ALTERNATIVES

INTRODUCTION

The *National Environmental Policy Act* (NEPA) requires that federal agencies explore a range of reasonable alternatives and provide an analysis of what impacts the alternatives could have on the natural and human environment. The “Environmental Consequences” chapter of this draft *Exotic Plant Management Plan / Environmental Impact Statement* (EPMP/EIS) presents the results of the analyses. The alternatives under consideration must include a “no-action” alternative, as prescribed by 40 *Code of Federal Regulations* (CFR) 1502.14. The no-action alternative in this draft EPMP/EIS is the continuation of the current management of exotic plants in the nine parks, and it assumes that the National Park Service (NPS) would not make major changes to the current management program.

The two action alternatives presented in this chapter were developed by the interdisciplinary planning team (“planning team”) and through feedback from federal, state, and local agencies and the public during the public scoping process. The interdisciplinary planning team is comprised of representatives from each of the nine parks, the NPS Florida and Caribbean Partnership Exotic Plant Management Team (EPMT), NPS Environmental Quality Division, the contractors assisting the NPS in preparation of this draft EPMP/EIS, and other resource specialists.

The two action alternatives analyzed in this draft EPMP/EIS meet, to a large degree, the management objectives for exotic plant management in the parks and also the purpose of and need for action, as expressed in the “Purpose of and Need for Action” chapter. Because each of the action alternatives is responsive to the objectives, they are considered “reasonable.”

This chapter describes the process used to develop the alternatives for this draft EPMP/EIS and identifies the study areas for which the alternatives were developed. This chapter provides descriptions of each alternative, summaries of the important features of the alternatives, their effectiveness in meeting goals of this draft EPMP/EIS, and the effects of the alternatives on park resources. This chapter also identifies actions or alternatives eliminated from further consideration and discusses the preferred alternative and environmentally preferred alternative.

The alternatives provide a broad description of actions and approaches to managing exotic plants that may take place within defined treatment areas in the parks. As park staff design and implement site-specific actions to treat exotic plant infestations, they would be able to select an alternative from the approaches presented in this chapter. The approaches consolidate knowledge and experience from all nine parks, thereby giving staff ready access to information relevant to a wide range of interactions among exotic plants, the habitats they invade, and the methods used to manage exotic plant species. Because these approaches would have already undergone the formal scrutiny required by NEPA, the time and effort needed to prepare for implementation would be minimized. Unless the site to be treated lacks significant data, its conditions vary from those described in this draft EPMP/EIS, or a new method is being employed that is not the same or similar to the methods described in this draft EPMP/EIS, implementing an action may involve little beyond consultation with the U.S. Fish and Wildlife Service (USFWS) and the State Historic Preservation Office.

OVERVIEW OF THE ALTERNATIVES

In addition to continuing current management (the no-action alternative), required as a baseline for analysis, the planning team developed two action alternatives to improve management of exotic plants in the nine parks.

Alternative A — No Action: Continue Current Management, would continue the existing management framework. The nine parks would continue to treat infestations of exotic plants on an *ad hoc* basis and with currently available funding sources. Initial treatment and re-treatment of areas in the parks would be done on an opportunistic basis when resources and funding permit. The effectiveness of treatment would continue to be documented for individual treatment events; however, a standardized monitoring protocol to determine treatment effectiveness and site resource conditions following treatment would not be employed.

Alternative B — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, would apply a systematic approach that would set priorities for exotic plants and their treatment, monitor effects of those treatments on exotic plants and park resources, and mitigate any adverse effects to park resources as determined through the monitoring program. Initial and follow-up treatment of sites would be conducted using treatment methods that have been defined based on resource conditions. Re-treatment would occur at an optimal frequency, depending on the exotic plant species. This alternative would employ an adaptive management strategy, using the results of monitoring to adjust treatment methods or mitigation methods to reach the desired future condition of treated areas in the parks. The effectiveness of efforts to control exotic plant invasion or native habitats would increase as a result of the uniform recording and storage of information acquired during monitoring and sharing of that information among the nine park units.

Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants (Preferred Alternative), would augment the systematic approach integral to alternative B, but would add an active restoration program to enhance the return of native species to treated areas in selected high-priority areas.

The following sections describe how these alternatives were developed.

REVIEW OF EXISTING DATA

The baseline condition data and level of information pertaining to exotic plant infestation and treatments vary greatly among the parks, because exotic plant control activities have taken place in some parks (such as Big Cypress National Preserve) since the mid-1980s, while in Salt River Bay National Historic Park and Ecological Preserve, for example, treatments have never occurred. In Florida, as part of the EPMT monitoring program, the NPS has been collecting aerial reconnaissance data of the distribution, and to some degree the density, of exotic plants in Big Cypress National Preserve and Everglades National Park.

Distribution data collected during aerial reconnaissance flights in 2002 to 2003 for melaleuca, Brazilian pepper, Old World climbing fern, and Australian pine were plotted to define the area of infestation in the parks. This data, however, provided only points on the ground, which represented the species and density (a single plant, less than 50% or greater than 50%). To allow for spatial analysis of this information, the point data had to be converted to represent an area of land. Therefore, each data point was buffered by 1 kilometer (a little over one-half mile) to best represent a potential area of infestation.

