary and appropriate, the least impacting equipment, vehicles,

and transportation systems should be used, consistent with public and employee safety. With regard to aircraft use, NPS *Management Policies 2001* require that parks

> use, to the maximum extent practicable, the quietest aircraft available for its aviation operations
>
> limit official use of flights over parks to those needed to support or carry out essential management activities in cases where there are no practical alternatives or when alternative methods would be unreasonable. Full consideration will be given to safety; wilderness management implications; impacts on resources, values, or visitors; impacts on other administrative activities and overall cost-effectiveness

NPS regulations pertaining to noise abatement for boating and off-road vehicle activities in parks nationwide are included in 36 CFR 3.7. These regulations prohibit operating any vessel in or upon inland waters so as to exceed a noise level of 82 decibels (dB) measured at a distance of 82 feet. In addition, wheeled off-road vehicles must not cause noise levels that exceed 60 dB measured on the A-weighted scale (dBA) at 50 feet, except pursuant to the terms and conditions of the off-road vehicle permit (36 CFR 2.12).

METHODOLOGY AND ASSUMPTIONS

GEOGRAPHIC AREA EVALUATED FOR IMPACTS

Impacts on soundscapes were analyzed for each of the nine parks. Exotic plant treatment and restoration activities involving mechanized equipment may affect soundscapes in all of the parks to some degree. The use of aircraft to access sites for treatment or for monitoring purposes in south Florida parks would affect soundscapes. Tables and maps define which areas in the parks a particular type of activity would occur (see the maps and tables in appendixes A – I).

IMPACT CRITERIA AND METHODOLOGY

Soundscape issues related to exotic plant management that were identified during internal and public scoping included the following.

> During exotic plant treatments, the soundscape can be adversely affected by noise from workers, equipment, or heavy machinery used to implement treatment methods; aircraft overflights associated with monitoring, surveillance, or aerial spraying of herbicides; or motorboats and vehicles used to access treatment sites.

Exotic plant management activities that could affect soundscapes include the use of motorized equipment to treat or monitor exotic plants, to actively restore areas, or to transport staff. Airboats, motorboats, and vehicles would be used to transport staff to treatment areas. Large construction equipment would be necessary to actively restore disturbed lands through soil removal, and this would be most likely to occur in disturbed lands in Big Cypress National Preserve and

in the northeastern portion of Everglades National Park where the park has acquired agricultural lands. In addition, noise would be generated from the use of chainsaws and mulching equipment when removing treated vegetation in areas of sensitive habitat, where removal of exotic plants was determined to be the most appropriate method. Removal of exotic plants would also occur near areas of high visitor use or for public safety in the event that standing dead trees become a hazard. Use of fixed-wing aircraft or helicopters for monitoring or treating exotic plants would occur in the Florida parks.

Noise can directly affect natural soundscapes by masking, modifying, or intruding on natural sounds that are an intrinsic part of the environment. This can be especially true in quiet places, such as on a beach or in the backcountry, or when sounds from the noise source occur at the same frequency as sounds in the natural soundscape. Noise can also adversely impact park visitor experiences by intruding on or disrupting experiences of solitude, serenity, tranquility, contemplation, or a completely natural or historical environment. This impact may be more pronounced during sensitive times of day such as early morning or near dusk when visitors expect to hear less human-induced sounds. Noise-generated impacts on visitors as a result of treatment methods to control exotic plants are presented in the "Visitor Use and Experience" section.

Noise can adversely impact wildlife resources by interfering with sounds important for animal communication, and cause animals to use avoidance mechanisms, especially animals that have not habituated to the sound. Effects of the noise generated as a result of physical or mechanical treatment methods to control exotic plants on wildlife are presented in the "Wildlife and Wildlife Habitat" section.

The methodology used to assess impacts on soundscapes from management actions to treat exotic plants or restore treated sites is consistent with NPS *Management Policies 2001* and *Director's Order 47*: *Soundscape Preservation and Noise Management*.

Context, time, and intensity together determine the level of impact for an activity. It is usually necessary to evaluate all three factors together to determine the level of noise impact. In some cases, an analysis of one or more factors may indicate one impact level, while an analysis of another factor may indicate a different impact level, according to the criteria below. In such cases, best professional judgment based on a documented rationale must be used to determine which impact level best applies to the situation being evaluated.

National literature was used to estimate the average decibel levels generated by equipment being used to treat or monitor exotic plants and equipment that would be used during active restoration of treatment areas to prepare sites for planting or seeding or to remove soils. The type and frequency of use of motorized equipment was determined through personal communications with park staff.

It was assumed for this analysis that soundscapes in remote and undeveloped areas would be more sensitive to noise than developed areas of the parks where the ambient soundscape is influenced by motorized equipment and high visitor use.

The time of day influences the impact a given noise may have. This analysis assumed that the periods of greatest sensitivity to noise includes sunset, sunrise, and at night.

IMPACT THRESHOLD DEFINITIONS

Negligible — Human-caused or project sounds do not compete with ambient sounds. Where noise is audible, it is for short duration, with significantly lengthy periods of time that are noise free.

Minor — Human-caused or project sounds are detectable above ambient sounds; however, there are frequent periods of time that are noise free. Where noise is audible, impacts occur for short durations (less than an hour) during the day.

Moderate — Human-caused or project sounds compete with ambient sounds. The noise generated is perceptible for extended periods throughout the day. There are however short periods of time that are noise free.

Major — Human-caused sounds dominate the soundscape and replace natural sounds. Natural sounds in the project area are commonly impacted by noise from management activities for most of the day without periods of time that are noise free.

IMPAIRMENT

Impairment of natural soundscapes in the parks would occur if they were impacted at major levels during the majority of the day and the night. Impairment would occur if the sound-related management goals as stated in *NPS Management Polices* and *Director's Order 47* could not be fulfilled.

IMPACTS OF THE ALTERNATIVES ON SOUNDSCAPES

ALTERNATIVE A — NO ACTION: CONTINUE CURRENT MANAGEMENT

Biscayne National Park Everglades National Park, Big Cypress National Preserve, and Canaveral National Seashore

Under alternative A, activities to manage exotic plants that would affect soundscapes include chainsaws, motor or off-road vehicles, motorboats or airboats, and overflights of helicopters or fixed-winged aircraft. Within the parks, the use of motorized equipment would occur during daylight hours. Impacts on soundscapes as from exotic plant management activities would continue to occur at the same level because it is assumed that treatments would occur at the same intensity using the same or similar treatment methods.

Trucks, airboats, motorboats, and off-road vehicles would continue to be used in the parks to transport crews and equipment. Noise levels generated by trucks and off-road vehicles ranges between 80–90 dBA (Bearden 2000; Federal Interagency Committee on Noise 1992); motorboat noise is between 80 and 115 dBA (Noise League 2004); and airboats, according to Florida Department of Environmental Protection experts, generate noise levels that are usually 140 dBA

or higher (Destination Florida Commission 2002). These levels of noise range from what would be considered moderate to very loud, but the noise generated by airboats would reach a threshold of "uncomfortably loud" (Cowan 1994). However, the noise of airboats is not stationary and the high level of impact would be detected when adjacent or in the immediate vicinity of the airboats and it would diminish as distance from the noise source increases.

In or near developed areas, background noise levels are influenced by motorized vehicles, recreational vehicles, watercraft, and general noise associated with high levels of human use. The noise generated from motorized equipment used by workers to access sites would at times, and depending on the vehicle or vessel, exceed the ambient levels of noise; therefore, the adverse impact from the use of motorized equipment to transport crews and equipment in developed areas would be considered minor and short term because the impact would only occur while the equipment was in operation.

The noise produced from vehicles or watercraft would introduce unnatural sound into backcountry or remote areas of the parks. The use of this equipment would occur frequently during the day as crews move through treatment areas. These impacts on the soundscape would only last for the duration of each treatment project, and the adverse impacts would be considered short term and minor to moderate with implementation of mitigation measures such as turning off equipment when not in use and using the quietest equipment available.

Chainsaws would be used during the cut stump method to treat areas infested with woody exotic plants. Chainsaws would be used on a limited basis when individual woody exotic plants need to be removed, or when a dead standing tree becomes a hazard and needs to be cut down. The noise level of a chainsaw is 100 dB (Beardon 2000), which can be considered very loud. In developed areas of the parks, the noise generated from chainsaws and chippers that would only be used in easily accessible areas may be perceptible above ambient background noise for periods of time during the day. The adverse impacts on soundscapes in these locations would be short term and negligible to minor because noise would only be generated during the activity. In remote areas or undeveloped areas of the parks, the noise from chainsaws would be heard a further distance from the activity and would periodically compete with daytime ambient sounds. Noise impacts from chainsaw use would be short term, minor to moderate, and adverse because the noise disturbance would only occur during the activity.

Aerial reconnaissance flights would occur every 2 years to determine the extent of infestation of exotic plants in Big Cypress National Preserve, Biscayne and Everglades National Parks, and Canaveral National Seashore. A small propeller plane (used for aerial reconnaissance flights) at 1,000 feet produces a sound level of approximately 88 dB (Beckman 2004). These flights would result in short-term, negligible impacts on soundscapes in the parks because of the altitude of the plane, the low decibel level, and the infrequency of the activity.

In Big Cypress National Preserve and Everglades National Park, the NPS uses helicopters to aerially treat exotic plants and transport crews and equipment. In Big Cypress National Preserve, helicopters are currently used approximately 24 hours per year and only during initial treatment activities and for

transportation of crews (Burch 2004b). In Everglades National Park, helicopters are used for spot reconnaissance to determine exotic plant distribution and for monitoring contractor's progress. The average number of helicopter flights per year would be 15 flights, with each flight lasting approximately 2 hours, for a total of 30 hours per year. The park would use helicopters to perform initial treatments two times a year on average. Re-treatment activities may occur every 2 years, and the treatment activity would take approximately 2 to 3 months to complete with a helicopter flying 4 days a week.

The sound level that a helicopter emits at 100 feet is approximately 100 dB, which could be considered to be loud to very loud (Beckman 2004). The use of helicopters for treatment activities in Everglades National Park and Big Cypress National Preserve would result in a minor level of effect on the soundscape in high use or developed areas because the noise generated would only be slightly more perceptible above the ambient sound levels that are a combination of natural and human induced sounds. Staging for aerial treatments would not occur in visitor use areas so that impacts to visitors would be kept at or below a minor level in developed areas of the parks.

In remote or undeveloped areas of these parks, the impacts on soundscapes would range up to a moderate level of effect because the noise would be detectable over a greater distance and would compete with the natural sounds. The impact, however, would be short term considering that helicopter use occurs periodically and, in the case of Everglades National Park, they are only used for a few months a year.

Buck Island Reef National Monument, Dry Tortugas National Park, Virgin Islands National Park, and Salt River Bay National Historic Park and Ecological Preserve

Under alternative A, the parks would treat exotic plants using cut stump, basal bark, or foliar ground methods. The impacts on soundscapes would result from the presence of crews in the field and the equipment used to transport crews to treatment areas. Impacts on soundscapes from exotic plant management activities would continue to occur over time at the same level as it is assumed treatments would occur through time and at the same intensity using the same or similar treatment methods.

Trucks, vehicles, and motorboats would be used in the parks to transport crews and equipment. This equipment would be used along established roadways, waterways, and marinas that are also used by visitors and staff for other park activities. The noise generated by use of this equipment would not be appreciably noticeable above that of ambient noise levels. The impacts on the soundscape would only last for the duration of equipment use; therefore, adverse impacts would be considered short term and negligible to minor with implementation of mitigation measures such as turning off equipment when not in use and using the quietest equipment available. In treatment areas that are removed from roadways and trails, the presence of crews treating exotic plants with hand tools would be noticeable above natural ambient sounds in these more remote locations; however, there would still be opportunity to experience the ambient soundscape

through periods of the day. Adverse impacts on soundscapes in these more remote areas of the parks would be considered short term and minor.

Chainsaws would be used when applying the cut stump method to treat areas infested with woody exotic species such as tan tan, genip, and lime berry in Salt River Bay National Historic Park and Ecological Preserve and Virgin Islands National Park. Dry Tortugas National Park has achieved a maintenance level of control over exotic plants and re-treatments that would occur at Buck Island Reef National Monument would not involve the use of chainsaws. As stated above, the level of noise that chainsaws emit can be considered loud at 100 dB. Compared to parks in Florida, where human-induced noise contributes more to the soundscape, the human-induced noise in the Caribbean parks would be lower. Therefore, the impact of mechanized equipment on the ambient soundscape in these parks in the developed areas would be higher. In these areas of the parks, the noise generated from use of chainsaws and chippers (which would only be used in easily accessible areas) would be noticeable above ambient background noise, resulting in a minor adverse impact. The impacts on soundscapes in these locations would be short term, as it would only occur during the activity. In remote or undeveloped areas of the parks, the noise from chainsaws would be heard a further distance from the activity and would compete with natural sounds. There would be periods of time during the day when ambient sounds in these areas would be drowned out. The adverse impact on soundscapes in undeveloped and remote areas of the parks would be moderate.

Because of the small size of these parks, the presence of crews treating exotic plants with hand tools may be noticeable above natural ambient sounds in more remote locations; however, these sounds would not dominate, and there would be ample opportunity to experience the ambient soundscape throughout most of the day. Adverse impacts on soundscapes in these more remote areas of the parks would be considered short term and negligible.

Christiansted National Historic Site

Exotic plant treatment activities at Christiansted National Historic Site under alternative A would include the removal of exotic plants by hand or with ground-based spraying of herbicides. These actions would not adversely affect the soundscape in the park

Cumulative Impacts

Soundscapes in the parks are being increasingly impacted as urbanization and development occur in areas adjacent to parks and as visitor use to the parks and regions increases. The soundscapes associated with Everglades National Park, Big Cypress National Preserve, Biscayne National Park, and Canaveral National Seashore are currently being adversely affected by proximity to metropolitan areas, airport traffic, vehicular traffic, industrial activities, intensive recreational/commercial boating, and other recreational activities. These long-term adverse impacts can range up to major because of the continual occurrence of noise associated with urbanization and high recreational use of areas adjacent to or within these parks.

Other projects are planned or ongoing in the parks that could contribute to cumulative impacts on the soundscapes. Infrastructure improvement projects, such as developing wastewater treatment plants, expansion or establishment of new visitor centers, construction of new marinas and docks, or improving or building new roads, involve the use of large construction equipment for periods of time with impacts on soundscapes ranging up to major if the activity is constant throughout the day during construction.

Preparation of new general management plans for Canaveral National Seashore; Biscayne, Everglades, and Virgin Islands National Parks; Big Cypress National Preserve, and Buck Island Reef National Monument would establish a framework and direction for protecting or improving soundscapes in the parks. Establishment of motorized use capacities for areas of the park to improve or preserve soundscapes would result in an overall improvement to soundscapes. Adverse impacts from motorized use would continue to occur in high-use areas, but limitations on motorized use in remote or natural areas would provide a benefit to soundscapes and provide increased opportunities to experience the natural soundscape of a park for longer periods of time.

Exotic plant management activities in the parks would continue, and where treatment activities would take place, there would be continued adverse impacts on soundscapes on a periodic basis, which would range up to moderate, particularly in remote or natural areas of the parks. These impacts, in combination with the noise generated from other industrial or recreational sources outside the parks, would result in cumulative impacts that are moderately adverse in high-use or developed areas and major adverse in remote or low-use areas.

Conclusion

The noise generated from helicopters and fixed-wing aircraft used to treat or monitor exotic plants in the parks would result in short-term, minor to moderate adverse impacts on soundscapes. Trucks, airboats, motorboats, and off-road vehicles used to transport equipment and crews to treatment locations and chainsaw use would have minor to moderate impacts in developed areas of the parks because the noise generated from use of this equipment would be detectable above ambient noise levels but audible only for short durations. In remote or undeveloped areas of the parks, the impact on soundscapes from use of mechanized equipment would range up to moderate because the ambient soundscape would be drowned out for periods of time when activities were occurring.

The cumulative impacts would be moderate to major and intermittent. Alternative A would not result in impairment of the soundscapes in any of the parks analyzed.

ALTERNATIVE B — NEW FRAMEWORK FOR EXOTIC PLANT MANAGEMENT: INCREASED PLANNING, MONITORING, AND MITIGATION

Under alternative B, the impacts on soundscapes would be at a similar level to alternative A when initial treatments of exotic plants occur in the first few years

of plan implementation. Treatment activities would occur more frequently under this alternative in the initial phase of the plan which would result in impacts occurring in more areas of the parks than compared to alternative A. Under alternative B, however, treating exotic plants on an optimal schedule would result in a decrease in impacts on soundscapes over time as less intrusive methods are employed. Compared to alternative A, the reduction over time in the use of mechanized equipment and machinery would be an overall benefit to soundscapes in the parks.

Biscayne National Park, Everglades National Park, Big Cypress National Preserve, and Canaveral National Seashore

Under alternative B, the same activities to manage exotic plants considered under alternative A would affect soundscapes. The use of mechanized equipment (chainsaws, motor or off-road vehicles, motorboats or airboats) and overflights of helicopters or fixed-winged aircraft would generate noise impacting the ambient soundscape. As with alternative A, the use of motorized equipment would occur during daylight hours.

Trucks, airboats, motorboats, and off-road vehicles would continue to be used in the parks to transport crews and equipment. Because of the increased maintenance of treated sites that would occur, the frequency with which this equipment is used would increase, and the impact on soundscapes would occur more frequently than under alternative A. However, the intensity of the impact would remain the same or similar to alternative A. The adverse impacts would be considered short term and minor to moderate with implementation of mitigation measures, such as turning off equipment when not in use and using the quietest equipment available.