Aerial reconnaissance has also been conducted in Biscayne National Park. It was determined, however, that the level of detail provided by this data was not sufficient for representing the distribution of exotic plants in this park. Biscayne National Park has been treating exotic plants over the years, and it is thought that the larger specimens that could normally be detected aerially have, for the most part, been treated, and that smaller specimens remaining to be treated were not detected. In addition to aerial reconnaissance data, infestation in the parks was estimated using data available in the NPS Alien Plant Control and Monitoring (APCAM) database and through the expert knowledge of park and EPMT staff. The NPS APCAM database provided gross infested acres within many treatment areas in the parks—the gross infested acres in Biscayne National Park were derived from this source.

Expert knowledge of the distribution and infestation of exotic plants for Canaveral National Seashore, Dry Tortugas 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 were provided by the EPMT or by resource managers in the parks. Once collected, this information was digitized to create geographic information system (GIS) layers, which were then used to create park maps representing the potential areas of infestation. The park maps were then combined with other resource data layers to formulate alternatives.

Information for treating exotic plants in the parks was derived from similar sources. In addition to the APCAM database and park and EPMT staff, past NEPA and NPS *Director's Order 12: Conservation Planning, Environmental Impact Analysis, and Decision Making* and handbook (NPS 2001a) compliance documentation provided information on the methods of treatment and rate of herbicide application used in the parks.

To determine the appropriate treatment methods, and to set priorities for the areas for treatments under the action alternatives, resource conditions were assessed in the parks. Information was compiled for each park pertaining to the distribution of native vegetation categories, potential areas of federally listed threatened and endangered species habitat, and visitor use of facilities, roads, and trails. The potential habitat of federally threatened and endangered species in Florida was obtained from the Florida Natural Areas Inventory. The species at risk from the presence and spread of exotic plants were then mapped for the south Florida parks. Critical habitats designated by the USFWS for the snail kite and the Cape Sable seaside sparrow were also overlain onto park maps.

Threatened and endangered species locations in the Caribbean parks, and for some species in Florida parks, were gathered from the expert knowledge of park staff and digitized on to park maps. Cultural resource information was compiled from the expert knowledge of park staff, as well as the NPS Archeological Sites Management Information System (ASMIS) database, which contains location information of archeological, historical, and cultural landscapes in the parks. High visitor-use areas (visitor centers, campgrounds, marinas, and trails) were also mapped and considered in the development of alternatives.

Information on funding for exotic plant treatments, education programs, and cooperation with other agencies was obtained through discussion with the EPMT and park staff.

The alternatives were developed based on an understanding of the purpose, need, issues, and objectives, as well as from input from the public and government agencies obtained during the scoping phase of the project. NPS staff (resource managers from the parks, EPMT program leaders, and the Environmental Quality Division) conducted numerous workshops to define the range of alternatives based on the objectives of this draft EPMP/EIS. Information received from the public, agencies, and park resource staff showed that the alternatives must include a formal monitoring program to adequately assess the effectiveness of an exotic plant management plan and the effects on park resources, and that any plan must be based on adaptive management, allowing for modification of management actions within the framework of a given alternative based on new research and monitoring information. In addition, the alternatives should include elements addressing improved education, cooperation with other agencies, and restoration.

In workgroup sessions, the planning team evaluated continuing current management against the plan's objectives. After assessing how well the elements of current management met or did not meet the plan's objectives, the team then developed program elements for the action alternatives that would assist parks in better achieving the plan objectives.

The information obtained about each park's current exotic plant management program led to the conclusion that a standardized priority-setting system to be used in the treatment areas in all parks would enhance the ability of the NPS to control exotic plants and to protect park resources at an ecosystem and regional level. The criteria for setting management priorities were developed based on consideration of those highly sensitive resources that would be most affected by the presence of exotic plants, the degree of accessibility to sites, and whether the infestation was in a highly visible area and of importance to visitors' understanding and appreciation of the park. Overlaying the individual data layers pertaining to sensitive resources and visitor-use areas, areas of infestation in the parks were ranked as to their priority for treatment. Under alternatives B and C, treatment areas were defined and priorities set for treatment.

Brazilian pepper

To further enhance the park ability to protect natural and cultural resources, a resource-based decision tool was developed to determine the locations of appropriate treatment methods in the parks. This tool took into consideration the distribution of individual exotic plant species, the potential threatened and endangered species habitat present, and the vegetative conditions. Based on the spatial patterns of these elements, appropriate initial and re-treatment methods could be determined for infestations in the parks. GIS spatial analysis was used to apply the decision tool for generating maps that could display appropriate treatment methods throughout the parks. Under alternatives B and C, each treatment area was then assigned those methods that are most appropriate for that specific area given the infestation, vegetation categories, and potential threatened and endangered species habitat.

One primary objective of this draft EPMP/EIS is to restore native communities and ecosystems. To best meet this objective, the team determined that alternatives could include either passive or active restoration. The parks currently rely on native plant species recolonizing an area without human assistance (passive restoration). Hence, it was necessary to develop criteria for setting priorities for active restoration of treated sites and determining when an area should be actively restored. The criteria take into consideration the level of infestation, length of time an area has been infested, ability of the native plant system to recover on its own, risk to potential threatened and endangered species habitat, treatment area location with respect to visitor services and amenities, and accessibility to the treated site. By applying a decision tool to the appropriate data layers, through GIS analysis, park areas infested with exotic plants were designated as candidates for active restoration. For alternatives B and C, a designation of either passive restoration (alternative B) or active/passive restoration (alternative C) was applied to each treatment area.