During initial treatment of exotic plants that would occur in the first few years of plan implementation, chainsaws and chippers would be used when applying the cut stump method to woody exotic plant species or removing individual dead or decaying trees that may present a hazard to public safety. Impacts on soundscapes would be the same as those described under alternative A. The adverse impacts on soundscapes in developed areas would be negligible to minor. The adverse impacts on soundscapes in remote areas would be moderate. The impacts on soundscapes would be short term because chainsaw use would only occur during operation of the equipment. As re-treatments occur in the parks, the use of chainsaws becomes unnecessary for treatment of exotic plants and impacts would not occur.

Throughout the life of the plan under alternative B, aerial reconnaissance flights would continue to occur in Big Cypress National Preserve, Canaveral National Seashore, and Everglades and Biscayne National Parks every 2 years to determine the extent of infestation of exotic plants Adverse impacts on soundscapes would be the same as alternative A—short term and negligible.

Under alternative B, helicopter use in both parks could increase over that of alternative A. Based on the decision tool, more treatment areas in the parks have been identified as being appropriate for aerial treatment with herbicides. Helicopter use in the first few years of the plan could increase over alternative A

to treat these additional areas. Aerial treatment with herbicides would not be used as a re-treatment method; however, helicopter use would increase to transport crews and equipment more frequently to re-treat sites and for monitoring purposes. Because of the frequency of re-treatment, crews and equipment would need to be transported to remote sites approximately every 6 months.

As part of an adaptive management program, monitoring in the parks would increase to determine the success of treatments, the extent of infestations, the effects on other park resources, and the recovery of native vegetation. Helicopters would be used to perform some of the monitoring in remote areas.

Although the frequency with which helicopters are being used would increase under alternative B, the use of this equipment for management would have the same intensity of impact as discussed under alternative A. The use of helicopters would result in a minor adverse impacts on the soundscape in high-use or developed areas with implementation of best management practices to prohibit staging of aerial treatments away from areas of visitor use, and in remote or undeveloped areas of the parks, the impacts on soundscapes would range up to a moderate. The impacts would be short term because helicopter noise would only occur during times of operation.

Buck Island Reef National Monument, Dry Tortugas National Park, Virgin Islands National Park, and Salt River Bay National Historic Park and Ecological Preserve

Under alternative B, the parks would initially treat exotic plants using cut stump, basal bark, or foliar ground treatments. The impacts on soundscapes would result from the presence of crews in the field and the equipment used to treat exotic plants and to transport crews to treatment areas.

Trucks and motorboats would continue to be used in the parks to transport crews and equipment. Because increased maintenance and monitoring of treated sites would occur, the frequency with which this equipment is used would increase, and the impacts on soundscapes would occur more frequently than under alternative A. However, the intensity of the impact would remain the same or similar to alternative A. The adverse effects would be short term, negligible to minor, with implementation of mitigation measures such as turning off equipment when not in use and using the quietest equipment available.

During initial treatment of exotic plants that would occur in the first few years of plan implementation, chainsaws and chippers would be used in Salt River Bay National Historic Park and Ecological Preserve and Virgin Islands National Park when using the cut stump method to treat woody exotic plant species or remove individual dead or decaying trees that may present a hazard to public safety. Impacts on soundscapes would be the same as those described under alternative A. The impacts on soundscapes in these locations would be short term and minor, and in remote areas or undeveloped areas of the parks, the adverse impacts would be moderate. These impacts would only occur during initial treatment of sites. As re-treatments occur in the parks, the use of chainsaws would become unnecessary because treatment of exotic plants and impacts would not occur.

Because of the small size of these parks, the presence of crews treating exotic plants with hand tools may be noticeable above natural ambient sounds in more remote locations; however, these sounds would not dominate, and there would be ample opportunity to experience the ambient soundscape throughout most of the day. Adverse impacts on soundscapes in these more remote areas of the parks would be considered short term and negligible. The impacts of crews in the remote areas would decline over time as the infestations of exotic plants decline and less manpower is required.

Christiansted National Historic Site

Under alternative B, the impacts of removing the exotic plants by hand or with ground-based spraying of herbicides would have no effect on the park's soundscape.

Cumulative Impacts

Cumulative impacts on soundscapes under alternative B would be very similar to those described for alternative A. The impacts on soundscapes associated with other projects and recreational uses occurring in the parks, regional influences, added to the impacts predicted under alternative B, would be expected to result in cumulative adverse impacts that would range from moderate to major and intermittent. General management plans that require the preservation of soundscapes in the locations of the parks would offset some of the adverse cumulative impacts.

Conclusion

During initial treatment of exotic plants, impacts on soundscapes would be similar to those described under alternative A although they would occur in more areas of the parks during the initial phase of the plan. Although the frequency of management actions would increase under alternative B, there would be a decrease in intensity of impact over time as less intrusive methods are employed to maintain sites. Compared to alternative A, there would be an overall benefit to soundscapes in the park. Impacts on soundscapes from use of motorized vehicles and vessels, mechanized equipment, and field crews would be short term, negligible to minor in developed areas and range up to moderate in remote or undeveloped areas of the parks. The cumulative impacts would be moderate to major and intermittent.

Cumulative impacts would be the same as alternative A. Alternative B would not result in impairment of the soundscapes in any of the parks analyzed.

Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants

Under alternative C, the impacts on soundscapes as a result of exotic plant treatments would be similar to alternative B. However, under alternative C, active restoration of treated sites in the parks could involve the use of large construction machinery to prepare sites for restoration, which would have an

added impact on soundscapes. Compared to alternative A, the reduction over time in the use of mechanized equipment and machinery would be an overall benefit to soundscapes in the park.

Biscayne National Park, Everglades National Park, Big Cypress National Preserve, and Canaveral National Seashore

Under alternative C, the same activities to manage exotic plants under alternative B would affect soundscapes. The use of mechanized equipment (chainsaws, motor or off-road vehicles, motorboats or airboats) and overflights of helicopters or fixed-winged aircraft would generate noise impacting the ambient soundscape.

Trucks, airboats, motorboats, and off-road vehicles would continue to be used in the parks to transport crews and equipment for treatment and restoration activities, and to monitor sites, and impacts would be similar to those described for alternative B. The adverse impacts would be considered short term and negligible to minor.

Under alternative C, there would be an increase in use of mechanized equipment for preparation of treatment sites for active restoration. In small treatment areas, active restoration of sites would involve the use of small-scale mechanized equipment such as rototillers to prepare the soils for either seeding or planting. This equipment would result in localized adverse impacts on the soundscape during use that would range up to minor in remote areas of the parks because the sound would be perceptible above ambient background levels. For larger areas of restoration, such as would occur in the southern portion of Big Cypress National Preserve, the northeastern portion of Everglades National Park, and on spoil islands in the northern portion of Canaveral National Seashore, large construction equipment would be needed to scrape and remove soils and alter the hydrology of the area. The impacts from using this large equipment would range up to major because the equipment noise would dominate the soundscape and be heard continuously during the day. With implementation of mitigation measures, such as turning off equipment when not in use and using the quietest equipment available, some of these impacts may be reduced.

The use of mechanized equipment for initial treatment of exotic plants would be the same as discussed under alternative B. The adverse impacts on soundscapes from use of this mechanized equipment in developed areas would be negligible to minor. The adverse impacts on soundscapes in remote areas would be moderate. Impacts on soundscapes would be short term and would only occur during operation of the equipment. As re-treatments occur in the parks, the use of chainsaws becomes unnecessary for treatment of exotic plants and impacts would not occur.

The impacts from use of aircraft for monitoring, transport of crews, or initial treatment of exotic plants would be the same as those discussed under alternative B. The use of aircraft would result in short-term negligible to minor adverse impacts on soundscapes in developed or high-use areas and would range up to short-term moderate impacts in more remote areas of the parks.

Buck Island Reef National Monument, Dry Tortugas National Park, Virgin Islands National Park, and Salt River Bay National Historic Park and Ecological Preserve

Under alternative C, the parks would initially treat exotic plants using cut stump, basal bark, or foliar ground treatments. The impacts on soundscapes would result from the presence of crews in the field and the equipment used to treat exotic plants and transport crews to treatment areas.

Trucks, airboats, motorboats, and off-road vehicles would continue to be used in the parks to transport crews and equipment for treatment and monitoring of sites with impacts similar to those described for alternative B. The adverse impacts would be considered short term and negligible to minor.

The use of mechanized equipment for initial treatment would be the same as discussed under alternative B. The adverse impacts on soundscapes from use of this mechanized equipment in developed areas would be minor, and the adverse impacts on soundscapes in remote areas would be moderate. The impacts on soundscapes would be short term because the noise would only occur during operation of the equipment. As re-treatments occur in the parks, the use of chainsaws would be unnecessary for treatment of exotic plants, and impacts would not occur.

Under alternative C, there would be an increase in use of mechanized equipment for preparation of treatment sites for active restoration in Buck Island Reef National Monument, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park. Because treatment areas are small, active restoration of these sites would involve the use of small-scale mechanized equipment, such as rototillers, to prepare the soils for either seeding or planting. The use of this equipment would result in localized adverse impacts on the soundscape during use that would range up to minor in remote areas of the parks as the sound would be perceptible above ambient background levels.

The impacts on soundscapes from the presence of work crews would be the same as those described for alternative B. Because of the small size of these parks, the presence of crews treating exotic plants with hand tools may be noticeable above natural ambient sounds in more remote locations, resulting in short-term, negligible adverse impacts.

Christiansted National Historic Site

Under alternative C, manual removal of exotic plants or treatment with herbicides using ground-based sprayers would have no effect on the park's soundscape. There would be no active restoration activities employed at Christiansted National Historic Site. impacts of removing the exotic hedge within the manicured landscape would be the same as described in alternative B. The adverse impacts on soundscapes would be very short term and negligible.

Cumulative Impacts

Cumulative impacts on soundscapes under alternative C would be very similar to those described for alternative B. The impacts on soundscapes associated with

other projects and recreational uses occurring in the parks and regional influences, added to the impacts predicted under alternative C, would be expected to result in cumulative adverse impacts that would range from moderate to major, and would occur intermittently. General management plans that require preservation of soundscapes in the locations of the parks would offset some of the adverse cumulative impacts.

Conclusion

During initial treatment of exotic plants, impacts on soundscapes would be similar to those described under alternative B. Impacts on soundscapes from use of motorized vehicles and vessels, mechanized equipment, and field crews to treat exotic plants would be short term and negligible to minor in developed areas and would range up to moderate in remote or undeveloped areas of the parks. The impacts of small-scale mechanized equipment used to prepare sites for active seeding or replanting with native plants would be short term and minor. Larger active restoration projects that involve large construction equipment would have adverse impacts on soundscapes that could range up to major. Over the 10-year life of the plan, the use of mechanized and motorized equipment would be considerably less than alternative A, and there would be an overall benefit to soundscapes in the parks. The cumulative impacts would be moderate to major and intermittent.

Cumulative impacts would be the same as alternative A. Alternative C would not result in impairment of the soundscapes in any of the parks analyzed.

WILDERNESS

GUIDING REGULATIONS AND POLICIES

The *Wilderness Act*, passed on September 3, 1964, established a national wilderness preservation system, "administered for the use and enjoyment of the American people in such manner as would leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness" (16 USC 1131). The *Wilderness Act* further defined what constitutes wilderness as "an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, and which is protected and managed to preserve its natural conditions" (16 USC 1131). The *Wilderness Act* gives the agency managing the wilderness responsibility for preserving the wilderness character of the area and devoting the area to the public purposes of recreational, scenic, scientific, educational, conservation, and historical use (16 USC 1133). Certain uses are specifically prohibited, with the exception for areas where these uses have already become established. The act states that "there shall be no commercial enterprise and no permanent road within any wilderness area designated by this chapter and, and except as necessary to meet minimum requirements for the administration of the area . . . there shall be no temporary road, no use of motor vehicles, motorized equipment or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within any such area" (16 USC 1133).

NPS MANAGEMENT POLICIES

NPS *Management Policies 2001* require all management decisions affecting wilderness to be consistent with the minimum requirements concept, in that the park needs to perform a minimum requirements analysis to determine "whether the proposed management action is appropriate or necessary for administration of the area as wilderness and does not pose a significant impact to wilderness resources and character; and the techniques and types of equipment needed to ensure that impact to wilderness resources and character is minimized" (NPS 2001e, 6.3.5). In addition, administrative use of motorized equipment or mechanical transport is authorized only if it is determined to be the minimum requirement needed by management to achieve the purposes of the area as wilderness, including the preservation of wilderness characters and values, or is necessary for an emergency health and safety situation (NPS 2001e, 6.3.5).

DIRECTOR'S ORDER 41: WILDERNESS PRESERVATION AND MANAGEMENT

NPS *Director's Order 41* was developed to provide accountability, consistency, and continuity to NPS wilderness management efforts and to otherwise guide NPS efforts in meeting the requirements set forth by the *Wilderness Act of 1964*. *Director's Order 41* interprets the *Wilderness Act* and consolidates its requirements and all applicable NPS *Management Policies 2001* to set guiding principles for all NPS units to determine wilderness suitability and appropriately manage those lands. Lands identified as being suitable for wilderness

designation, wilderness study areas, proposed wilderness, and recommended wilderness (including potential wilderness) must also be managed to preserve their wilderness character and values in the same manner as "designated wilderness" until Congress has acted on the recommendations (NPS 1999). *Director's Order 41* sets forth guidance for applying the minimum requirement concept to protect wilderness, as well as guidance for the overall management, interpretation, and uses of wilderness. Specific management direction applicable to this plan includes the discussion on fire management, which states, "under ideal conditions, natural fire should be considered as a fundamental component of the wilderness environment" (NPS 1999). It further states that parks containing wilderness would integrate wilderness considerations in the decision-making process to determine the most appropriate management strategies for all prescribed fires (NPS 1999). Air quality in wilderness class I areas must be protected and preserved as required by the *Clean Air Act*. *Director's Order 41* recognizes that smoke from wildland fire is an exception in that it commonly occurs within class I areas. However, it further states that "managers will be responsible for reducing the impacts of smoke from wildland fires on visibility in class I wilderness, while understanding and promoting the need to re-introduce the natural role of fire into wilderness ecosystems" (NPS 1999).

Melaleuca wildfire

METHODOLOGY AND ASSUMPTIONS

GEOGRAPHIC AREA EVALUATED FOR IMPACTS

Of the nine parks included in this draft EPMP/EIS, Everglades National Park is the only park with designated wilderness or with lands identified as suitable for wilderness designation. The geographic area for this analysis includes the 1,296,500-acre Marjory Stoneman Douglas Wilderness in Everglades National Park. The boundary of the wilderness and analysis area can be seen in figure 8 in the "Affected Environment" chapter.

IMPACT CRITERIA AND METHODOLOGY

Wilderness values, as described in the *Wilderness Act*, are analyzed as the absence of permanent improvements and human habitation, outstanding opportunities for solitude and primitive, unconfined recreation, and the prevalence of natural conditions over man-made conditions.

As directed by NPS *Director's Order 41*, lands identified as being suitable for wilderness designation, wilderness study areas, proposed wilderness, and recommended wilderness (including potential wilderness) must be managed to preserve their wilderness character and values in the same manner as "designated wilderness." Therefore, this analysis regards all lands identified as being suitable for wilderness designation the same and offers no distinction in the impact analysis.

The analysis of impacts on wilderness are qualitative and assessed given the degree to which exotic plant management actions would change compared to existing management.

Specific issues addressed in the analysis include those developed through internal and public scoping. The following issue statements have been developed.

> Exotic plant treatments can create unnatural features (such as chain-sawed trunks or stands of dead plants) and intrude on the visual landscape within wilderness areas. Monotypic stands (stands of the same species) of exotic plants do not impart the same sense of wilderness as diverse natural habitat. Control of exotic plants would assist in maintaining natural plants, thereby improving wilderness value and character.
>
> Noise and visual intrusion during treatments may reduce wilderness character. Although only lasting for a short period of time, the noise created by the equipment and crews is pervasive and would detract from the wilderness experience. Accessing treatment areas with heavy equipment can cause unintended trails and rutting and can provide substrate for the establishment of other exotic plants, further affecting wilderness resources and values. A comprehensive plan to control exotic plants in wilderness would lessen intensity of disturbance in wilderness areas and reduce adverse effects on wilderness resources.

The use of prescribed fire to manage exotic plants has the potential to degrade visibility and air quality in wilderness areas. The preservation and protection of visibility in class I wilderness areas must be guaranteed under the *Clean Air Act* and as directed in NPS *Director's Order 41*. The effects on visibility from the use of prescribed fire is not included in this analysis, but is analyzed under the "Air Quality" impact topic.

IMPACT THRESHOLD DEFINITIONS

Negligible — Management actions would have no discernable effect on wilderness resources. Natural conditions would prevail. There would be no permanent visual improvements or human habitation. The wilderness area would be affected primarily by the forces of nature. There would be outstanding opportunities for solitude or a primitive and unconfined type of recreation.

Minor — Effects of management actions would be slightly detectable within limited areas of the wilderness. Natural conditions would predominate. There would be no permanent visual improvements or human habitation. The wilderness area would generally appear to have been affected primarily by the forces of nature. While there may be short-term actions within the wilderness, over the long term, outstanding opportunities for solitude or a primitive and unconfined type of recreation would prevail.