ALTERNATIVE A
NO ACTION: CONTINUE CURRENT MANAGEMENT

GENERAL CONCEPT

“No action” is the baseline condition against which the proposed activities in alternatives B and C are compared. It is defined as taking no action to change or alter current management.

Each park currently controls exotic plants using an integrated pest management (IPM) approach developed just for that park. The IPM approach is a means of planning and implementing a coordinated program, utilizing a combination of methods to contain, control, or replace exotic plants to manageable levels. Other components equally important to the IPM program include nontreatment practices (such as exotic plant prevention, education, and coordination measures), as well as mitigation measures and best management practices.

The IPM program targets individual plant species, then prescribes the combination of methods that would best achieve the desired result. Under alternative A, the parks would continue to manage exotic plants using a variety of physical, mechanical, chemical, and biological methods. 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 endangered, threatened, or otherwise unique species.

The availability of funds is what primarily drives current treatment decisions, leaving managers with no choice other than to focus on periodic treatment to remove exotic plants and then returning to re-treat (maintain) a site so that the exotic plants are in a controlled condition when funding and resources become available. Monitoring to determine the need to re-treat (maintain) an area, and then ascertain the longer-term effects of treatment on park resources, would be sporadic. Parks would continue to rely on the return and growth of native plants from native seed sources that naturally re-establish themselves in the treated site.

Under the no-action alternative, parks would continue to employ nontreatment elements of the program as well, such as collaboration with other local, state, territorial, and federal agencies. The parks would continue to provide educational materials to the public on a limited basis. A more detailed description of the current program to manage exotic plants is provided below, as well as specific descriptions of unique actions taken in individual parks.

GUIDANCE FOR SETTING MANAGEMENT PRIORITIES

The nine parks participating in this draft EPMP/EIS coordinate some or all of their exotic plant control projects through the EPMT. The EPMT has an established protocol for ranking what exotic species to treat and ranking criteria to set priorities for what areas to treat (NPS 2003m). Park staff and the EPMT set priorities for what species to treat and the treatment areas, which are based on potential impacts to park resources and the potential for controlling the exotic plants.

In Florida, the Florida Exotic Pest Plant Council (FLEPPC) has categorized exotic species that are a priority for treatment into two groups: Category I and Category II plants. (This list can be found in appendix M of this draft EPMP/EIS and is also available on the FLEPPC website at www.fleppc.org.) Category I plants are invasive exotic plants that are altering native vegetation categories by displacing native species, changing community structures or ecological functions, or hybridizing with native plants. Category II plants are invasive exotic plants that have increased in abundance or frequency but have not yet altered Florida vegetation categories to the extent shown by Category I species (FLEPPC 2004).

In accordance with the *Federal Noxious Weed Act of 1974*, as amended (7 USC 2801 *et seq*.), the United States government has designated certain plants as noxious weeds. This list is provided in appendix N.

In addition to state and federal lists of priority species, the NPS has developed a planning resource called the Alien Plant Ranking System to set priorities for exotic plant management. The nine parks, through work with the EPMT, use this ranking system to determine treatment priorities (Heibert and Stubbendieck 1993). Resource managers may use the Alien Plant Ranking System to sort exotic plants in a park according to the plant's current level of impact and its innate ability to become a pest. This information is then weighed against the perceived feasibility or ease of control. The system is designed to first separate the innocuous (harmless) species from the disruptive species. This separation allows managers to concentrate further efforts on species in the disruptive category. Disruptive species typically exhibit one or more of the following characteristics:

- They have community-level or ecosystem-level effects and significantly alter natural processes, such as fire regimes, nutrient cycling, hydrology, or successional patterns.

- They alter species composition and reduce populations of native species.

- They alter genetic variability through hybridization with native species.

- They affect localized resources, such as archeological or scenic qualities.

Lower priority is given to innocuous exotic plants that have almost no impact on park resources or that probably cannot be successfully controlled. Innocuous species do not significantly harm park resources and are, therefore, usually a lower management priority. Most innocuous species do not invade native ecosystems without human-caused disturbance, and their populations generally do not expand in the park. Other innocuous species may invade native ecosystems, but they do not significantly displace native species. The system is also designed to identify those species that are not presently a serious threat but have the potential to become a threat and, thus, should be closely monitored. The potential cost of delaying any action is also considered in this analysis.

The results of the rankings are used to determine relative management priorities. In accordance with NPS *Management Policies 2001* (NPS 2001e), the highest priority is to manage disruptive exotic plants that have, or could potentially have, a substantial impact on park resources and could reasonably be expected to be controlled.

In addition to these criteria, the parks set priorities for areas for treatment based on the following:

- Control technologies have already been established for exotic plant species, and the species are also ranked as high priority for treatment.
- The control project would benefit specific threatened or endangered species that inhabit the area or site.
- The site has a relatively high restoration potential, which is determined through consideration of the following:
  - There are significant patches of native vegetation remaining on the site or on the site perimeter, increasing the potential for natural recruitment into the site.
  - The native seed bank is shown to be present on the site.
  - Revegetation planting is practical and funded.
  - There are opportunities for public involvement.
  - The park has made a commitment to follow up with monitoring and treatment.
  - There are cooperative, cost-sharing, matching funds available (this applies only to projects in Florida parks).