Moderate — Effects of management actions would be readily apparent within limited areas of the wilderness. The wilderness area would appear to have been affected primarily by the forces of nature. Adverse effects would result if limited areas of wilderness were altered to the point that they do offer outstanding

opportunities for solitude or a primitive and unconfined type of recreation. Beneficial effects would result if those affected areas were recovered or returned to a state that offered outstanding opportunities for solitude or a primitive and unconfined type of recreation.

Major — Effects of management actions would substantially alter the wilderness resource throughout the designated wilderness area. Adverse effects would result if extensive areas of wilderness were altered to the point that they do not offer outstanding opportunities for solitude or a primitive and unconfined type of recreation. Beneficial effects would result if extensive areas were recovered or returned to a state that offered outstanding opportunities for solitude or a primitive and unconfined type of recreation.

IMPAIRMENT

Impairment would occur when the wilderness resources have been substantially altered, eliminating the characteristics that meet the criteria for consideration and classification as wilderness. Criteria for determining classification as wilderness can be found in *Management Policy* 6.2.1, *Assessment of Wilderness Suitability or Nonsuitability* (NPS 2001e).

IMPACTS OF THE ALTERNATIVES ON WILDERNESS

ALTERNATIVE A — NO ACTION: CONTINUE CURRENT MANAGEMENT

Everglades National Park

Alternative A (no action) is the continuation of current management. Management under alternative A would continue to prioritize and manage exotic plants using a variety of treatment methods, and existing monitoring and re-treatment actions would continue into the future.

Current exotic plant management actions are implemented by Everglades National Park staff in an attempt to reduce the damaging effects exotic plants can have on wilderness resources and values. Exotic plants can displace or hybridize with native species and can change the structure of a vegetation category, the competitive regimes, or the function of the ecosystem they invade (Gordon 1998). Exotic plants can also form monotypic stands after displacing native species. These areas do not impart the same backcountry wilderness experience on visitors because of the lack of biodiversity that would be associated with natural conditions. Wilderness resources can also be threatened from altered fire regime as a result of a lowered water table, increased litter accumulation, or altered vegetative structure, and can destroy threatened and endangered species habitat. Because alternative A would not include performance of re-treatments at an optimal frequency, Everglades National Park would protect areas of the park from further exotic plant damage but would not be able to reduce the exotic plant population. Therefore, the management actions associated with alternative A would continue to have a minor, beneficial effect on wilderness over the long term because, through treating the exotic plant population, the threat to wilderness resources and values would be reduced, and natural conditions and ecosystem functions could be better protected.

Exotic plant management associated with alternative A would continue to have short-term impacts on wilderness resources and values attributed to treatment actions within wilderness. A minimum requirements analysis would be conducted for each treatment project to determine the minimum tool and treatment method required for managing exotic plants in infested areas. Minimum tools that have been used in the past, and would likely continue in the future, include the use of helicopters, trucks, airboats, motorboats, and off-road vehicles for accessing treatment and monitoring sites, and in the case of helicopters and fixed wing aircraft, for treatment and aerial reconnaissance.

Everglades National Park would continue to use helicopters for monitoring exotic plant distribution, overseeing contract work, and treating exotic plants. Helicopter use in Everglades National Park can range up to 2 to 3 months of activity within a given year. These helicopters would provide noise disturbance within wilderness because they produce about 100 decibels; however, this disturbance would be considered short term because of intermittent use. The use of fixed-wing aircraft for aerial reconnaissance of the distribution of exotic plants would also continue under alternative A, which would produce short-term noise disturbance once every 2 years for about 40 hours. The fixed-wing aircraft would produce 88 decibels of noise and would also be considered short term.

In addition, trucks, airboats, motorboats, off-road vehicles, and chain saws would continue to be used intermittently in wilderness when needed for treatment actions after the appropriate minimum requirements analysis was conducted. The noise produced from vehicles and chain saws would introduce unnatural sound into backcountry wilderness and would temporarily detract from the remote wilderness experience for any visitors that may be in the immediate area. These effects to the natural soundscape within wilderness would only last for the duration of each treatment project and associated monitoring, and the effects would be considered short term, minor to moderate, and adverse. This is a result of mitigation measures being implemented by park staff and contractors while working within wilderness. These include vehicles only being turned on while transporting, and chain saws only being turned on while actually being used. The park would also request that contractors utilize only the quietest equipment possible when performing treatment actions.

Emissions from the mechanized equipment used for treatment and access would also have short-term impacts on local air quality. There would also be impacts from dust generation by equipment and vehicle traffic during project transport and treatment activities, depending on the soil moisture. These adverse impacts would be of negligible intensity because activities would be sporadic and the equipment, especially vehicles for transport, would not be in operation for long periods of time. In addition, dust generated during project activities would disperse quickly from the area.

The use of prescribed fire has become widely recognized as an essential tool to maintain natural fire-adapted vegetation categories. Its use in wilderness helps to maintain native plants and natural ecosystem functions. Under alternative A, prescribed fire would continue to be used in Everglades National Park and the Marjory Stoneman Douglas Wilderness. The effects from the use of prescribed fire in wilderness would be short term, minor, and adverse due to a temporary

increase in particulate matter and local degradation of visibility from smoke. These impacts would only last during, and shortly after, a prescribed fire was implemented. A detailed analysis of air quality impacts in Everglades National Park is included in the "Air Quality" impact topic evaluated in this draft EPMP/EIS.

The actual presence of vehicles and work crews in wilderness would impart a visual intrusion from the natural viewshed visitors would expect while visiting remote wilderness. This visual intrusion would be short term, adverse, negligible to minor, and would be highly localized. In addition, the viewshed would be diminished slightly in isolated areas where exotic plants are treated and dead plants are left standing, or where trees are cut with chain saws. The visual evidence from a chemically treated plant left standing or a cut stump could possibly persist for as much as 15 to 25 years. In some areas, such as where airboats or motorboats operate, cut stumps need to be left tall enough so that they are visible to visitors as a safety precaution. Trees would be cut with an irregular or jagged edge so that they would imitate a natural break, or the stump would be cut to the ground when possible, in order to mitigate impacts on the visual landscape. In instances where stumps would be cut to ground level, marker trees would be left standing to indicate an area where unsafe stumps may exist. However, even with the implementation of these mitigation measures, there are times when a monotypic stand would be treated and dead vegetation left standing, which would be noticeable to some visitors. These adverse impacts would be short and long term, depending on the native community type and its natural recovery, and would be of minor intensity because treatment project locations would be scattered throughout the park, and the above-described mitigation measures would be employed.

The trucks, airboats, off-road vehicles, motorboats, and helicopters that land on the ground have the potential to crush vegetation, compact soils, and facilitate the introduction of exotic plant species in remote areas. Trucks would be used on paved roads, levee roads, fire roads, and dirt roads, which would minimize new disturbance to park resources. Off-road vehicles would continue to predominantly provide support for the exotic plant management staff, and may also be used on fire roads, dirt roads, and trails. Off-road vehicles would create new disturbance that could remain visible in marshes for up to 3 to 5 years, but on established roads or trails, no impacts would be anticipated. In areas where helicopters land, vegetation could also be disturbed. To reduce the potential impacts related to new trail development and helicopter landing areas, the points of entry into the park would be minimized and chosen to be as discrete and limited as possible. A supervisory botanist would monitor the trail condition and recommend changes if necessary to prevent disturbance. The potential for disturbance to native vegetation and introduction of exotic plant species would result in short-term, negligible, adverse impacts. However, these highly localized impacts could be long term if damage occurred in extremely wet conditions because vehicles would penetrate the soil deeper and produce more effects that are more lasting.

Cumulative Impacts

There are regional projects being undertaken that aim to restore hydrologic function in south Florida and the Everglades. The Comprehensive Everglades Restoration Project includes more that 50 elements designed to capture, store, and redistribute freshwater previously lost to tides and to regulate the quality, quantity, timing, and distribution of flows. Eight projects are intended to provide improvements to flows in and around Everglades National Park, which would be a long-term, minor to moderate, beneficial effect on wilderness resources and values because the natural wilderness conditions would be restored. The C-111 Canal Project and the Modified Water Deliveries Project would both improve the hydroperiods and timing of water deliveries to the park, and would be considered a long-term, negligible to minor, beneficial effect. In addition, all efforts being taken by other agencies, such as the South Florida Water Management District, Florida Department of Transportation, and U.S. Fish and Wildlife Service, to treat exotic plants on their lands is a beneficial effect because the efforts would minimize the potential for exotic plants to infest Everglades National Park. The long-term, minor, beneficial effects of alternative A would contribute to beneficial effects on wilderness. Overall, beneficial effects of all of the projects, in conjunction with alternative A, would cumulatively result in long-term, moderate, beneficial effects on wilderness resources and values.

Noise from within the park and from surrounding areas can affect wilderness and the wilderness experience. Recreational boating activities in the park, vehicle use, and aircraft from nearby Homestead General Airport and Homestead Air Reserve Base all contribute noise into wilderness that could have long-term, moderate, adverse impacts. The management actions under alternative A would contribute moderate adverse impacts, but taking into consideration all other activities affecting the park, this would not be a very substantial contribution. Overall, cumulative adverse impacts on wilderness would be short and long term and of moderate intensity.

Conclusion

Adverse impacts on wilderness resources and values from exotic plant management actions would be short term and minor to moderate as a result of the temporary introduction of human-induced noise, visual intrusion, and local air quality decline. Effects from leaving dead exotic trees standing, as well as potential effects from vehicles traveling along previously undisturbed lands, especially those that could occur in very wet conditions, would be considered short and long term, negligible, and adverse. These impacts would be highly localized because of the mitigation measures that would be employed. Minor, beneficial effects would result over the long term from controlling exotic plant populations and sustaining the diverse, natural conditions and functions within designated wilderness.

Cumulative impacts would be moderate adverse. Alternative A would not result in impairment of wilderness resources and values.

ALTERNATIVE B — NEW FRAMEWORK FOR EXOTIC PLANT MANAGEMENT: INCREASED PLANNING, MONITORING, AND MITIGATION

Everglades National Park

Under alternative B, Everglades National Park would continue to implement the types of exotic plant treatment methods during initial treatment and for re-treatment as provided in alternative A. However, the decision tool for determining the method of treatment would differ, and increased planning, monitoring, and mitigation would be implemented. Therefore, the types of impacts that would occur under alternative B would be similar to those described above for alternative A; however, the intensity and timing of the impacts would differ. As described in the "Alternatives" chapter, the amount of infestation in the park would be reduced by approximately 50% each re-treatment interval and, over the long term, the park would achieve a maintenance level of infestation. Over the life of this plan, this alternative would provide a long-term, major, beneficial effect on wilderness resources throughout the park by reducing the damaging impacts of exotic plants and recovering a more natural and diverse ecosystem. This impact would be of major intensity because the magnitude of infestation (54%) that exists in the park would be substantially reduced to a maintenance level over time, and infested areas could return to conditions that are more natural.

Under alternative B, an optimal schedule would be employed that would increase the frequency of re-treatments. The number of times crews would be bringing motorized vehicles and equipment into wilderness for a specific project would increase from about every 2 years under alternative A to approximately every 6 months under alternative B. The frequency of helicopter use for crew transport and contract oversight would increase; however, helicopters would no longer be necessary for aerial herbicide spraying of large areas after the initial treatment. The motorized vehicles and equipment that would be necessary to carry out treatment activities would provide noise disturbance that would temporarily detract from the wilderness experience for any visitors in the area. These moderate adverse impacts would be short term, lasting only for the duration of each initial and re-treatment action.

Alternative B would also produce air quality impacts associated with the implementation of exotic plant management actions. Emissions from mechanized equipment used for treatment and access would have short-term, negligible, adverse impacts on air quality within wilderness. Depending on the soil moisture, there would also be impacts from dust generated by equipment and vehicle traffic during project transport and treatment activities. These impacts would be the same as would occur under the no-action alternative because, although the frequency of re-treatments would increase, equipment use would still be sporadic and would only be operated for short periods of time. Prescribed fire would be used more regularly under alternative B, which would contribute adverse impacts on visibility. In addition to prescribed fire being used as a tool for the initial treatment of Old World climbing fern, it would also be considered for re-treatment of this same species, as well as for melaleuca, Australian pine, and Brazilian pepper. The frequency of prescribed fire would therefore increase; however, the scale of the fire would be reduced considerably with each

re-treatment interval because of the reduction in infestation. The potential treatment areas where prescribed fire could potentially be used under alternative B would be about 63,206 acres. This is the estimate of lands where fire may be appropriate; it would not necessarily be used in all treatment areas and would likely involve only a portion of project areas. The smoke and particulate matter emitted from each prescribed fire would temporarily degrade visibility in and around the project area during and immediately following a fire, which would have short-term, moderate, adverse impacts on wilderness resources.

The adverse impacts on the viewshed in wilderness would be similar as those described under alternative A. The actual presence of vehicles and work crews in remote wilderness areas would provide a visual intrusion, which would be a short-term, negligible, adverse impact. The effects on the viewshed from the evidence of treated exotic plants would range depending on the extent in which an area is infested and its recovery rate. Although alternative B would involve more frequent re-treatment activities, the size of the treatment areas would decline over time. A large monotypic stand with dead trees left standing would not impart the same sense of wilderness character as that of a natural area. The park would carry out mitigation measures to make treated areas appear more natural, such as cutting trees in a manner that would imitate a natural break. Re-treatment activities would occur more frequently under alternative B, but the size of the area needing re-treatment would decline over time as the amount of infestation is reduced. Therefore, impacts on the viewshed within wilderness from re-treatment activities would be short and long term, minor, and adverse depending on the native community type and its recovery. These impacts could range up to moderate in certain areas if a considerable amount of exotic plants were treated and several stumps remained or dead trees left standing.

The trucks, airboats, off-road vehicles, motorboats, and helicopters that land on the ground have the potential to crush vegetation, compact soils, and facilitate the introduction of exotic plant species in remote areas. Vehicles would remain on established roads or trails to minimize disturbance; however, vehicles used for off-road support could create some new trails. impacts would be more apparent in marshes or very wet conditions where vehicles could penetrate the soil deeper and create longer-lasting impacts. Because the frequency of re-treatments would increase under alternative B, ground disturbance from vehicles transporting crews or equipment would result in short-term, minor, adverse impacts. Impacts would be long term if damage occurred in very wet conditions.

Cumulative Impacts

As described in alternative A, there are regional projects being undertaken that aim to restore hydrologic function in south Florida and the Everglades that would beneficially contribute up to moderate effects on wilderness resources and values. In addition, all efforts being taken by other agencies, such as the South Florida Water Management District, Florida Department of Transportation, and U.S. Fish and Wildlife Service, to treat exotic plants on their lands is a beneficial effect because the efforts would minimize the potential for exotic plants to infest Everglades National Park. The long-term, major, beneficial effects of alternative B would strongly contribute to beneficial effects on wilderness.

Overall, beneficial effects of all of these projects in conjunction with alternative A would cumulatively result in long-term, major, beneficial effects to wilderness resources and values.

Noise from within the park and from surrounding areas can affect wilderness resources and values. Recreational boating activities in the park, vehicle use, and aircraft from nearby Homestead General Airport and Homestead Air Reserve Base all contribute noise into wilderness that could result in long-term, moderate, adverse impacts. The adverse impacts from alternative B would contribute to moderate adverse cumulative impacts, but taking into consideration all other activities affecting the park, this would not be a very substantial contribution. The park would also implement a fire management plan that would use prescribed fire to maintain naturally functioning ecosystems and prevent more intense and damaging wildfires from occurring. Adverse impacts from the use of prescribed fire would have impacts on air quality within wilderness similar to those that would occur from alternative A. Many of these adverse impacts would be offset by the beneficial effects from managing fire and ultimately reducing the threat for future intense wildfires that would have greater impacts. Overall, cumulative adverse impacts on wilderness would be short and long term and of moderate intensity.

Conclusion

Adverse impacts related to human-induced noise and visual intrusion from the implementation of exotic plant management actions would be short term and of minor to moderate intensity. The higher-intensity impacts would result from the potential for localized noise disturbance from motorized equipment and visual effects when large areas are treated. Visual impacts could become long term depending on the native vegetation category type and its recovery. The emissions from mechanized equipment and smoke from prescribed fire would result in short-term impacts on air quality and the viewshed but only in the immediate vicinity of the treatment areas. Emissions from tools and vehicles would be negligible, but impacts on air quality within wilderness could range up to moderate if the park were implement larger prescribed fires. Vehicles traveling along previously undisturbed lands within wilderness, especially if they were used under very wet conditions, would produce short- and long-term, minor, adverse impacts from rutting. Major beneficial effects would result over the long term from controlling exotic plant populations and sustaining the diverse, natural conditions and functions within designated wilderness.

Cumulative impacts would be the same as alternative A. Alternative B would not result in impairment of wilderness resources and values.

ALTERNATIVE C — NEW FRAMEWORK FOR EXOTIC PLANT MANAGEMENT: INCREASED PLANNING, MONITORING, AND MITIGATION, WITH AN EMPHASIS ON ACTIVE RESTORATION OF NATIVE PLANTS

Everglades National Park

Under alternative C, Everglades National Park would continue to implement the types of exotic plant treatment methods during initial treatment and for

re-treatment as included in alternative A. However, the decision tool for determining the method of treatment would differ, and there would be increased planning, monitoring, and mitigation similar to alternative B. Active restoration methods such as seeding, planting, and altering hydrology would also be employed in appropriate areas. As described in the "Alternatives" chapter, the amount of infestation in the park would be reduced by approximately 50% each re-treatment interval and, over the long term, the park would achieve a maintenance level of infestation. Over the 10-year life of the plan, this alternative would provide a long-term, major, beneficial effect on wilderness resources throughout the park by reducing the damaging impacts of exotic plants and recovering a more natural and diverse ecosystem throughout a large portion of the park. The park would achieve these beneficial effects at a faster rate than under alternative B in areas where active restoration is used.

Under alternative C, an optimal schedule would be employed that would increase the frequency of re-treatments when compared to current exotic plant management. When active restoration is used, the areas needing re-treatment would be reduced, and with each re-treatment interval, the intensity of effort that would be necessary would also be reduced. For the most part, the frequency of vehicle and equipment use associated with treatment activities under alternative C would be slightly less than under alternative B when taking into account restoration work. The restoration activities would contribute short-term, adverse impacts of varying intensity depending on the level of effort. All types of restoration activities would involve noise impacts related to vehicles accessing the sites. When the park implements physical site alterations, higher intensity impacts could occur from the noise associated with bulldozers, backhoes, and other similar equipment. The park would likely use these large-scale restoration methods in the disturbed areas located in the northeast portion of the park. The motorized vehicles and equipment used for monitoring, treatment, and restoration would provide noise disturbance that would detract from the wilderness experience for the length of the activity. These adverse impacts would be short term and could range up to a moderate intensity.

Management actions under alternative C would produce air quality impacts that are similar to those described for alternative B. The vehicles used for transport, monitoring, and treatment, equipment used for treatment activities, and heavy equipment potentially used for active restoration would all produce emissions that would impact air quality in wilderness areas. Depending on soil moisture, there would also be impacts from dust generated by equipment and vehicle traffic during project transport, treatment, and restoration activities. These impacts on wilderness would last the duration of equipment usage and would be short term, negligible, and adverse, but could range to minor if site alteration occurred over a large area. Because the park would actively restore certain project areas, those areas where prescribed fire could be used would be slightly less than under alternative B. The potential treatment areas where prescribed fire could potentially be used under alternative C would be about 59,728 acres. This is the estimate of lands where fire may be appropriate; it would not necessarily be used in all treatment areas and would likely involve only a portion of project areas. The smoke and particulate matter emitted from each prescribed fire would temporarily degrade visibility in and around the project area during and

immediately following a fire, which would have short-term, moderate, adverse impacts on wilderness resources.

The actual presence of vehicles and work crews in remote wilderness areas would provide a visual intrusion, which would be a short term, negligible, adverse impact. Under alternative C, the long-term impacts on the viewshed in many areas would not last as long as under alternatives A and B because active restoration efforts would assist areas in recovering native vegetation faster than would normally occur. There would still be evidence of treated exotic plants, especially in areas where larger monotypic stands are left with dead standing trees. These impacts would be adverse because they would not impart the same wilderness experience as a fully vegetated area. When necessary, the park would implement mitigation measures to make treated areas appear more natural, such as cutting trees in a manner that would imitate a natural break. Therefore, impacts on the viewshed within wilderness from remnant treated exotic plants would be short and long term, minor, and adverse, although areas that would undergo active restoration would recover faster than if no active restoration was performed. In other areas, the duration of impacts would vary depending on the native vegetation category type and its natural recovery. Impacts could range up to moderate if a considerable amount of vegetation is treated and several stumps remained or dead trees were left standing, and the area is not actively restored.

The trucks, airboats, off-road vehicles, motorboats, and helicopters that land on the ground have the potential to crush vegetation, compact soils, and facilitate the introduction of exotic plant species in remote areas. These adverse impacts would be considered short term and minor, and could be considered long-term if new trails were established in previously undisturbed or very wet conditions.

Cumulative Impacts

Cumulative impacts would be very similar to those described for alternatives A and B. Regional projects being undertaken that aim to restore hydrologic function in south Florida and the Everglades would beneficially contribute up to moderate effects on wilderness resources and values. In addition, all efforts being taken by other agencies to treat exotic plants on their lands would be a beneficial effect because the efforts would help minimize the potential for exotic plants to infest Everglades National Park. The long-term, major, beneficial effects of alternative C would strongly contribute to these beneficial effects to wilderness. Overall, beneficial effects of all of these projects, in conjunction with alternative A, would cumulatively result in long-term, major, beneficial effects on wilderness resources and values.

Noise from within the park and from surrounding areas can adversely affect wilderness resources and values up to a moderate level. The adverse impacts from alternative C would contribute moderate adverse impacts, but taking into consideration all other activities affecting the park, this would not be a very substantial contribution. The park would also implement a fire management plan that would use prescribed fire to maintain a naturally functioning ecosystem and prevent more intense and damaging wildfires from occurring. The use of prescribed fire would have impacts on air quality within wilderness similar to those that would occur from alternative B. Many of these adverse impacts would

be offset by the beneficial effects from managing fire and ultimately reducing the threat for future intense wildfires that would produce greater impacts. Overall, cumulative adverse impacts on wilderness would be short and long term and moderate.

Conclusion

Adverse impacts related to human-induced noise and visual intrusion from the implementation of exotic plant management actions would be short term and minor to moderate. The higher-intensity impacts would result from the potential for localized noise disturbance from motorized equipment and visual effects when large areas are treated. Visual impacts could become long-term depending on the native vegetation category type and its recovery. Short-term air quality impacts would occur in the immediate vicinity of the management actions from emissions from mechanized equipment, dust generated from project activities and transport vehicles, and smoke from prescribed fires. Emissions from tools and vehicles and the generation of dust would be negligible; however, impacts on air quality within wilderness could range up to moderate if the park implements larger prescribed fires. Vehicles traveling along previously undisturbed lands within wilderness, especially those that could occur in very wet conditions would produce short- and long-term, minor, adverse impacts from rutting. Major beneficial effects would result over the long term from controlling exotic plant populations and sustaining the diverse, natural conditions and functions within designated wilderness. These beneficial effects would occur more rapidly with the employment of active restoration methods because the vegetation category would recover faster than what would occur under passive (natural) restoration.

Cumulative impacts would be the same as alternative A. Alternative C would not result in impairment of wilderness resources and values.

PUBLIC HEALTH AND SAFETY

GUIDING REGULATIONS AND POLICIES

NPS GUIDANCE

NPS *Management Policies 2001* (NPS 2001e) requires that parks

> provide a safe and healthful environment for visitors and employees. Management actions strive to protect human life and provide injury-free visits, to the extent that they will not impair park resources and values
>
> reduce or remove known hazards and apply other appropriate measures, including closures, guarding, signing, or other forms of education

In addition, NPS *Management Policies 2001* specify that park visitors assume a substantial degree of risk and responsibility for their own safety when visiting areas that are managed and maintained as natural, cultural, or recreational environments (NPS 2001e).

METHODOLOGY AND ASSUMPTIONS

GEOGRAPHIC AREA EVALUATED FOR IMPACTS

The affected area for human health risks includes lands and waters that people access in the nine parks.

IMPACT CRITERIA AND METHODOLOGY

Safety concerns expressed in the issue statements fall into two broad categories: risks posed by the exotic plants themselves and risks posed by treatment to control those plants. The "Purpose of and Need for Action" chapter presents detailed discussion of these risks, including those associated with herbicides and prescribed fire. The "Alternatives" chapter discusses current and proposed exotic plant management, including treatments and mitigation of risks associated with those treatments.

Specific issues addressed in the analysis include those developed through internal and public scoping. Representatives from the nine participating parks have developed the following issue statements:

> The presence of exotic plants may pose a health risk to park visitors, staff, or area residents. Many people are allergic to exotic plants. Melaleuca causes severe respiratory disorders in some people. Brazilian pepper is in the same family as poison ivy, and some people experience contact dermatitis after exposure to the leaves, berries, and sap.
>
> As discussed earlier in the "Native Plants and Vegetation categories" and "Wildlife and Wildlife Habitat" sections, exotic plants can alter the intensity and structure of wildfires due to an increase in fuel loads and flammable chemicals in leaves and can also facilitate the spread of fire into

the forest canopy. Stands of exotic plants near residential areas increase the risk of fire and threat to public health and safety. An overgrowth of exotic plants close to roadways can potentially interfere with travelers' ability to navigate or view road signs.

The treatment of exotic plants may also present health and safety risks to workers, park visitors, and area residents. The operation of equipment used to treat exotic plants may pose a danger to the operators or those in the vicinity of the treatment areas. There could be risks to workers during transport to treatment areas in boats, helicopters, and trucks.

Fire and flooding to treat exotic plants may damage property and pose a safety risk to people. Exotic tree species (like Australian pine, which can grow to 100 feet tall) left standing following chemical treatment may present a safety hazard when they decay and fall after treatment.

Chemicals (herbicides) used to control exotic plants may enter the groundwater and have adverse impacts on public health and safety. The use of EPA-approved herbicides and use-specific application methods would reduce this risk significantly because the EPA requires that before a pesticide may be sold in the United States, research must show that its use will not present unreasonable risks to people and the environment.

People in or near exotic plant treatment areas may be accidentally exposed to herbicides; however, the herbicides typically used in the parks are rarely classified as "restricted" or potentially harmful to humans or the environment.

Impacts are related to the effects of exotic plants on humans (e.g., exposure to pollens and plant chemicals) and the measures to control the plants (e.g., exposure to the chemical herbicides applied to infested sites, exposure to smoke or flames from prescribed fires). Direct and indirect impacts can be determined by assessing infested areas where plant control measures would be applied.

Impacts on public health and safety were evaluated using the process described in the "General Methodology for Establishing Impacts Thresholds and Measuring Effects by Resource" section of this chapter. Impact threshold definitions for public health and safety are as follows.

IMPACT THRESHOLD DEFINITIONS

Negligible — Public health and safety would not be affected; effects on employee and visitor health or safety would not be appreciable or measurable.

Minor — Effects on employee and/or visitor health and safety would be detectable; however, they would not produce an appreciable change in public health or safety. Mitigation would be relatively simple and likely successful.

Moderate — The effects would be readily apparent, and would result in significant, noticeable effects on employee and/or visitor health and safety on a local scale. Changes in rates or severity of injury or illness could be measured.

Mitigation would probably be necessary to offset adverse effects and would likely be successful.

Major — The effects would be swiftly apparent, and would result in substantial, noticeable effects on employee and/or visitor health and safety on a regional scale, and could lead to employee or visitor mortality. Extensive mitigation would be needed to offset adverse effects, and its success would not be assured.

IMPACTS OF THE ALTERNATIVES ON PUBLIC HEALTH AND SAFETY

ALTERNATIVE A — NO ACTION: CONTINUE CURRENT MANAGEMENT

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Under alternative A, parks would continue to select exotic plants for treatment and methods for that treatment on an as-needed basis. To the extent possible, managers would take action whenever exotic plant species are known to interfere with natural processes and the perpetuation of natural features or native species, especially those that are endangered, threatened, or otherwise unique. However, all too often re-treatment is determined by funding cycles and fund availability, resulting in re-treatment every three to 5 years. As a result, by the time areas receive follow-up treatment, exotic plants have re-established themselves so thoroughly that treatment methods, to be effective, are essentially the same as those of the initial treatment; that is, primarily herbicide application. Three of the nine parks have treated all infested acres within their boundaries. Biscayne National Park has initially treated all infested acreage over the course of 5 years. Only Dry Tortugas National Park and Buck Island Reef National Monument have reduced their exotic plant population enough to achieve a maintenance treatment level with its associated reduced risks.

The parks would continue to manage exotic plants using a variety of physical, mechanical, chemical, and biological methods. Treatment decisions would continue to be driven primarily by funding opportunities. Monitoring to determine the need to re-treat areas would continue to be sporadic, and parks would continue to rely on return and growth of native plants from native seed sources that naturally establish in the treated site.

The “Alternatives” chapter provides a detailed discussion of alternative A.

Although allergic reactions to melaleuca and Brazilian pepper are possible, severe reactions are rare, and none is known to have occurred in the nine parks. There is also a slight chance that overgrowth of exotic plants close to roadways can interfere with drivers’ ability to navigate or view road signs, and dense stands of melaleuca and Australian pine can present a hazard to those using airboats (Taylor 2004). The greatest threat, though, to public health and safety from exotic plant infestations appears to be the threat of wildfires. Dense stands of exotic plants, such as melaleuca or Australian pine, increase the available fuel

load, while exotic plants such as Old World climbing fern can intensify wildfires by providing access to tree crowns.

Fort Jefferson, Dry Tortugas National Park

To the extent that parks reduce populations of these exotic plants, they also reduce the threat to public health and safety. Control efforts have reduced target plant populations in some parks: Dry Tortugas National Park has reduced them to maintenance levels, while Biscayne National Park anticipates achieving that level by the end of 2004. In these parks, exotic plant management actions have had long-term, negligible to minor, beneficial effects on public health and safety. In all parks, similar benefits would result from the treatment of exotic plants that return slowly, such a melaleuca and Australian pine, and that can be controlled to a maintenance level with current management methods and frequencies. Fast growing exotic plants, such as lygodium, would continue to expand their territory, resulting in long-term, negligible to minor, adverse impacts on public health and safety.

Published information on the modes of action, efficacy, and best management practices associated with each treatment method are used in addition to professional experience and judgment to select appropriate treatments. Biological agents would not be released until approved by the U.S. Department of Agriculture Animal and Plant Health Inspection Service and reviewed by an integrated pest management specialist.

Workers may be exposed to potential safety hazards by equipment used to treat exotic plants and during transport by boats, helicopters, and trucks to treatment areas, but the NPS uses accepted mitigation measures to reduce such risks. NPS policies require that all personnel be physically fit and certified; wear protective clothing, boots, and eyewear; and satisfy specific educational and safety requirements of the job they are performing. Contractors must meet applicable federal, state, and local regulations. Risks associated with vehicles and other machinery are minimized by strict equipment maintenance routines, implementation of health and safety plans, and use of trained, experienced workers. The use of helicopters and heavy equipment are limited during heavy visitation periods and in high visitor-use areas.

To protect the public during treatment activities, area closures may be instituted and advance warning provided. Signage and flagging would identify all treatment areas. In treatment areas where motorboats or airboats operate, trees can be left standing or “marker trees” used to provide visual evidence of treated vegetation. As a result of such measures, the adverse impacts on public health and safety resulting from use of equipment for treatment and transportation in the parks would be short term and minor.

Internal scoping and public comments show that most popular concerns regarding the safety of exotic plant treatments center on prescribed fires and

herbicide use, reflecting the findings of a recent survey in Florida and Minnesota (Nelson et al. 2003).

Public Health Concerns Regarding Use of Herbicides. Although many members of the public are wary of herbicides, the NPS uses best management practices to significantly reduce associated risks. Herbicides are extensively screened and tested before they are approved and registered for use by the U.S. Environmental Protection Agency, which classifies none of the herbicides used by participating parks as "restricted" (that is, potentially harmful to humans or the environment). An NPS integrated pest management coordinator reviews all proposed herbicide use on a case-by-case basis to ensure that applicable safety precautions are met (NPS 2003m). Proper storage and transport practices ensure safety before application. Appropriate application methods minimize the chances of direct or indirect exposure by applicators and the public. A spill containment kit would always be on hand during chemical treatments and, in case of an accidental herbicide spill, specific procedures as outlined in the *Exotic Plant Management Teams Operations Handbook* (NPS 2003m) would be followed.

None of the proposed herbicides poses a health risk to members of the public from typical exposures. Mitigation efforts to reduce the risk of exposure to the public include information at entrance stations and visitor centers, verbal communication by park staff and contractors, signing and/or closing treatment sites, and prohibiting public access to herbicide mixing and spraying sites. Adjacent landowners are notified in advance of herbicide applications. Because any public exposure to herbicides is more likely to be indirect than direct, associated risks are less for the general public than for applicators.

The *Exotic Plant Management Teams Operations Handbook* (NPS 2003m) provides detailed guidelines on the proper storage and transportation of all herbicides, identifies the proper personal protective equipment that must be used during herbicide application, and proper disposal of herbicides. Mitigation measures used by parks and contractors to reduce the risk of accidental herbicide contamination of resources to which the public may be exposed also include defined procedures for mixing, loading, and disposing of herbicides; mixing herbicides only at sites where spills could not enter streams; properly calibrating, rinsing, and cleaning equipment; having an approved herbicide emergency spill plan and spill containment equipment available during herbicide application; and maintaining no-treatment / no-spray buffer zones around water bodies.

Contracted companies use the accepted, industry standard methodologies approved by the NPS and come with technical experience, training, and certifications required for safe handling of the materials and supplies, as well as the supervision and administration critical to treatment success. The NPS requires that all staff applying herbicides have proper training, licenses, and certification. Aerial spraying would involve minimal risk to the public because the only park to use this technique, Everglades National Park, applies drift mitigation measures and uses aerial spraying only in areas inaccessible by land or water.

Although workers may be at some risk during mixing and application procedures, a U.S. Forest Service examination of accident records for a 10-year period

revealed no major accidents involving herbicide application projects (USFS 2003b). There has been one report of herbicides possibly affecting worker health and safety in the nine participating parks: a contractor at Biscayne National Park became ill while spraying herbicides. He was taken to the emergency room, and made a full recovery. No link was shown between his illness and the herbicide application. Mitigation measures to prevent and reduce risks from exposure include training in mixing, loading, and applying herbicides; required use of personal protective equipment; and following directions on herbicide labels. In addition, individuals with known hypersensitivity to herbicides used in the parks would not be permitted to work on spray crews.