As stated earlier in this section, the nine parks collaborate with the EPMT to acquire funding and labor to treat exotic plants. Parks such as Biscayne National Park, Canaveral National Seashore, Buck Island Reef National Monument, and Virgin Islands National Park rely solely on the EPMT for funds for initial treatment of exotic plants. Each park conducts a review of projects and sets priorities for treating areas using a combination of the Alien Plant Ranking System, EPMT priority-setting criteria, and internal deliberations with park resource specialists. The following sections provide a detailed description of the unique elements of the current exotic plant control programs at each park, plus additional information on EPMT funding.

EXOTIC PLANTS TREATED

In response to the growing threat on native ecosystems, nine national parks in the southeastern United States and Caribbean are joining together in a methodical approach to take advantage of shared information and improved methods of treating exotic plants. The detection, quantification, and analysis of exotic plant infestations can now benefit from high-tech tools, such as satellite imagery, aerial photographs, and global positioning system (GPS) technology integrated with GIS.

Numerous exotic plant species have invaded the nine NPS units participating in this coordinated effort, but to keep this draft EPMP/EIS to a manageable size, this study only focuses on nine high-priority species that were selected using the following three criteria: immediacy of threat to park resources, prevalence in the parks, and responsiveness to treatment. These nine species are also representative of the treatment methods employed by the NPS to treat numerous other exotic plant species.

The nine exotic plant species that are receiving the highest priority for treatment are Australian pine**,** Brazilian pepper, guinea grass, lather leaf, melaleuca, Old World climbing fern, tan tan, lime berry (or sweet lime), and genip.

Table 2 provides a description of the life cycle for each species, the environmental issues associated with each exotic plant species, and what species occur in each park. A complete list of exotic plants known to occur in the parks is provided in appendix O. Table 3 provides the extent of infestation of the state and territory priority exotic plant species (category I and category II plant species in Florida) and acres of infestation that have been inventoried in each park.

For the most part, available information on these plants includes their characteristics and consequent danger to the ecosystem, native range, invaded range, reasons for introduction, and methods used to treat infestations. Information is also available for some of the participating parks about the extent of exotic plant infestation. Most predictions about the anticipated spread of exotic plants in park boundaries tend to be anecdotal rather than quantitative. The following briefly describes the locations of high-priority (category I) species currently being treated in the parks and what treatment methods are employed.

AUSTRALIAN PINE

Australian pine is currently found in Everglades National Park, Big Cypress National Preserve, Canaveral National Seashore, Dry Tortugas National Park, and Salt River Bay National Historic Park and Ecological Preserve (Pernas 2003). The parks currently treat this species with a cut stump or basal bark herbicide application using a variety of herbicides (including Garlon 3A™ and Garlon 4™).

BRAZILIAN PEPPER

Brazilian pepper invades fallow farmlands, pinelands, hardwood hammocks, roadsides, and mangrove forests (Laroche 1994). By 1997, it was estimated to occupy over 700,000 acres in central and south Florida (Ferriter 1997). The shrub is found in Everglades National Park, Big Cypress National Preserve, Biscayne National Park, Virgin Islands National Park, and Canaveral National Seashore. The treatment methods currently used are cut stump or basal bark herbicide application (typically using Garlon 3A and Garlon 4), with the treated plants left to decay in place.

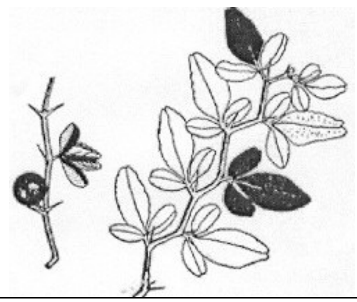
TABLE 2: PRIORITY EXOTIC PLANT SPECIES

Plant Identification	Exotic Plant Species	Life Cycle	Vegetation Category and Location	Issues	Park Occurrences
	Australian pine (*Casuarina* spp.)	Tree	Upland Dry / Mesic Forest Shrubland Grassland / Coastal Strand Agriculture / Disturbed Land / Developed Area	Allelopathic activity Competes with and displaces native vegetation Forms monocultures reducing species diversity Changes structure and composition of habitats	BICY[a] BISC[b] CANA[c] DRTO[d] EVER[e] SARI[h]
	Brazilian pepper (*Schinus terebinthifolius*)	Shrub	Upland Dry / Mesic Forest Shrubland Grassland / Coastal Strand Agriculture / Disturbed Land / Developed Area	Allelopathic activity Competes with and displaces native vegetation Forms monocultures reducing species diversity Changes structure and composition of habitats Can be toxic to some birds Sap can cause allergic reaction in some people	BICY[a] BISC[b] CANA[c] EVER[e] VIIS[i]
	guinea grass (*Urochloa maxima*)	Perennial grass	Upland Dry / Mesic Forest Shrubland Grassland / Coastal Strand Agriculture / Disturbed Land / Developed Area	Allelopathic activity Increases risk of catastrophic fire Tolerant of dry, exposed, or shady conditions Competes with and displaces native vegetation Forms monocultures reducing species diversity	BICY[a] CANA[c] DRTO[d] EVER[e] BUIS[f] CHRI[g] SARI[h] VIIS[i]

Table 2: Priority Exotic Plant Species (continued)

Plant Identification	Exotic Plant Species	Life Cycle	Vegetation Category and Location	Issues	Park Occurrences
	lather leaf (*Colubrina asiatica*)	Shrub/vine	Upland Dry / Mesic Forest Shrubland Grassland / Coastal Strand Agriculture / Disturbed Land / Developed Area	Competes with and displaces native vegetation Forms monocultures reducing species diversity Changes structure and composition of habitats Disperses via water – hard to control Tolerant of high salinity	BICY[a] EVER[e]
	melaleuca (*Melaleuca quinquenervia*)	Tree	Everywhere except in Coastal Marshes and below mean high water	Allelopathic activity Competes with and displaces native vegetation Forms monocultures reducing species diversity Changes structure and composition of habitats Alters hydrology and flow regimes Causes respiratory problems for allergic people	BICY[a] EVER[e]
	Old World climbing fern (*Lygodium microphyllum*)	Vine	Everywhere except high salinity habitats	Creates fire "ladders" into tree canopies Engulfs trees and pulls them down with the weight of built-up dead matter Spreads by spores into undisturbed habitat Can invade wetlands as well as uplands Extremely hard to control because of viability and dispersal of spores	BICY[a] EVER[e]

TABLE 2: PRIORITY EXOTIC PLANT SPECIES (CONTINUED)

Plant Identification	Exotic Plant Species	Life Cycle	Vegetation Category and Location	Issues	Park Occurrences
	tan tan, lead tree, or wild tamarind (*Leucaena leucocephala*)	Tree	Upland Dry / Mesic Forest Shrubland Grassland / Coastal Strand Agriculture / Disturbed Land / Developed Area	Tolerant of a variety of conditions, but not shade, saturated soils, or high salinity Competes with and displaces native vegetation Forms monocultures reducing species diversity Changes structure and composition of habitats	BICY[a] BISC[b] EVER[e] BUIS[f] CHRI[g] SARI[h] VIIS[i]
	lime berry or sweet lime (*Triphasia trifolia*)	Tree	Upland Dry / Mesic Forest Shrubland Agriculture / Disturbed Land / Developed Area	Forms dense, spiny, thickets Crowds out native plants, especially in understory Dispersed by birds, small animals Edible fruit, widely cultivated Requires full sun and drained soils	SARI[h] VIIS[i]
	genip (*Melicoccus bijugatus*)	Tree	Upland Dry / Mesic Forest Shrubland Agriculture / Disturbed Land / Developed Area	Prefers full sun, tolerates a wide range of soils Grows slowly, 40 to 100 feet tall Dense foliage shades out understory Fruit is edible, seeds are used to make flour Seeds germinate readily and trees form dense monotypic groves	BUIS[f] SARI[h] VIIS[i]

Illustrations courtesy of Joy King, Miami-Dade Parks and Recreation Department, Miami, FL. Elizabeth Smith, artist.

a. BICY–Big Cypress National Preserve
b. BISC–Biscayne National Park
c. CANA–Canaveral National Seashore
d. DRTO–Dry Tortugas National Park
e. EVER–Everglades National Park
f. BUIS–Buck Island Reef National Monument
g. CHRI–Christiansted National Historic Site
h. SARI–Salt River Bay National Historic Park and Ecological Preserve
i. VIIS–Virgin Islands National Park

TABLE 3: LEVEL OF INFESTATION OF PRIORITY EXOTIC PLANT SPECIES

Exotic Plant Species		Acreage of Inventoried Exotic Plant Infestation by National Park								
		Big Cypress National Preserve			Biscayne National Park			Canaveral National Seashore		
Common Name	Scientific Name	Total Acres[a]	Acres Infested	Percent of Total Acres Infested	Total Acres[a]	Acres Infested[b]	Percent of Total Acres Infested	Total Acres[a]	Acres Infested	Percent of Total Acres Infested
Australian pine	*Casuarina equisetifolia*	720,567	1,768	less than 1	6,282	Unk	Unk			
Australian pine and Brazilian pepper	*Casuarina equisetifolia*							17,982	1,293	7
Lather leaf	*Colubrina asiatica*				6,282	Unk	Unk			
Old World climbing fern	*Lygodium microphyllum*	720,567	1,182	less than 1						
Melaleuca, paper bark	*Melaleuca quinquenervia*	720,567	46,323	6						
Brazilian pepper	*Schinus terebinthifolius*	720,567	111,366	15	6,282	Unk	Unk	17,982	1,980	11
Guinea grass	*Urochloa maxima*							17,982	Unk	Unk
	Total exotic species	**720,567**	**160,639**	**22**	**6,282**	**Unk**	**Unk**	**17,982**	**3,273**	**18**

Exotic Plant Species		Acreage of Inventoried Exotic Plant Infestation by National Park					
		Dry Tortugas National Park			Everglades National Park		
Common Name	Scientific Name	Total Acres[a]	Acres Infested	Percent of Total Acres Infested	Total Acres[a]	Acres Infested	Percent of Total Acres Infested
Australian pine	*Casuarina equisetifolia*	40	less than 1	3	883,508	41,605	5
Lather leaf	*Colubrina asiatica*				883,508	Unk	Unk
Old World climbing fern	*Lygodium microphyllum*				883,508	8,132	1
Melaleuca, paper bark	*Melaleuca quinquenervia*				883,508	37,359	4
Brazilian pepper	*Schinus terebinthifolius*				883,508	109,813	12
Tan tan	*Leucaena leucocephala*				883,508	Unk	Unk
Guinea grass	*Urochloa maxima*				883,508	Unk	Unk
	Total Exotic Species	**40**	**less than 1**	**3**	**883,508**	**197,493**	**22**