Due to the EPA-required testing and certification of herbicides and the mitigation measures taken by the parks and their contractors, herbicide use would have minor, adverse impacts on public health and safety in both the long and short term.

Public Health Concerns Regarding Prescribed Fires. Primary concerns expressed about prescribed fires are containment of the fire and the effects of smoke (Nelson et al. 2003). Such fires are used for exotic plant control in Big Cypress National Preserve and Everglades National Park. In each park, not more than one such treatment occurs annually, and it is performed by the parks' fire management teams in coordination with local fire officials (Burch 2004c; Taylor 2004d). Because fire management teams are well trained and follow stringent safety procedures, adverse impacts such as risk of injury from burns while starting prescribed fires or from loss of control over prescribed fires are negligible to minor and short term.

Smoke from fire may degrade air quality. Although some interested parties have expressed concern that smoke from areas previously treated with herbicides may contain dangerous levels of herbicide residues, available evidence indicates that actual levels are well below hazardous concentrations (NCASi 1987; USFS 1989; McMahon and Bush 1992). Fire management techniques used by the NPS minimize the amount of smoke produced by prescribed fires and reduce how much of that smoke drifts into smoke-sensitive areas such as population centers and roads. Mitigation measures also include encouraging workers and volunteers to stay upwind of fire and using signage to alert visitors to planned fires so that they may avoid exposure to the smoke. Such precautions help limit adverse impacts on public health and safety to short term and minor.

Another concern regarding control techniques involving prescribed fire or herbicides is that trees left standing after treatment could decay and fall, endangering nearby workers or members of the public. This risk is minimal because most treatment currently takes place in remotes areas that are not easily accessible. When such treatment occurs in visited areas, standard precautions, such as cutting down snags, can reduce the effect to a short-term, negligible, adverse impact.

Cumulative Impacts

Pubic health and safety is affected by activities inside and outside of the parks. These include other herbicide and chemical application projects, fire programs,

and general park operations. Over all these past, present, and future activities have a negligible to moderate, short-term and long-term, adverse cumulative effects to public health and safety.

Chemical are applied on public and private lands outside of the parks, often in multiple simultaneous projects and over extensive areas. These can include control of exotic vegetation on public and private lands, applications of herbicides and pesticides to agricultural lands, and aerial applications of insecticides for mosquito control. Applications are assumed to be made using best management practices similar to those described for National Park Service applications. Often they are in remote areas where risks may be posed to employees but effects on the general public would be minimal. The cumulative effects of applications of chemicals from past, present, and future activities would be minor to moderate, adverse, and both long term and short term.

Increases in weed infestations on adjacent lands may cumulatively increase the possibility of adverse impacts on public health and safety through the potential for allergic reactions in staff, workers, and the public. The cumulative effects would be negligible to minor.

Within parks the use of prescribed fire for other resource management purposes results in health and safety impacts that are short term, minor, and adverse. This results from the risks from operations and management of fire projects and exposure to smoke and particulates.

General park operations, maintenance and resource management activities such as construction or aerial monitoring in parks result in exposure to risks from the operation of machinery, climbing and lifting, helicopter use, handling of chemicals and toxic materials, and performing operations in traffic areas. These result in short-term, minor adverse impacts.

New general management plans are providing enhanced goals and frameworks for management of park operations and visitor safety and would contribute to long-term moderate benefits. Implementation of improved management as a result of new plans would not eliminate risks to public health and safety within the parks, and would not substantial improve the overall negligible to moderate adverse cumulative effects from all past, present, and future activities considered in this analysis.

The actions occurring under alternative A would reduce exotic plant infestations to maintenance levels and result in long-term, negligible to minor beneficial effects. Exotic plant treatments would result in short-term minor adverse effects. These would contribute to the cumulative effects of other past, present, and future activities, but the overall cumulative effect would remain negligible to moderate, short term and long term, and adverse.

Conclusion

In parks that have reduced exotic plant infestations to a maintenance level, exotic plant management actions have had long-term, negligible to minor, beneficial effects on public health and safety. In other parks, exotic plants continue to

expand their territory and would continue to present a long-term, negligible to minor, adverse impact on public health and safety. The adverse impacts on public health and safety resulting from exotic plant treatments would be short term and minor. Any cumulative adverse impacts would be negligible and short term.

ALTERNATIVE B — NEW FRAMEWORK FOR EXOTIC PLANT MANAGEMENT: INCREASED PLANNING, MONITORING, AND MITIGATION

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Alternative B would provide exotic plant managers with a decision-making tool to determine the most effective treatments for exotic plants that occur in native vegetation categories. This alternative also involves a more effective re-treatment cycle of 6 months. Treating the younger, smaller exotic plants that would be present under a 6-month treatment cycle would allow more efficient re-treatment than under the current 3-year re-treatment cycle, wherein the plants have more time to grow and spread, resulting in increased need for treatment and increased risks to applicators, staff, and the public. Treatment methods using backpack sprayers, hand pulling, or prescribed fire could replace hack and squirt treatment or aerial spraying. The Florida Department of Environmental Protection predicts that with semiannual re-treatment, the amount of herbicide needed per acre would decline by half each year, significantly reducing the herbicide load on treated areas and potential exposure for applicators (FDEP 2004c).

This alternative would also includes regular, rigorous monitoring to identify regeneration rates of native plants, re-infestation rates of exotic plants, and the effectiveness of treatment methods, allowing resource managers to fine tune treatments to improve their effectiveness. As treatments reduce infested acres in the parks and, likewise, the treatment required to control exotic plants, the impacts on public health and safety from the exotic plants and methods to control would decline.

The “Alternatives” chapter provides a detailed discussion of alternative B.

As under alternative A, Dry Tortugas National Park and Buck Island Reef National Monument would continue to suppress exotic plants at a maintenance level. In these parks, exotic plant management actions have had long-term, negligible to minor, beneficial effects on public health and safety. The more effective re-treatment under alternative B would allow other parks to also reduce their exotic plants infestations to maintenance levels, reducing the impacts on public health and safety in those parks to negligible levels.

More effective re-treatment scheduling would reduce the number of acres requiring treatment each year and the amount of transportation to and from treatment sites, resulting in simultaneous declines in related risks. These changes would be partially offset by increases in monitoring and active restoration. The parks would continue to follow the same mitigation measures as in alternative A to protect staff, contractors, and the public during transportation associated with treatment of exotic plants and related activities such as monitoring. As a result of

such measures, the adverse impacts on public health and safety resulting from use of equipment for treatment and transportation in the parks would be short term and negligible to minor, with the risk diminishing as declining levels of infestation reduce the need for treatment activities.

Public Health Concerns Regarding Use of Herbicides. As in alternative A, parks and contractors would use only EPA-approved herbicides that are not classified as restricted. Herbicide use would follow the procedures in the *Exotic Plant Management Teams Operations Handbook* (NPS 2003m) and best management practices. Therefore, herbicide use would have negligible to minor, adverse impacts on public health and safety in both the long and short term, with the intensity diminishing during the life of the plan as the amount of acres requiring treatment declines.

Public Health Concerns Regarding Prescribed Fires. Big Cypress National Preserve may use a fire regime to re-treat Old World climbing fern within 1 year after initial herbicide treatment of infestations, and the number of prescribed fires in the other south Florida parks could increase slightly over current levels The impacts on public health and safety, however, would remain negligible due to the use of fire management practices and post-treatment precautions proposed under alternative B. Prescribed fires to control exotic plants would be coordinated with the parks' fire management teams.

Cumulative Impacts

The cumulative effects of other past, present, and future actions on public health and safety would be the same as discussed under alternative A, and would be negligible to moderate, short term and long term, and adverse.

The actions occurring under alternative B would reduce exotic plant infestations to maintenance levels and result in long-term, negligible to minor beneficial effects. Exotic plant treatments would result in short-term and negligible to minor adverse effects. These would contribute to the cumulative effects of other past, present, and future activities, but the overall cumulative effect would remain negligible to moderate.

Conclusion

The more effective re-treatment schedule proposed under alternative B would help all parks reduce exotic plant infestations to maintenance levels, thereby reducing the risks posed by exotic plants to negligible. The adverse impacts on public health and safety resulting from treatment in the parks would be short term and minor, with long-term impacts declining to negligible to minor as parks reduce infestations. Any adverse cumulative impacts would be negligible.

ALTERNATIVE C — NEW FRAMEWORK FOR EXOTIC PLANT MANAGEMENT: INCREASED PLANNING, MONITORING, AND MITIGATION, WITH AN EMPHASIS ON ACTIVE RESTORATION OF NATIVE PLANTS

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Alternative C adopts the same principles and methods described in alternative B, plus an active restoration plan, with some alterations to the monitoring plan and the criteria used to determine success of treatment. Physical site alterations could involve the removal or addition of soils or hydrologic alterations within treatment areas, which often involve the use of heavy construction machinery to alter the physical structure of the site. The "Alternatives" chapter provides a detailed discussion of alternative C.

As with alternative B, parks would reduce exotic plant infestations to maintenance levels, and risks posed by exotic plants would decline to negligible. These reductions would occur at a slightly faster rate under alternative C because active restoration, where appropriate, would somewhat reduce the potential for re-infestation.

As with alternative B, the adverse impacts on public health and safety resulting from use of equipment for treatment and transportation in the parks would be short term and negligible to minor, with the risk diminishing as declining levels of infestation reduce the need for treatment activities. The improved level of return of native species as a result of active restoration under alternative C would slightly speed the decline in infestations, somewhat speeding the reduction in associated treatment risks.

Public Health Concerns Regarding Use of Herbicides. As in alternatives A and B, parks and contractors would use only EPA-approved herbicides not classified as restricted, would follow the procedures in the *Exotic Plant Management Teams Operations Handbook* (NPS 2003m), and use best management practices. Herbicide use would have negligible to minor adverse impacts on public health and safety in both the long and short term, with the intensity diminishing over the 10-year life of the plan as the amount of acres requiring treatment declines.

Public Health Concerns Regarding Prescribed Fires. While the number of prescribed fires in south Florida parks could increase slightly over current levels (all except Big Cypress National Preserve could use a fire regime to re-treat lygodium within 1 year after initial herbicide treatment of infestations), the use of fire management practices and post-treatment precautions used under alternative A would ensure that the impact on public health and safety would remain negligible. Prescribed fires to control exotic plants would be coordinated with the parks' fire management teams.

Cumulative Impacts

The cumulative effects of other past, present, and future actions on public health and safety would be the same as discussed under alternative A, and would be negligible to moderate, short term and long term, and adverse.

The actions occurring under alternative C would reduce exotic plant infestations to maintenance levels and result in long-term, negligible to minor beneficial effects. Exotic plant treatments would result in short-term and negligible to minor adverse effects. These would contribute to the cumulative effects of other past, present, and future activities, but the overall cumulative effect would remain negligible to moderate.

Conclusion

As under alternative B, parks would reduce exotic plant infestations to maintenance levels, and risks posed by exotic plants would decline to negligible. These reductions would occur at a slightly faster rate because active restoration, where appropriate, would somewhat reduce the potential for further infestation. The adverse impacts on public health and safety resulting from exotic plant treatments would be short term and minor, with long-term impacts declining to negligible to minor as parks reduce infestations. Any cumulative adverse impacts would be negligible.

ESSENTIAL FISH HABITAT

GUIDING REGULATIONS AND POLICIES

The *Magnuson-Stevens Fishery Conservation and Management Act*, as amended by the *Sustainable Fisheries Act of 1996* (Public Law 104-267) requires all federal agencies to consult with National Marine Fisheries Service on all actions, or proposed actions, permitted, funded, or undertaken by the agency, that may adversely affect Essential Fish Habitat. Essential fish habitat is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." "Waters" include aquatic areas and their associated physical, chemical and biological properties. "Substrate" includes sediment underlying the waters. "Necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem. Spawning, breeding, feeding, or growth to maturity covers all habitat types utilized by a species throughout its life cycle. The National Marine Fisheries Service would provide recommendations on conserving essential fish habitat to federal or state agencies for activities that would adversely affect essential fish habitat. The National Park Service would consult with the National Marine Fisheries Service before any action is undertaken that may affect essential fish habitat.

METHODOLOGY AND ASSUMPTIONS

GEOGRAPHIC AREA EVALUATED FOR IMPACTS

Canaveral National Seashore, Everglades National Park, Virgin Islands National Park, Salt River Bay National Historic Park, and Buck Island Reef National Monument were considered in the analysis of exotic plant management activities on essential fish habitat. The habitat that was considered in these parks are estuarine habitats including salt marshes and mangroves, seagrass beds, coral reefs, oyster and shell, hard bottom areas, and sand/soft bottom areas.

Within Everglades National Park, areas of mangroves and salt marshes along the western boundary of the park may be affected by the proposed actions. In the southern portion of the park mangroves, salt marshes, and seagrass in the Florida Bay area may be affected by management actions.

Within Canaveral National Seashore, salt marshes, mangroves, seagrass, and oyster and shell habitats within Mosquito Lagoon and the northern portion of the Indian River may be affected by exotic plant management activities.

In Virgin Islands National Park, treatment and restoration activities could affect seagrass and mangrove habitat that occur in the bay areas. Coral reefs and hard-bottom habitat along the shoreline could be affected where management activities occur on the adjacent lands.

At Salt River Bay National Historic Park, mangrove and seagrass habitat within the estuary could be affected by management activities in the park. Coral reefs adjacent to park lands could also be affected. And at Buck Island Reef National Monument, seagrass habitat along the southwestern end of the island and coral

reefs that surround the rest of the island may be affected by management activities.

IMPACT CRITERIA AND METHODOLOGY

Issues were identified during internal and public scoping that related to physical, mechanical, and chemical treatment of exotic plants as well as the means to access treatment sites may affect essential fish habitat. Biological control agents which facilitate the reduction of exotic plants in mangroves habitats which are important essential fish habitats have been discussed in the "Vegetation" section of this chapter and are not repeated here.

Use of prescribed fire to treat exotic plants in Everglades National Park or the potential for wildfire in Caribbean Parks may indirectly affect essential fish habitat by increasing sediments and nutrients.

Mechanical treatments may increase the chance of erosion, which can result in a reduction in water clarity, increased sedimentation, and elevated nutrient levels.

Chemical treatment may result in herbicides entering the water that may degrade water quality and alter habitat suitability for fish.

Accessing treatment areas may result in increased turbidity or result in direct physical damage (for example, from propellers) to essential fish habitat.

The intent of the 1996 *Magnuson-Stevens Fishery Conservation and Management Act* is to conserve and enhance essential fish habitat and focus conservation efforts on areas that are important to the life cycles of federally managed fish and shellfish. For this EPMP/EIS, it includes the protection of estuarine systems (mangroves and salt marshes), coral reefs, seagrasses, and hard-bottom habitats that provide refuge, foraging, and breeding areas for fish and shellfish.

The above issues were evaluated using information obtained through best professional judgment of park staff. In addition, relevant scientific literature and data was used to assess impacts. In particular, the following plans were used to evaluate impacts to essential fish habitat in the parks:

> FEIS for the *Generic Essential Fish Habitat Amendment to Caribbean Fisheries Management Plan 2004*.
>
> *South Florida Fisheries Management Plan* Amendment 1998.
>
> *Gulf Coast Fisheries Management Plan* Amendment 1998.

For a detailed analysis of effects of exotic plant management activities and cumulative effects analysis for mangroves, salt marshes, seagrasses in the "Vegetation" section of "Environmental Consequences."

ASSUMPTIONS

Impacts were evaluated considering the rate of return of both native and exotic species. In the tropical environment, the return of vegetation into disturbed areas can be rapid, reducing the potential for erosion of exposed soils. Therefore it is assumed that impacts would be most likely to occur when a rain event happens within a few months of vegetation removal.

It was also assumed that essential fish habitat closest to the terrestrial environment would be most affected by management activities that result in erosion of soils as sediments would fall out of the water column quickly or be trapped by vegetation or reefs.

IMPACT THRESHOLD DEFINITIONS

Negligible — The waters and substrates that define the essential fish habitat would not be affected or the effects would be at or below the level of detection, and the changes would be so slight that they would not be of any measurable or perceptible consequence to the essential fish habitat. Fisheries or invertebrate species that depend upon these habitats would not be affected.

Minor — Effects to waters and substrates that define the essential fish habitat would be detectable, although the effects would be localized, and would be small and essential habitat would not be lost in the area. The function of the habitat for fisheries or invertebrate species would not be affected. Although some individuals may avoid areas that are affected, populations of the fish and invertebrate species that use these habitats would not be affected.

Moderate — Effects to waters and substrate of the essential fish habitat would be readily detectable resulting in a loss of small portions of habitat and it would lose some of its function for fisheries or invertebrates that depend upon it. This would result in a decline in populations of these fish or invertebrate species in the local area.

Major — Effects to waters and substrates that define essential fish habitats would be widespread. The effects result in the loss of essential fish habitat over a large area and would result in a loss of function of the habitat to support fisheries and invertebrate populations resulting in a substantial decline in fisheries or invertebrate populations that rely upon that habitat.

Impairment — Within the parks, impacts to essential fish habitat would be major and the extent of degradation to the waters and substrate that define essential fish habitat would result in the inability of fish or invertebrates that rely on that habitat to spawn, breed, feed, or grow and thus a loss of populations of these species within the parks.

IMPACTS OF THE ALTERNATIVES ON ESSENTIAL FISH HABITAT

ALTERNATIVE A — NO ACTION: CONTINUE CURRENT MANAGEMENT

Physical, chemical, and mechanical treatment methods to control exotic plants may affect essential fish habitats within the parks by increasing turbidity and sedimentation, changing nutrient levels, decreasing water quality, or direct physical damage to the habitat. Treatment of exotic plants in mangrove habitats would promote restoration of the biological integrity of these areas of important essential fish habitat although under this alternative with treatment occurring sporadically restoration would not be complete. The overall long-term benefit would be negligible to minor in the Caribbean parks where infestation of these habitats is lower and up to moderate in Canaveral National Seashore and Everglades National Park where infestation is greater.

Canaveral National Seashore and Everglades National Park

The essential fish habitat within Everglades National Park and Canaveral National Seashore is comprised of estuarine waters and substrates (mud, sand, rock, and associated biological communities), including the submerged vegetation (seagrasses and algae), marshes and mangroves (GMFMC 1998; SAFMC 1998), and oyster and shell bottom at Canaveral National Seashore.

Everglades would use prescribed fire to control exotic plants in treatment areas. If controlled burns are used to treat exotic plants in areas adjacent to essential fish habitat, this could result in short-term negligible to minor effects to the water quality within the essential fish habitats as nutrients are released from the site. Large inputs of nutrients can result in eutrophication of estuarine waters which degrade the habitat and food available for fisheries dependent on the habitat. Increases in nutrient can result in increase bacteria and algal blooms which lowers dissolved oxygen levels which may cause some individuals to avoid the area.

Bare soils may also be exposed leading to increases in erosion potential. Following a rain event, transport of soils after a burn would increase sedimentation and turbidity in areas of essential fish habitat. Reduction in water clarity as a result of suspended sediment in the water column can clog fish gills, deter successful recruitment of invertebrates onto shell bottom or ocean hard bottom, reduce feeding success of visually oriented predators. Elevated turbidity also impacts the ability of submerged aquatic vegetation, such as seagrasses, to survive and grow.

Because these prescribed fire events are small-scale, native vegetation is present to trap and absorb nutrient and sediments, and elevations are low, the transport of nutrients and sediments to the waters would be minimal. These effects would not result in changes in permanent changes in habitat or cause long-term avoidance of the habitat as the burned areas would recover quickly and further reduce nutrient and sediment inputs. The adverse effects of prescribed fire on essential fish habitat would be localized to areas of input, short term, and negligible to minor. The impacts of sedimentation and turbidity on seagrass, mangroves, and salt marshes has been described in the "Vegetation" section of this "Environmental Consequences" chapter.

The use of mechanical methods to pull seedlings or cutting and mulching of monotypic stands using large trucks and equipment that would expose bare soils in Canaveral National Seashore and in Everglades National Park, may lead to sediment delivery into essential fish habitats. As stated above due to the topography and the high recovery rate of vegetation in the region little transport of soils to aquatic environments would be expected. Mechanical activities to remove exotic plants would have short-term adverse negligible to minor impacts on essential fish habitat.

Herbicides can enter the waterways through runoff and degrade essential fish habitats by adversely affecting the health and productivity of submerged and emergent vegetation (seagrasses and mangroves), and oysters. Only those herbicides that are registered for use in aquatic environments would be used in areas adjacent to waters containing essential fish habitat. In addition, as stated in the "Water Quality and Hydrology" section, the potential for runoff of herbicide into aquatic environments following herbicide application is low in the parks due to the rapid binding and/or breakdown of herbicides in the environment and the use BMPs and SOPs to avoid application when there is potential for extreme rain occurring after application of the herbicide. And the implementation of BMPs and SOPs during aerial applications in Everglades National Park would reduce the risk of herbicides entering the aquatic environment. The use of herbicides within the parks is expected to have short-term negligible to minor effects essential fish habitats.

Access to project areas via motor or air boats has the potential to result in direct physical damage to essential fish habitat and in particular to seagrasses within the park or result in increased turbidity. Motorized boating to sites has the potential to physically damage submerged vegetation, cause uprooting, and exposure of substrates as a result of propellers and groundings of boats. Propellers can also cause fine sediments to suspend in the water column and degrade water clarity and inhibiting growth. Seagrasses may recover quickly, if damage is slight and the substrate has not been severely altered (CFMC 2004). Because the use of boats to access sites would be infrequent the resulting turbidity increases would be very short-term and localized and would not be expected to affect submerged vegetation. Damage to seagrasses from propellers could be long term. With access to sites limited to park staff and contractors that are well trained in boating techniques in these sensitive areas of the parks, the direct physical adverse effects to submerged and emergent vegetation designated as essential fish habitat from access to sites would be short term and negligible to minor.

Virgin Islands National Park, Salt River Bay National Historic Park, and Buck Island Reef National Monument

The essential fish habitat within the Caribbean parks include, seagrasses; mangroves; benthic algae; coral habitats; sand/shell bottoms; soft bottoms; pelagic, and hard bottoms.

Large areas of infestation would not be treated by mechanical methods such as may occur in Canaveral National Seashore or Everglades National Park. The use of mechanical methods to pull seedlings or saplings would expose small areas of bare soils and result in minimal erosion of those soils. Because of the rapid

recovery of the vegetation and the small area of effect as a result of pulling individual seedlings, there would be no effects on essential fish habitats.

Under the no-action alternative, soils could be exposed after exotic plant treatments or in the event that a wildlife fire would occur in Salt River Bay or Virgin Islands National Park in areas of guinea grass infestation. Because of the elevation of the slopes in these parks, exposure of soils could result in sediments being transported into the marine and estuarine environments and adversely affect essential fish habitats by increasing sedimentation and turbidity. Sedimentation into the marine environment would affect submerged vegetation, coral habitat, and alter hardbottom habitat. Sediments can smother coral and increased turbidity would reduce the ability for photosynthesis by zooxanthellae. Corals live symbiotically with zooxanthellae which are single-celled algae that live in the tissues of corals and are essential to coral health and it gives them their color. Without these symbiotic plants, the coral animals would be unable to obtain enough nutrients to build their calcium carbonate skeletons, which accumulate to form the vast coral reefs of the tropics. Deposition of sediments would also make both the coral and hard-bottom habitats unsuitable for settlement and growth of new corals and other larvae (CFMC 2004). Large amounts of sedimentation and turbidity inhibits light availability and the ability of seagrasses to grow and survive.

The potential for soil erosion after treatment of exotic plants or following a wildfire in areas of untreated guinea grass is low as the root system of guinea grass and the rapid recovery of treated areas with native vegetation would stabilize soils minimizing the amount of sediment transported to the marine or estuarine environments (see the “Soils” section in this chapter). In addition, due to the concerns of resource staff about transport of sediments to essential fish habitats within the park, mitigation measures would be employed to minimize or eliminate such movement of soils after treatment. The short-term adverse effects on the essential fish habitat as a result of turbidity and sediments within the Caribbean parks would therefore be negligible to minor. The diversity and abundance of fish and invertebrates that rely on the habitat would not change as a result of exotic plant management activities.

Under the no-action alternative, areas of untreated guinea grass infestation in Salt River Bay (56 acres) and Virgin Islands National Park (400 acres) may go untreated for a number of years which increases the potential for wildfires in these areas which would result in the potential for nutrient flushing into areas of essential fish habitat. The threat of sediment and nutrient delivery to essential fish habitat is much greater at Salt River Bay where 56 acres of guinea grass persists close to the marine environment. As stated above nutrient loading can result in increased bacteria and algal blooms which lowers dissolved oxygen levels and alters light availability inhibiting the growth of seagrasses and corals. These effects are more typical when nutrient loading is chronic and at high levels. Nutrient loading in the event of a wildfire would not be chronic as pulses of nutrients would be added only following rain events. And the potential for nutrient transport to aquatic systems would decrease as either the exotic guinea grass recovered or native plants recovered in the area which would occur rapidly in this tropical environment. The adverse effects would be short term and range from negligible to minor dependent upon the size of the area burned.

The use of herbicides within the Caribbean parks is expected to have no effects on essential fish habitat. As described in the "Water Quality and Hydrology" section, the herbicides used in the parks have very little mobility or potential to effect water quality. Given the brief persistence and rapid degradation of these herbicides, the presence of native vegetation to reduce runoff into the environment, the use of BMPs and SOPs to prevent spills or leaking, there would be no effect on essential fish habitats from the use of herbicides.

The use of motorboats to access treatment areas can cause direct physical damage to essential fish habitats such as coral reefs, hard-bottom, and seagrasses either through grounding (propeller damage) or inadvertent placement of anchors. Recognizing this concern, Buck Island Reef and Virgin Islands National Park have defined specific areas where boats can moor and dock to reduce impacts to essential fish habitat in the parks. Contractors and staff would be made knowledgeable of the impacts of improper boating in this sensitive marine habitat and would be trained on how to access treatment areas properly to avoid disturbance to essential habitats. As a result, there would be negligible to minor short- and long-term adverse effects to essential fish habitat as a result of access by motorboat to transport crews and equipment to the monument.

Cumulative Impacts

Essential fish habitat is being affected by human induced environmental degradation that results from both fishing and recreational activities as well as activities such as coastal development and pollution from agricultural and urban land uses. These activities have degraded essential fish habitats in the past and continue to occur. Depending on the intensity and frequency of the activities, the long-term adverse impacts on essential fish habitat can range from moderate to major. Fishing related impacts to essential fish habitat result from the use of bottom-disturbing fishing gear such as trammel and gills nets. Boating activity due to commercial or recreational uses also disturb the bottom as a result of propellers, grounding, and anchoring. These activities disturb bottom substrates and uproot seagrass. Habitat such as corals and hard bottom can be physical destroyed and water clarity reduced as a result of these activities. The disturbance of soft bottom habitat can alter productivity of benthic microalgae and reduce structural complexity of the bottom (North Carolina Department of Environment and Natural Resources 2004).

A number of non-fishing impacts to EFH occur throughout the region, and include a variety of physical, water quality, and biological effects. The majority of these impacts are directly related to anthropogenic activities such as dredge and fill operations, urbanization and land development, and industrial and municipal waste, and they vary throughout the region. Nutrient loading from agricultural areas and sewage entering the water can severely degrade essential fish habitats. Excess nutrients fuel phytoplankton blooms in the water column, which can contribute to low oxygen events in the water column and bottom sediments, causing fish kills and mortality of fish and non-mobile invertebrates in the various habitats. Reduced light availability in the water column from plankton blooms and excessive epiphytic growth impacts the ability of seagrasses to survive and grow. Excess nutrient loading can result in toxic blooms such as red tide or *Pfiesteria* outbreaks.

Dredging activities uproot seagrasses and directly impact shell bottom, wetlands, or shallow soft bottom features. Conversion of shallow habitat to deep habitat from dredging activities results in loss of valuable nursery habitat and alters natural circulation patterns. Dredging can also degrade habitat by increasing turbidity and sedimentation.

Activities associated with urbanization (e.g., building construction, utility installation, road and bridge building, storm water discharge) can significantly affect EFH through habitat loss or modification. Construction activities and removal of vegetation that expose soils to erosion, alter essential fish habitat by increasing sedimentation which prohibits the settlement of corals and other larvae, and inhibits coral ability to feed. Increasing turbidity in the habitat and diminishing light penetration causes mortality of seagrass and corals and inhibits visual predators ability to feed. Development activities also alter the amount of water entering the habitats thereby changing salinity, raising water temperature, and transporting pollutants causing the loss of essential fish habitat.

In addition to the human induced damage that occurs, essential fish habitat is also affected by natural events. Hurricanes and disease outbreaks have severely damaged coral reefs in the Virgin Islands in the past. Hurricanes cause direct damage to corals and reefs. White-band and black-band disease and coral bleaching has resulted in the decline of some coral species.

The development of fisheries management plans which incorporate measures to protect essential fish habitats from fishing and non-fishing related threats. These plans provide measures to protect and enhance essential fish habitats at a regional level and provide long-term major benefits to these sensitive areas. South Florida ecosystem restoration projects to restore the water quality of estuarine and bay areas would provide long-term moderate benefits to essential fish habitats. In addition, local actions to restore and protect essential fish habitat such as the mangrove restoration project in Salt River Bay and the future development of the East End Marine Park on St. Croix would provide long-term moderate level benefits.

The long-term adverse effects of fishing and non-fishing related actions have resulted and would continue to result in minor to major adverse effects that are occurring on a regional level. These adverse effects are off-set to a small degree by restoration and conservation efforts that provide mitigation measures and recommend restrictions on uses in areas of essential fish habitat; however the damage that has been done and continues to occur outweighs to a large degree the benefits of these plans. The negligible to minor short-term adverse effects of exotic plant management activities that occur from localized transport of nutrients and sediments to the aquatic environment which occur within the parks under the no-action alternative contributes negligibly to the overall effect of other land and water based activities that adversely impact these habitats. The overall effect of commercial, recreational, and agricultural actions occurring with the region outweigh to a large degree conservation and restoration efforts as adverse effects continue to occur to these sensitive habitats. The combined effects of past, present, and future actions along with the short-term adverse effects of the no-action alternative results in overall moderate to major long-term adverse effects on essential fish habitats within the region.

Conclusion

Removing exotic vegetation would restore the biological integrity of infested mangrove habitats within the parks, and improving essential fish habitat. Because infestation in these habitats is low and restoration would not be fully achieved under this alternative, the overall long-term benefit to essential fish habitat would be negligible to minor. Increased sedimentation and reduced water clarity as a result of mechanical treatment and use of prescribed fire would have short-term negligible to minor adverse impacts on essential fish habitats. The low slopes in south Florida and the rapid revegetation that occurs within the region would reduce the amount of sediments and nutrient being transported to the aquatic environment. In the Caribbean parks, mechanical treatments would result in localized soil disturbance and with rapid revegetation of the area, there would be no potential for transport to essential fish habitats resulting in no effect. In the event of wildfire occurring in areas infested with guinea grass in the Salt River Bay and Virgin Islands National Park, the delivery of sediment and nutrients to localized areas would have short-term negligible to minor adverse effects. Due to the low probability of herbicides being transported to the aquatic environment, application of herbicides according to the label, and implementation of BMPs and SOPs, the effect from chemical treatment on the essential fish habitats in the parks would also be negligible to minor. Short- and long-term localized adverse effects from motor or air-boat access to sites would negligible to minor.

Cumulative impacts would be moderate to major adverse. Overall, the diversity and abundance of fisheries that rely on the essential fish habitats within the parks would not be affected. Exotic plant management activities under no action would not result in the impairment of essential fish habitat resources or values.

ALTERNATIVE B — NEW FRAMEWORK FOR EXOTIC PLANT MANAGEMENT: INCREASED PLANNING, MONITORING, AND MITIGATION

Under this alternative, essential fish habitat would be affected by exotic plant management actions in the same manner as described under alternative A, however the magnitude of the adverse effects would be lessened under this alternative. Under this alternative, the NPS would continue to treat and control exotic plants using mechanical and chemical treatment methods in the parks and prescribed fire in Everglades National Park. However, the treatment actions would be conducted in a manner that provides enhanced protection of natural resources within the parks and re-treatment actions would be conducted under an optimal treatment schedule that would reduce the intensity of the treatments over the long-term. In addition, implementation of a monitoring program that would allow for identification of unacceptable adverse effects to non-target resources such as essential fish habitats and alteration of treatment methods as needed based on adaptive management would provide enhanced protection to essential fish habitats under this alternative.

Restoration of mangrove habitat which are areas of essential fish habitat would be achieved to a greater degree under this alternative. As a result, the overall long-term benefit to essential fish habitat in the Caribbean parks would be minor to moderate where these habitats are not as greatly impacted by exotic plants

compared to Canaveral National Seashore and Everglades National Park that have larger areas of infestation and benefits would extend up to major.

Canaveral National Seashore and Everglades National Park

The use of mechanical treatment methods including pulling and cut and mulching activities would be the same as described for alternative A with short-term impacts from localized transport of sediment into areas of essential fish habitat ranging from negligible to minor.

Under this alternative, there would be an increased use of prescribed fire as a re-treatment method to control exotic plants. The increased use of prescribed fire within Everglades National Park to re-treat approximately 28,000 acres of habitat within the park would have effects similar to alternative A, however the effects would occur over a larger area within the park. Because prescribed fire involves low intensity burns and burns are done on small scales to allow for control of the fire, the presence of adjacent patches of native vegetation, rapid recovery of burned areas, and the low slope of the area, the transport of sediments and nutrients to the aquatic environment would be minimal and therefore would have negligible to minor short-term adverse effects on essential fish habitat.

The use of herbicides to treat exotic plants within the parks would increase initially so that all acres would be treated within a 3-year period and then re-treatment would occur every 6 months following. Although there is an initial increase in herbicide used under this alternative, over the long-term the rate of herbicide application drops dramatically (see tables 3 and 4 of appendixes A – I). Only those herbicides that are registered for use in aquatic environments would be used in areas adjacent to waters containing essential fish habitat. In addition, the potential for runoff of herbicide into aquatic environments following herbicide application is low in the parks due to the rapid binding and/or breakdown of herbicides in the environment and the use BMPs and SOPs to avoid application when there is potential for extreme rain occurring after application of the herbicide and to reduce drift when applied aerially in Everglades National Park would reduce the risk of herbicides entering the aquatic environment. The use of herbicides within the parks under this alternative would have short-term negligible to minor effects essential fish habitats.