TABLE 3: LEVEL OF INFESTATION OF PRIORITY EXOTIC PLANT SPECIES (CONTINUED)

Exotic Plant Species		Acreage of Inventoried Exotic Plant Infestation by National Park					
		Buck Island Reef National Monument			Christiansted National Historic Site		
Common Name	Scientific Name	Total Acres[a]	Acres Infested	Percent of Total Acres Infested	Total Acres[a]	Acres Infested	Percent of Total Acres Infested
Tan tan	*Leucaena leucocephala*	168	49	29	**7**	less than 1	7
Guinea grass	*Urochloa maxima*	168	7	4	**7**	less than 1	1
	Total Exotic Species	**168**	**56**	**33**	**7**	**less than 1**	**8**

Exotic Plant Species		Acreage of Inventoried Weed Infestations by National Park					
		Salt River Bay National Historic Park and Ecological Park			Virgin Islands National Park		
Common Name	Scientific Name	Total Acres[a]	Acres Infested	Percent of Total Acres Infested	Total Acres[a]	Acres Infested	Percent of Total Acres Infested
Tan tan	*Leucaena leucocephala*	423	333	79	9,039	1,113	12
Mother-in-law's tongue	*Sanseviera hyacinthoides*				9,039	137	2
Australian pine	*Casuarina equisetifolia*	423	less than 1	less than 1			
Guinea grass	*Urochloa maxima*	423	56	13	9,039	400	4
Lime berry	*Triphasia trifolia*	423	5	1	9,039	922	10
Brazilian pepper	*Schinus terbinthifolius*				9,039	16	less than 1
	Total Exotic Species	**423**	**394**	**93**	**9,039**	**2,588**	**28**

a. Total acres represent terrestrial acres within the park based on the summation of acreage of vegetation categories.

b. Due to the nature of the data regarding infestation at Biscayne National Park, the actual acreage of the priority exotic plant species within the park was unable to be determined.

GUINEA GRASS

Guinea grass is found in all of the parks with the exception of Biscayne National Park. The NPS currently treats guinea grass with foliar (leaf) applications of Roundup® and Aquaneet®.

LATHER LEAF

Lather leaf is present along the eastern and western coastlines of central and southern Florida (essentially frost-free areas), including the Florida Keys. It also occurs in tropical hardwood hammocks in Biscayne National Park and Everglades National Park. Because lather leaf is widespread throughout the Caribbean Basin, there is a likelihood that it may also occur in the United States possessions of Puerto Rico and the U.S. Virgin Islands. However, it is not known to occur in the four Caribbean national parks at this time. Lather leaf would continue to be treated using a cut surface or basal bark application of Garlon 4 (Jones 1999).

MELALEUCA

Melaleuca, found mainly in the southern half of Florida, infests 500,000 to 1.5 million acres (Bodle et al. 1994). The tree is among the worst of the nuisance species in the south Florida national parks (in Everglades National Park and in Big Cypress National Preserve). Melaleuca is initially treated by aerial spray of Arsenal/Glyphosate or a cut stump treatment with Arsenal/Glyphosate or Glypro®. Follow-up treatments consist of similar herbicide applications, prescribed fire, and/or hand pulling of seedlings in subsequent years. Fire is used in treated areas within 6 to 18 months of the initial treatment when seedlings are less than 50 centimeters in height. The parks currently use biological treatment, which includes the release of the snout beetle (*Oxyops vitiosa*) and sap sucking psyllid (*Boreioglycapsis melaleuca*).

Melaleuca leaf weevil

OLD WORLD CLIMBING FERN

Old World climbing fern (commonly referred to as lygodium) is currently found in the vegetative cover of Everglades National Park and Big Cypress National Preserve. Old World climbing fern is difficult to treat chemically because it typically embeds in native communities, so there is always a chance for over-spray and damage to nontarget species. The parks currently conduct ground-based and aerial application of herbicides (Escort®, Rodeo®, Arsenal®, and Garlon 3A) to treat lygodium. In 2003, the EPA granted Florida governmental agencies a special local needs (SLN) label for the use of ESCORT XP® (Metsulfuron methyl) herbicide in dry wetlands. It is hoped that this herbicide would provide selective control of lygodium in native vegetation categories and reduce non-target damage.

To reduce nontarget damage to cypress in the parks, the NPS sprays in the winter when the cypress trees are dormant, but there is no optimal time for treating lygodium in evergreen species such as pines and palmettos (Pernas 2003).

Everglades National Park uses fire as a re-treatment to control lygodium in areas where there is no threat of flames climbing into the forest canopy. Fire is also used to reduce the amount of dead plant material following mechanical or chemical treatments.