Because of the increased treatment that would occur under this alternative, there would be an increase in the frequency that motorized boats or airboats are used to access treatment sites and there would be an increase in the number of crews accessing sites. Adverse effects to essential fish habitats from direct physical damage and turbidity would be expected to occur as under alternative A however they would occur likely in more locations. With training of staff and contractors to minimize boating impacts to these sensitive habitats the adverse impacts would be localized, short- and long-term, and minor. As infestation decreases and the level of effort for treatment declines over time, these effects would be reduced to negligible to minor.

Virgin Islands National Park, Salt River Bay National Historic Park, and Buck Island Reef National Monument

The use of mechanical methods to pull seedlings or saplings that would expose small areas of bare soils would have no effect on essential fish habitats such as was described above under alternative A.

Under this alternative all infested areas of the parks would be treated thereby increasing the potential for soil erosion in essential fish habitats. However, as stated in the Soils section, studies conducted on Buck Island Reef National Monument had shown very little movement of soils within treated areas on sloped hillsides even following heavy rain events. Although this study had positive results park staff are concerned about sediment transport to essential fish habitats and would therefore implement protection measures to minimize or eliminate transport of sediments. With the quick recovery of native vegetation, the use of mitigation measures to reduce potential for erosion, the short-term adverse effects on essential fish habitat would be negligible to minor.

Methodical and frequent treatment of guinea grass within the parks under this alternative would greatly reduce the potential for wildfire and the resultant transport of sediments and nutrients to the aquatic environment. This alternative would have long-term negligible to minor benefits on essential fish habitats as a result of this.

Although herbicide use would be initially increased under this alternative so that all areas would be treated, in the long-term herbicide use would be lower than alternative A. The rapid degradation and brief persistence of herbicides used in these parks, the rapid recovery of native vegetation after treatment, and the use of BMPs and SOPs to prevent spills and leaks into aquatic habitats, there would be no effect of herbicide use on essential fish habitats.

The use of motorboats to access treatment sites would occur more frequently under this alternative that would increase the potential for damage to essential fish habitats. With training of staff and contractors and designated mooring sites that would be used, the adverse effects on essential fish habitat would be short and long term and minor. As the level of infestation decreases and the level of effort declines over time, the effects would be reduced to negligible to minor.

Cumulative Impacts

The cumulative effects of past and on-going commercial, industrial, recreational, and agricultural activities that occur over the region would continue to have minor to major long-term adverse effects that outweigh to a large degree moderate beneficial effects as described in alternative A. Moderate long-term beneficial effects would occur from implementation of regional conservation plans and local plans to protect and restore essential fish habitats as described under alternative A. These plans in combination with the short-term negligible to minor adverse and minor to major beneficial effects from exotic plant treatment activities that occur within the parks under this alternative would not off-set the adverse effects from large-scale damaging activities and the overall cumulative effect on essential fish habitats would be long term and range from minor to major.

Conclusion

Removing exotic vegetation would restore infested mangrove habitats within the parks and improve essential fish habitat as described under alternative A, however restoration would be more complete and occur faster. The overall long-term benefit from this restoration would be minor to major. During the initial phase of the plan, the adverse effects on essential fish habitats would be similar to those described in alternative A. Mechanical treatment methods in Canaveral and Everglades National Parks and the use of prescribed fire in Everglades would have short-term negligible to minor adverse effects from sediment delivery to the aquatic environment. The use of small-scale mechanical treatment methods in the Caribbean parks would have no effect on essential fish habitats. Due to the low probability of herbicides being transported to the aquatic environment, application of herbicides according to the label, and implementation of BMPs and SOPs, the effect from chemical treatment on the essential fish habitats in the parks would also be negligible to minor. Effects from use of motor or air-boats to access sites would be expected to occur more frequently under this alternative during the initial phase of the plan resulting in short-and long-term minor adverse effects. The adverse effects from exotic plant treatments would decline over time as less intrusive methods are employed to maintain treated sites and the amount of herbicide that would be applied decreases rapidly over time compared to alternative A. Under this alternative guinea grass in the Caribbean parks would be treated under an optimal schedule reducing the threat of wildfire and indirect effects on essential fish habitats resulting in negligible to minor long-term benefits.

Guinea grass after treatment

Cumulative impacts would be minor to major adverse. Overall, the diversity and abundance of fisheries that rely on the essential fish habitats within the parks would not be adversely affected. Exotic plant management activities under alternative B would not result in the impairment of essential fish habitat resources or values.

ALTERNATIVE C — NEW FRAMEWORK FOR EXOTIC PLANT MANAGEMENT: INCREASED PLANNING, MONITORING, AND MITIGATION, WITH AN EMPHASIS ON ACTIVE RESTORATION OF NATIVE PLANTS

Under this alternative, essential fish habitat would be affected by exotic plant management actions in the same manner as described under alternative B resulting in negligible to minor short- and long-term adverse effects on essential fish habitats in the parks. The benefits from treatment of exotic plants and passive restoration of mangrove habitats that are important essential fish habitats would be the same as described under alternative B. In areas that would be actively restored under this alternative, the recovery of native vegetation would be faster. The overall benefit to essential fish habitat from active and passive restoration of infested mangroves would be minor to moderate in the Caribbean parks and up to major in Canaveral National Seashore and Everglades National Park.

Canaveral National Seashore and Everglades National Park

In Canaveral National Seashore and Everglades National Park, active restoration methods could include the use of soil amendments, seeding, planting, and large-scale physical site restoration. Methods chosen would depend upon site specific evaluations. Seeding and planting activities would have little potential to affect essential fish habitats due to the limited about of surface disturbance. Soil amendments and large-scale physical alterations could adversely affect water quality and therefore have adverse effects on essential fish habitats. Use of soil amendments and fertilizers could result in nutrient enrichment of adjacent waters which would have negligible adverse effects on essential fish habitats. As described in alternative A, increases in nutrient can result in increase bacteria and algal blooms which lowers dissolved oxygen levels and degrade essential fish habitat causing some individuals to avoid the area. Because of the dense vegetation in the parks, excess nutrients would be expected to be absorbed leaving minimal amounts to be transported to the aquatic environment.

Large-scale restoration involving the movement of soils to remove seed banks may occur within these parks. These restoration projects would alter elevation affecting surface flows and hyrdoperiods in low-relief wetland environments. These marsh type areas may be adjacent to areas of essential fish habitat. Short-term effects from soil removals would result from sediment delivery to the aquatic environment while the action was taking place. Implementation of BMPs to avoid actions during rain events would reduce the effect to negligible to minor.

Virgin Islands National Park, Salt River Bay National Historic Park, and Buck Island Reef National Monument

Active restoration within the Caribbean parks would include seeding, planting, and/or soil modifications. During restoration actions, best management practices would be employed to reduce soil erosion and minimize the transport of soil amendments to the aquatic environment. As a result, the impacts on essential fish habitats from active restoration within the parks would be negligible.

Cumulative Impacts

The cumulative effects on essential fish habitat under alternative C would be the similar to those described under alternative B. The short-term negligible to minor adverse and minor to major beneficial effects from exotic plant treatment and restoration activities that occur within the parks under this alternative would contribute negligibly to the cumulative effects of other large-scale regional actions and plans that adversely affect these areas and there would be an overall long-term minor to major adverse effect on essential fish habitats.

Conclusion

Removing exotic vegetation and passive and active restoration of infested mangrove habitats within the parks would improve essential fish habitat resulting in an overall long-term minor to major benefit. The short- and long-term adverse and beneficial impacts of exotic plant management actions would be the same as described in alternative B and would be negligible to minor. Seeding, planting,

and/or use of soil amendments to actively restore treated areas within the parks would have negligible to minor adverse effects on essential fish habitats from the transport of sediments or nutrients that affect water quality. Large-scale restoration actions in Canaveral National Seashore and Everglades National Park that occur adjacent to areas of essential fish habitat could result in the transport of sediments that would degrade the water quality and the habitat. With implementation of mitigation measures, the short-term effects would be negligible to minor.

Cumulative impacts would be the same as alternative B. Overall, the diversity and abundance of fisheries that rely on the essential fish habitats within the parks would not be adversely affected. Exotic plant management activities under alternative C would not result in the impairment of essential fish habitat resources or values.

MANAGEMENT AND OPERATIONS

GUIDING REGULATIONS AND POLICIES

NPS *Management Policies 2001* (NPS 2001e) require that park operations achieve the following conditions:

> Park facilities and operations demonstrate environmental leadership by incorporating sustainable practices to the maximum extent practicable in planning, design, siting, construction, and maintenance, including preventive and rehabilitative maintenance programs.
>
> Exotic species will not be allowed to displace native species if displacement can be prevented. . . . High priority will be given to managing exotic species that have, or potentially could have, a substantial impact on park resources, and that can reasonably be expected to be successfully controllable.

The *Exotic Plant Management Teams Operations Handbook* calls on parks to meet the Natural Resource Challenge and contribute to individual park goals by "containing exotic plant disturbances" (NPS 2003m).

Fire management plans for the parks in south Florida identify control of exotic species as one objective of the prescribed fire management program (NPS 1990a; NPS 1994e; NPS 1998c; NPS 2003n).

METHODOLOGY AND ASSUMPTIONS

GEOGRAPHIC AREA EVALUATED FOR IMPACTS

The impacts on park management and operations from the management actions proposed in the alternatives were considered within the boundaries of the nine participating parks and for any entities that may implement simultaneous exotic plant management actions on adjacent lands.

IMPACT CRITERIA AND METHODOLOGY

Specific issues addressed in the analysis include those developed through internal and public scoping. Representatives from the nine participating parks have developed the following issue statements:

> The burden on NPS staff and resources to control exotic plants has grown with the increasing presence of the plants and need to treat these species. The NPS also strives to prevent the introduction of exotic plants into the parks.
>
> Treatment activities, especially fire or flooding, may prohibit access to areas of the park, which may disrupt or hinder other park activities. In

addition, heavy machinery used for mechanical control of exotic plants can damage park roads and infrastructure.

Impacts on park management and operations were evaluated using the process described in the "General Methodology for Establishing Impacts Thresholds and Measuring Effects by Resource" section of this chapter. Impact threshold definitions for park management and operations are as follows.

IMPACT THRESHOLD DEFINITIONS

Negligible — Park management or operations would not be affected, or effects would be at or below levels of detection and would not have an appreciable impact on park operations.

Minor — Effects would be detectable but would not be of a magnitude that would appreciably change park management or operations. Effects might be noticed by park and partner staff, but probably would not be noted by visitors. If needed to offset adverse effects, mitigation would be relatively simple and would likely succeed.

Moderate — The effects would be readily apparent and would result in a substantial change in park management or operations in a manner noticeable to staff and visitors. Mitigation would probably be necessary to offset adverse effects and would likely succeed.

Major — The effects would be readily apparent and would result in a substantial change in park management or operations in a manner noticeable to staff and visitors as markedly different from existing operations. Extensive mitigation would be needed to offset adverse effects, and success would not be assured.

IMPACTS OF THE ALTERNATIVES ON MANAGEMENT AND OPERATIONS OF THE NINE NPS UNITS

ALTERNATIVE A — NO ACTION: CONTINUE CURRENT MANAGEMENT

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

The NPS has used integrated pest management since the 1980s. This approach reduces herbicide use by making it one element of a comprehensive approach that also applies biological controls, such as insects, that target exotic plants; manual controls such as removing exotic plants by hand pulling or with heavy machinery; or prescribed fires such as prescribed fire. Biological control is rarely effective as a primary control method but can be an effective in supporting other treatment methods. Prescribed fires are also most effective as a secondary treatment. Manual removal of exotic plants can be quite effective but is also very labor intensive. Herbicide application provides effective treatment at the lowest cost in time and funds. However, the more selective herbicide application methods are also generally more labor intensive. Under alternative A, herbicides

would be applied with portable backpack sprayers, all-terrain vehicles equipped with sprayers, and aircraft.

Minimum tool analysis would be conducted for all projects located within designated or proposed wilderness areas under all three alternatives to achieve treatment objectives while minimizing impacts on wilderness values.

Exotic Plant Management. Under current management, the parks would initially treat all infestations within the 10-year life of the plan. However, re-treatment would not occur frequently and a minimal reduction of exotic plant populations would occur slowly over the life of the plan, except in Dry Tortugas National Park (which has only one acre of infestation) and Buck Island Reef National Monument (which has treated all 75 infested acres and anticipates re-treatment every 6 months until exotic plants are eradicated or are at a maintenance level (NPS 2004c). Biscayne National Park has initially treated all 162 infested acres over the course of 5 years.

Due to staffing and funding constraints, it is often difficult to allocate resources to re-treat sites as often as needed to successfully control exotic plants. Re-treatment is primarily determined by current funding cycles and availability, which, as shown by the APCAM database, results in re-treatment every 3 to 5 years. Canaveral National Seashore, for example, has treated 5,496 acres, with 3,273 acres not yet treated. Big Cypress National Preserve has treated 287,517 infested acres, leaving 155,445 acres awaiting initial treatment. Everglades National Park has treated 288,141 acres, and 177,603 infested acres have yet to receive treatment.

As a result, by the time areas receive follow-up treatment, exotic plants have reestablished themselves to an extent that treatment methods, to be effective, are essentially the same as those of the initial treatment. Moreover, areas already treated tend to be the most visible and hence the most accessible. Remote areas, many in marshy areas, are more difficult to treat, and mechanical treatments, for example, can be difficult or even impossible to perform in such areas.

Resource managers in the participating parks work with contractors to treat exotic plants. This use of contract labor can reduce the overall cost by reducing NPS staff time as well as the purchase of materials and supplies (NPS 2002m). Other responsibilities prevent park resource managers from supervising contract labor as frequently as they would like, often limiting them to pre-treatment consultation with contractors, occasional spot checks of progress, and a final check following treatment; many parks rely on EPMT personnel to oversee treatment operations (Boulon 2004b; Burch 2004c; Hillis-Starr 2004; Kellison 2004; Stiner 2004b). In parks that benefit from volunteers who treat exotic plants, such as in Big Cypress National Preserve or Buck Island Reef National Monument, resource managers also coordinate with the volunteers (Hillis-Starr 2004).

In addition, park resource managers coordinate with EPMT personnel and with the Southeast Exotic Pest Plant Council. Park staff and the EPMT work collaboratively with neighboring agencies and landowners, providing technical expertise as well as assistance in treating exotic plants. EPMT staff share

information about exotic plant control with representatives from other nations and territories. Although these activities can be time intensive in the short term, they can increase treatment efficiency in the long term.

Such duties extend into the foreseeable future, and as the exotic plant environmental assessment for Buck Island Reef National Monument states, "long-term success of the project will require follow-up treatments in perpetuity" (NPS 2004c).

As new exotic plants invade the parks, staff face a continuing and increasing need to evaluate resources and techniques to address the problem, and to research and evaluate the effectiveness of control methods. In addition, continuing problems with current species require research and evaluation of new techniques for managing these species.

In sum, the requirements of exotic plant management exceed available resources, particularly time, resulting in long-term, minor, adverse impacts on resource managers' ability to control exotic plants in the nine parks.

Support Operations for Exotic Plant Management. Resource managers conduct field evaluations and assist with monitoring operations. Some parks rely on opportunistic observation by staff and visitors; others use more systematic means, including reconnaissance flights, GIS mapping, inventories, and databases. Every 2 years, Big Cypress National Preserve and Everglades National Park share systematic reconnaissance flights in fixed-wing aircraft used by the EPMT (Burch 2004c; Taylor 2004d). These intensive reconnaissance projects take about one week. In addition, personnel at Big Cypress National Preserve make observations by helicopter, often as part of flights for other missions, with annual air time of about four hours (Burch 2004c). Biscayne and Dry Tortugas National Parks have used annual aerial surveys since 2000. Aerial surveys of plant infestation at Canaveral National Seashore begin in 2005. Contractors at both parks also use helicopters to access remote areas undergoing treatment (Burch 2004c; Taylor 2004d). Other vehicles providing access to remote areas include swamp buggies, motor boats, and trucks (Burch 2004c; Taylor 2004d).

Another important, and sometimes time-consuming, duty taken on by resource managers is pursuit of funding for exotic plant programs, particularly grants. The NPS provides some direct funding for exotic plant control; for example, the salary of the exotic plant manager for Everglades National Park and Dry Tortugas National Park. Most NPS funds are channeled through EPMT grants. The parks also rely on other grants and funding sources; examples include Canaveral National Seashore's joint proposal for state funding submitted with Volusia County mosquito control program (Stiner 2004); Buck Island Reef National Monument's award of $25,000 of NPS Natural Resources Preservation Project funding to begin an invasive nonnative plant management program (NPS 2004c), and Virgin Islands National Park's use of herbicides and volunteers provided by a local nonprofit organization (Boulon 2004). Increased funding through grants has allowed at least two parks, Big Cypress National Preserve and Everglades National Park, to treat exotic plants throughout the year rather than for only 6 to 8 months annually (Burch 2004c; Taylor 2004d).

Area closures for exotic plant operations are rare in the parks. Most current treatment in the south Florida parks occurs in remote areas. Best management practices, such as using appropriate vehicles, minimize the probability of damage to roads and other infrastructure. When it began treating exotic plants, Big Cypress National Preserve did occasionally close roads in areas being treated, but it has been several years since areas in the preserve that are visited by the public have undergone treatment to control exotic plants (Burch 2004). Contractors in the parks do place signs warning the public about treated areas and explaining why the operations take place and what they intend to accomplish. Signs and other communications such as brochures and Web pages allow the parks to educate the public about the problems posed by exotic plants, not only in the national parks, but also on a regional basis.