TAN TAN

The tan tan tree is found extensively in Virgin Islands National Park, Buck Island Reef National Monument, and Salt River Bay National Historic Park and Ecological Preserve. It is found to a lesser degree in Big Cypress National Preserve, Biscayne National Park, Everglades National Park, and Christiansted National Historic Site (Pernas 2003; Clark 2005). Tan tan is treated with cut stump or basal bark applications of Garlon 4.

LIME BERRY

Lime berry, a shrub native to southeast Asia, occurs as an understory plant in the Virgin Islands and Salt River Bay National Historic Site and Ecological Preserve. It grows beneath native trees in disturbed areas, such as campgrounds and beach access points. The plant grows to a height of 9 feet, has dark green leaves, and small, white, fragrant flowers. This spiny ornamental was likely introduced for its fruit, which can be eaten, used in beverages, and cooked for preserves. The edible fruits are bright red and contain two to three seeds (Tropilab 2004), which are dispersed by birds and other animals that feed on the fruit (IPIF 2003). Lime berry is treated with basal bark application of Garlon 4.

GENIP

Genip is found in Virgin Islands National Park, Salt River Bay National Historic Park and Ecological Preserve, and Buck Island Reef National Monument. Genip is native to central and northern South America, and it is thought aboriginal settlers brought the plant to the Virgin Islands from South America prior to European contact (NPS 2004c). Genip is slow-growing, erect, stately, and attractive and can grow to 85 feet tall. The plant has smooth, gray bark, relatively large seeds, and fruits borne in clusters about 0.75 to 1.5 inches in diameter. Genip is often planted in tropical areas for its fruit; however, it can grow in most soils (even poor soils) and is well adapted to areas of low rainfall (Morton 1987). Genip is propagated by seeds that are dispersed over short distances by bats and pigeons and longer distances by humans eating the fruit and throwing the seeds out along the roadside (NPS 2004c). Genip is treated using a basal bark application of triclopyr mixed with vegetable oil.

CURRENT EXOTIC PLANT TREATMENT METHODS

Under alternative A, the parks would continue to use a single method or a combination of chemical, biological, mechanical, and prescribed fire treatment methods when applying an IPM approach to control exotic plants. Park resource managers consider all of the following factors prior to selecting the most appropriate treatment method: the risk of exotic plant spread or expansion, exotic plant species biology, time of year, environmental setting, soil type, and management objective.

MECHANICAL TREATMENT

Mechanical treatment consists of methods that physically destroy, disrupt growth, or interfere with the reproduction of noxious and invasive exotic plants. It can be accomplished by hand, hand tool, power tool, or heavy equipment (such as bulldozers), and may include manual pulling, digging, hoeing, tilling, cutting, mowing, and mulching exotic plants. Remote locations and marshy conditions make it difficult, or impossible, to perform mechanical treatment in some areas of the parks.

Manual pulling of exotic plants is very labor intensive, while often leaving root fragments in the ground. If sufficient root mass is removed, the individual plant can be destroyed—this can be done successfully with shallow-rooted plants. Opportunistic manual pulling of seedlings would be conducted in all treatment areas when either initial treatments or re-treatments are occurring as crews are canvassing the area for species that respond successfully to this treatment method. However, some exotic plant species respond to mechanical treatment by aggressively resprouting, even if only small root fragments are left in the soil. This type of treatment is much less effective on rhizomatous plants than non-rhizomatous exotic plant species because of their well-developed root system and carbohydrate reserves.

Rhizomatous plants—Plants that have a thick, underground, horizontal stem that produces roots, and whose shoots develop into plants (e.g., guinea grass).

Mechanical treatments must be repeated several times a year for many years in order to eradicate exotic plant species that are prolific seed producers and have built up a residual seed bank in the soil. To be most effective, mechanical treatment must occur before seed production occurs. Plants that have already flowered must be removed from the treatment area and destroyed. Mechanical treatment methods are most effective when used in combination with other controls, such as chemical treatments. The basal bark herbicide application method is an example of a successful mechanical and chemical control.

BIOLOGICAL TREATMENT

This treatment consists of using biological controls (agents) such as insects and plant pathogens to attack, weaken, and kill a targeted exotic plant species and reduce its competitive or reproductive capacity. Natural limiting factors such as predators (animals, insects), disease, and other vegetation competing for nutrients, moisture, space, and light, generally prevent populations of native plants from spreading out of control. Exotic plant species have become a problem because of the absence of limiting factors that are present in their native habitats. Biological controls are used to reduce densities and rates of exotic plant spread rather than to eradicate the plants. Biological controls may decrease the production of viable exotic plant seed and may slow the rate of exotic plant spread, but by themselves, they do not eradicate or contain exotic plant infestations.

The use of biological controls include the following limitations: (1) exotic plants continue to spread while the biological controls are becoming established; (2) some exotic plant species do not have biological controls; (3) populations of biological controls can fail (leave an area or die); (4) in some instances, biological controls can be more costly than other methods, such as herbicides; and a mix of different species of biological controls is often necessary to effectively treat a given exotic plant site (NPS 2003f). Biological treatment is more effective when used in combination with, or prior to, other treatment methods, such as herbicides.

The USDA Animal and Plant Health Inspection Service (APHIS) rigorously screens and tests new biological agents for impacts on agricultural plants and on threatened, endangered, and sensitive plant species. It then prepares environmental assessments, in accordance with the NEPA on the possible impacts of releasing those agents. Before the prospective biological controls can be released, they are placed in quarantine under “eat or starve” conditions with a variety of plant species to determine if they are host-specific to the plants they are intended to control. Insects are generally the most popular and available biological agents (APHIS 2006).