Impacts on park operations from exotic plant management can be beneficial or adverse, short term, and negligible to moderate.

Resource Management. Limited budgets and insufficient staff are common problems across the national parks, some of which have half the staff necessary to fully perform all functions (NPS n.d.drt). As a result, resource management staff would continue to be drawn from other important duties, such as wildlife management, fisheries management, fire management, and cultural resources protection. At the same time, parks are unable to fully address even high-priority exotic plant infestations; Buck Island Reef National Monument labels complete treatment as "unlikely" (NPS 2004c). Balancing exotic plant control with other resource management activities produces long-term, minor, adverse impacts on the ability to manage other resources in the nine parks.

Education and Interpretation. Interpretive programs and displays in visitor centers include information about the threat posed by exotic species. Outreach also includes distributing brochures, providing information in annual reports park newsletters about exotic plants, submitting news releases and articles, presenting lectures to organizations, and hosting focus-group meetings. Cooperation with other government agencies, environmental organizations, and native plant societies provides information to a broader audience. These programs balance short-term expenditures of park budgets and staff time against the long-term benefit of a better-educated public that can more effectively support park operations to manage exotic plants.

The individual parks provide information as they see fit and as funding and staff duties allow. For example, Everglades National Park staff and contractors answer questions for visitors, and the park is developing Web pages and brochures that distribute information about exotic plants and their management (Taylor 2004d). The contractor at Buck Island Reef National Monument posts signs after treatment explaining the program (Hillis-Starr 2004). Biscayne National Park, which has exotic plants primarily in remote areas that are rarely visited, relies on staff to answer questions raised by visitors (Kellison 2004). EPMP provides signs for parks to post in treated areas to explain what is happening in the area and why (Pernas 2004b). Because such activities are minimal, current exotic plant management has long-term, minor, adverse impacts on visitor education and interpretation in the nine parks.

Park Operations. Park and EPMT staff would continue to solicit services and manage contracts at about the current level. Since 2000, the nine parks have treated over 25,000 acres of infested land, at a cost of approximately $3.5 million. About one-half of these funds have come from the NPS, one-third from the Florida Department of Environmental Protection, and one-sixth from the federal Cooperative Conservation Initiative. Most work has been done through 36 contracts involving seven different contractors. While pursuing funding for exotic plant management can occasionally place heavy demands on resource managers, it is a relatively small element of overall park operations. In contrast, exotic plant management operations dominate resource managers' time often enough to interfere with performance of other responsibilities, including management of other pests, wildlife, fisheries, feral animals, fire ecology, cultural resources, and mooring and buoys (Boulon 2004b; Kellison 2004; Stiner 2004b). Hence, exotic plant management and supporting operations have long-term, minor, adverse impacts on park operations.

Cumulative Impacts

Management and operations of the South Florida and Caribbean parks are increasing in complexity and difficulty as visitor uses of the parks increase, as outside threats to resources increase, and as the backlog of facility improvement needs increases. Growing visitation is resulting in greater demand for services such as interpretation and commercial services, increased wear and tear on facilities, and increased needs for visitor protection and law enforcement. Regional population growth, development of private land, and agriculture are resulting in ecosystem-level changes, and NPS response to these outside issues includes participation in interagency ecosystem restoration activities, and coordination and communications with local government, private organizations, and individuals. This increases demands for staff time and increases management logistics resulting in long-term and short-term minor moderate adverse impacts to park management and operations. Planning is also required to manage private activities within the parks such as the oil and gas management plans in Big Cypress National Preserve and the airboat concessions management plan in Everglades National Park. These require staff time to develop and review plans, and manage commercial operators that result in long-term minor to moderate adverse effects.

The budget of the National Park Service has not provided adequate funds to prevent deterioration of park buildings, roads, and infrastructure. There has been, and would likely continue to be, a long-term minor to moderate adverse impact on park management and operations as the parks continue to operate and provide service to visitors with current facility conditions.

Past, present, and anticipated park management planning, although requiring staff time and funds, would implement actions that would improve management and operations of the parks. Each of the nine parks is preparing a new or amended general management plan, which would establish the framework for improvements to park management through more effective management of visitors, improved park development and improved delivery of services. Implementation of general management plan proposals would result in minor to moderate beneficial impacts to park management and operations.

Other park plans such as:

- the fire management plans for Big Cypress National Preserve, Everglades National Park, and Canaveral National Seashore,
- the Big Cypress National Preserve Scenic Corridor Visitor Safety Highway Management Improvements project,
- the Virgin Islands National Park North Shore Road project,
- the Virgin Islands National Park Rats, Cats, and Mongoose Management Plan,

would improve management responses to resource and visitor issues, improve and coordinate funding processes, and establish prescribed actions that improve park operations, and result in long-term minor to moderate beneficial effects.

Ecosystem-level plans are underway in the south Florida and Caribbean parks including the Comprehensive Everglades Restoration Plan and the actions of the South Florida Ecosystem Restoration Task Force, the Coral Species and Ecosystem Conservation Project and the activities of the U.S. Coral Reef Task Force, and the Fisheries Management Plans of the Gulf of Mexico, U.S. Caribbean, and South Atlantic. These plans would have long-term moderate beneficial effects by reducing resource management activities associated with degrading park resources.

The long-term, minor to major beneficial cumulative effects that have and would result from park planning and management activities would mitigate some of the minor to moderate adverse cumulative effects of activities related to ecosystem restoration, visitor increases, and infrastructure backlog. Cumulative adverse effects on park management and operations could be reduced to a long-term moderate adverse effect.

The actions of alternative A would result in both short-term and long-term, minor adverse effects and negligible to minor beneficial effects on park management and operations. These actions would contribute to reducing long-term cumulative adverse impacts to a moderate level.

Conclusion

The requirements of exotic plant management exceed available resources, particularly time, resulting in long-term, minor, adverse impacts on resource managers' ability to control exotic plants in the nine parks. Because education and interpretation activities associated with exotic plant control are minimal, current exotic plant management would have long-term, minor, adverse impacts on visitor education and interpretation in the nine parks. Continuing to divert resources from management of other park resources would cause long-term, minor, adverse impacts on park operations. The exotic plant management actions would contribute to reducing regional long-term cumulative adverse impacts to a moderate level.

ALTERNATIVE B — NEW FRAMEWORK FOR EXOTIC PLANT MANAGEMENT: INCREASED PLANNING, MONITORING, AND MITIGATION

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

As with alternative A, alternative B would involve an integrated pest management approach to managing exotic plants in the parks. Parks would continue to rank exotic plant species that are a priority for treatment as described above under the no-action alternative. In contrast to alternative A, funding would not be the primary determinant of treatment strategies under alternative B—this would provide resource managers with a systematic decision-making tool to determine the most effective treatments for exotic plants in specific native vegetation categories, allowing managers to more efficiently address and resolve impacts on park resources prior to treatment.

Rigorous re-treatment of sites under alternative B would be based on the rate of return or reestablishment of the exotic species present, increasing the rate of reduction of exotic plants. Regular monitoring would identify regeneration rates of native plants, re-infestation rates of exotic plants, and the effectiveness of treatment methods. Monitoring results would give park staff the information they need to adjust treatment methods and maintenance of treated areas to achieve long-term objectives for the re-establishment of native plants; such adaptive management would make treatment decisions more efficient and effective. Parks would continue to rely on passive restoration of native plants in treated areas and would not take substantial measures to replant native plants.

The "Alternatives" chapter provides a detailed description of alternative B. Table 14 in the "Alternatives" chapter summarizes the timeframe to achieve desired future conditions of native plant species following treatment and passive restoration. Appendix Q presents a detailed description of the desired future conditions for each broad vegetation category, including the timeframe for restoration of each community type and the list of species that would be dominant in that particular community.

The number of treatments over the 10-year life of the plan would be greater than under alternative A because re-treatment of areas would occur every 6 months (approximately 3 to 10 treatments) until native vegetation is restored to the desired condition to achieve a maintenance level. In the first few years, this would increase maintenance and operations activity compared to alternative A, but unlike that alternative, alternative B would enable parks to control exotic plants within their boundaries.

Exotic Plant Management. The re-treatment of younger, smaller exotic plants under a 6-month cycle, compared to the 3-year cycle under current management, would allow more efficient re-treatment methods that require less time and cause less adverse impacts on the environment. Methods such as hand spraying using backpack sprayers, hand pulling, or prescribed fire (as with Old World climbing fern in Florida parks except Big Cypress National Preserve) could replace hack and squirt treatment or aerial spraying.

Greater frequency of re-treatment would increase time demands on staff in the short term, as would heightened monitoring. However, the Florida Department of Environmental Protection projects that the level of infestation decreases by approximately 50% every time treatment occurs if the plants are being re-treated on a schedule appropriate for the exotic plant species. As the infested areas decrease, the number of people needed for re-treatment and monitoring would also decrease, with similar decreases in treatment materials and hours. In contrast, under alternative A, infested areas in the parks and the commitment of resources to respond to those infestations would remain stable at best.

Increased planning before treatment may have a minor, adverse impact on time demands of park staff in the short term as they acquire and analyze data, but long-term impacts on exotic plant management operations would be beneficial and minor to moderate as decreased re-infestation rates decrease the time required for re-treatment.

Support Operations for Exotic Plant Management. The reduction of herbicide use compared to management practices would reduce not only the field work and supervision associated with herbicide application but also the administrative burden associated with herbicide storage and transportation. Because the NPS requires that all staff applying herbicides have proper training, licenses, and certification, reducing the number of applicators could reduce efforts associated with these requirements. The impact on park management and operations, however, would be negligible.

Annual monitoring of treatment implementation, effectiveness, and effects and the success of native plant recovery, would have a long-term, negligible-to-minor, adverse impact on management resources. The information gathered by monitoring would enhance exotic plant management operations while providing reference and guidance for future projects, resulting in long-term, minor to moderate beneficial impacts.

Resource Management. While increased initial efforts associated with implementation of alternative B would produce short-term, minor, adverse impacts on other resource management activities in the nine parks, these efforts would lead to more effective exotic plant management activities, ultimately producing long-term, minor to moderate beneficial impacts on resource management.

Education and Interpretation. Parks may identify and maintain some species of exotic plants that have historical or cultural significance, as on Buck Island Reef National Monument. Containment of these plants and interpretation of their presence would have negligible impacts on planning and operations, while providing visitors with a better understanding of the parks' histories and environments.

Park Operations. Increased external collaboration with other parks and with local, state, and federal agencies, and internal collaboration among divisions within each park, including cultural resources, would increase administrative time but decrease treatment time. Exotic plant management and supporting operations under alternative B would have long-term, negligible to minor adverse

impacts on park operations, which would decrease in intensity as the areas requiring re-treatment decrease.

Cumulative Impacts

The effects of other past, present, and future actions would continue to produce long-term beneficial and adverse cumulative effects, as described under alternative A, the would result in net long-term, moderate adverse impacts to park management and operations.

The actions of alternative B would result in both short-term and long-term, minor adverse effects and negligible to minor beneficial effects on park management and operations. These actions would contribute to reducing long-term cumulative adverse impacts to a moderate level.

Conclusion

While increased planning before treatment may have a minor, adverse impact on time demands of park staff in the short term as they acquire and analyze data, long-term impacts on exotic plant management operations would be beneficial and minor to moderate as decreased re-infestation rates decrease the time required for re-treatment. Increased, systematic monitoring would have a long-term, negligible to minor adverse impact on management resources. However, the information gathered would enhance exotic plant management operations while providing reference and guidance for future projects, resulting in long-term, minor to moderate beneficial impacts. Increased initial efforts associated with implementation of alternative B would produce short-term, minor, adverse impacts on other resource management activities in the nine parks, but resulting in more effective exotic plant management activities that would produce minor to moderate beneficial effects on resource management over the long term. Impacts on education and interpretation activities would be negligible. Exotic plant management and supporting operations under alternative B would have long-term, negligible to minor adverse impacts on park operations, decreasing in intensity as the areas requiring re-treatment decrease. Cumulative impacts would be the same as alternative A.

ALTERNATIVE C — NEW FRAMEWORK FOR EXOTIC PLANT MANAGEMENT: INCREASED PLANNING, MONITORING, AND MITIGATION, WITH AN EMPHASIS ON ACTIVE RESTORATION OF NATIVE PLANTS

Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, Buck Island Reef National Monument, Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park

Alternative C adopts the same principles and methods described in alternative B, plus an active restoration plan, with some alterations to the monitoring plan and the criteria used to determine success of treatments. The following actions would be the same as described under alternative B: site-specific treatment priorities, species-specific treatment priorities, treatment method decision tool, re-treatment schedule and methods, retention of culturally significant exotic plant specimens, monitoring, collaboration and partnership, and the decision tool for NEPA

compliance. Physical site alterations and other activities associated with active restoration of infested areas would involve the removal or addition of soils or hydrologic alterations within treatment areas. This would often involve labor-intensive activities and heavy construction machinery to alter the physical structure of the site. Using active restoration to facilitate the return of native plants would more quickly reduce the need for and intensity of re-treatment. The "Alternatives" chapter provides a detailed description of alternative C.

Active Restoration. Following the initial treatment of exotic plants, sites to be actively restored would be prepared for seeding or planting of native plants. This may involve little additional site preparation or, depending on specific site requirements, may involve moving large quantities of material to augment or remove soils or sterilize soils to eliminate exotic plant seeds. The mobilization of work crews, material, and equipment and then performance of active restoration activities would be greater than passive restoration activities and would result in long- and short-term adverse impacts on park operations that would be of minor to moderate intensity.

Passive Restoration. Operations would be much like those under alternative B and would continue to occur in areas where passive restoration methods are used.

Support Operations for Exotic Plant Management. Operations would be much like those under alternative B, with active restoration activities contributing a minor increase in demands on park personnel while speeding the return of native vegetation.

Resource Management. Operations would be much like those under alternative B, with active restoration activities causing a minor diversion of personnel from resource management while speeding the return of native vegetation.

Education and Interpretation. Effects on education and interpretation would be much like those described for alternative B.

Cumulative Impacts

The effects of other past, present, and future actions would continue to produce long-term beneficial and adverse cumulative effects, as described under alternative A, this would result in net long-term, moderate adverse impacts to park management and operations.

The actions of alternative C would result in both short-term and long-term, minor adverse effects and negligible to minor beneficial effects on park management and operations. These actions would contribute to reducing long-term cumulative adverse impacts to a moderate level.

Conclusion

Alternative C impacts would be similar to those described for alternative B, and active restoration activities would result in minor to moderate, long- and short-term adverse impacts on park operations. Cumulative impacts would be the same as alternative A.

SUSTAINABILITY AND LONG-TERM MANAGEMENT

UNAVOIDABLE ADVERSE IMPACTS

Unavoidable adverse impacts are those environmental consequences of an action that cannot be avoided, either by changing the nature of the action or through mitigation if the action is taken. Therefore, they would remain throughout the duration of the action.

Some potential unavoidable adverse impacts associated with the use of herbicides in alternatives A, B, and C include possible effects on non-target plant species, possible entry of minute amounts into surface waters, and possible adverse effects on wildlife. However, the extremely low amounts of herbicide that could potentially come in contact with these resources—together with the implementation of best management practices, mitigation measures, and a decision process to select the most appropriate tool—would not be expected to result in a significant environmental impact under reasonably foreseeable circumstances. This same conclusion applies to human health and safety.

There would be unavoidable adverse impacts in all alternatives from human access into the environment to control exotic plants. This would include the impacts on the natural soundscape and disturbance of wildlife from the use of mechanized equipment and aircraft, and the trampling of vegetation and compaction of soils from foot and vehicular traffic. With the employment of best management practices and mitigation measures these impacts would be minimal and short term.

Under all alternatives use of vehicles to reach treatment areas and removal of exotic plants that stabilize cultural sites could increase erosion and result in unavoidable impacts to archeological resources. Treatment of traditionally used exotic plants of ethnographic importance could decrease their number and availability and impacts would be unavoidable.

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The intent of this determination is to identify whether the proposed action would trade-off the immediate use of the land or resources for any long-term management possibilities, adversely affecting the productivity of park resources. This determination also discloses whether the proposed action or alternatives would be a sustainable action that could continue over the long term without environmental problems (NPS 2001b).

None of the alternatives suggest substantial loss or impairment of natural resources or ecosystems in any of the parks as a consequence of their implementation. There would be some trade-offs from a local or short-term perspective. Alternatives B and C would trade-off the localized increase in

emissions from equipment and use of herbicides on an annual basis for the first 6 years, with an increased rate of restoration of the native vegetation communities and long-term productivity of those communities.

The more effective an alternative is at controlling the spread of exotic plants, the better that alternative is at protecting the natural resources of a park—despite potential minor, short-term impacts on the environment.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

The intent of this determination is to identify whether the proposed action or alternative would result in effects or impacts that could not be changed over the long term or would be permanent. An effect on a resource would be irreversible if the resource could not be reclaimed, restored, or otherwise returned to conditions that existed before the disturbance. An irretrievable commitment of resources involves the effects on resources that, once gone, cannot be replaced or recovered (NPS 2001b).

All three alternatives would involve the irretrievable commitment of labor and fossil fuels to varying degrees. None of the alternatives would be expected to result in the irreversible or irretrievable commitment of park resources.