Only APHIS-approved biological controls would be used in the parks and would be released according to APHIS requirements and NPS policy.

The biological controls for melaleuca that would be used in Everglades National Park and Big Cypress National Preserve include the snout beetle and the sap-sucking psyllid. In February 2005, a nonindigenous moth was released by the USDA, Agriculture Research Service, in south Florida, as a biocontrol agent for Old World climbing fern (USDA 2005). These biological control agents have been released in areas outside of the parks. These agents enter the parks passively as they spread to areas of infestation.

CHEMICAL TREATMENT

Chemical treatment involves the application of herbicides (chemical compounds) at certain stages of exotic plant growth in order to kill the species. Herbicides are extensively screened and tested before they are approved and registered for use by the EPA.

The NPS designated IPM coordinator must approve the use of all herbicides in NPS units. Depending on the intended use, an herbicide can be approved at the park level, regional level, or national level. IPM coordinators review each herbicide use proposal on a case-by-case basis, taking into account environmental effects, cost and staffing, and other relevant considerations.

Many herbicides are “selective” and kill specific types of plants, while others are “general” and kill almost all actively growing plant species they contact. Most herbicides are not truly selective at the species level but selectively kill forbs or certain groups of species. Some of these herbicides are pre-emergent and absorbed through the roots, but most herbicides affect established plants through foliar (leaf) and root absorption. The primary herbicides used in the parks have metsulfuron methyl, triclopyr, impazapyr, or glyphosate, as their active ingredients. These herbicides are registered with the EPA and are non-restricted use pesticides, meaning that no license is required to purchase or use the herbicides in accordance with label specifications.

The rates of active ingredient proposed for application on exotic plants within the parks are below the maximum rate per acre allowed by the label (identified in table 4) and by law (Pernas 2005). Thus, environmental toxicity concerns related to applicators, non-target wildlife species and the surrounding physical environment are expected to be minimal. These herbicides are discussed briefly below and described further in table 4. (See appendix J for a general discussion of these chemicals and their properties, as well as for more information regarding the risk to other resources from their use.)

In addition, answers to concerns about the use of glyphosate and triclopyr in the parks can be found in the EPA Registration Eligibility Decisions (RED) (EPA-738-F-93-011 for Glyphosate; EPA-738-F-98-007 for Triclopyr). The RED for imazapyr has not been completed to date, but is expected to be completed in 2006. No RED has been scheduled to date for Metsulfuron methyl. The EPA continues to review fate and chemistry information of pesticides derived from studies submitted by pesticide manufacturers in support of the registration or re-registration of their pesticide products. Through this review and re-registration process, the EPA would reclassify and restrict herbicides, as appropriate. The NPS would apply herbicides based on the most current EPA recommendations and label instructions. The overall intent of the label is to provide clear directions for effective product performance while minimizing risks to human health and the environment and it is a violation of federal law to use a herbicide in a manner inconsistent with its labeling.

Fate—Referring to the eventual disposition of the chemical in the environment, whether it degrades or persists.

Metsulfuron methyl (e.g., Escort)—Metsulfuron methyl is a broad-spectrum, selective herbicide that is absorbed through roots and foliage and moves rapidly through the plant, inhibiting cell division in roots and shoots. It is used to control brush and certain unwanted woody plants, annual and perennial broadleaf weeds, and annual grassy weeds. This broad-spectrum herbicide can affect non-target plant species, as well. It dissolves easily in water and is of relatively low toxicity for most animals tested, with little to no bioaccumulation. Metsulfuron methyl in the soil is broken down to nontoxic and nonherbicidal products by soil microorganisms and chemical hydrolysis (IVI 2004c).

Triclopyr (e.g., Garlon)—Triclopyr, a selective herbicide used to control broadleaf and woody plants, is applied to cut surfaces using backpack sprayers. Two products containing triclopyr that are used to treat exotic plants in the parks are Garlon 3A and Garlon 4. Garlon 4 formulations are water emulsifiable and oil soluble and can penetrate bark and can therefore be used in basal bark or cut stump applications (which are described below) at any time during the year. Garlon 3A is a water-soluble amine salt formulation that needs to be directly applied to cut surfaces for plant uptake. Therefore, it is used only in cut stump and not for basal bark applications.

TABLE 4: SUMMARY OF HERBICIDES CURRENTLY USED BY PARKS TO TREAT EXOTIC PLANTS

Active Ingredient	Trade Name	Target Plants (specific to this project)	Mode of Action	Method of Application	Use Rates	Soil Adherence
Metsulfuron methyl	• Escort® • Escort XP® • Ally®	Brush, certain woody plants, annual and perennial broadleaf weeds, and annual grassy weeds. Specifically: Old World climbing fern.	Absorbed through roots and foliage and moves rapidly through the plants. It inhibits cell division in the roots and shoots, stopping growth.	Aerial foliage spraying or spraying from ground equipment and/or a handgun sprayer.	0.33 to 4.0 ounces of active ingredient per acre; for noncropland uses.	Generally active in soil; it is absorbed from the soil into the plant. Adsorption varies by the amount of organic matter, soil texture, and pH level. Adsorption to clay is low.
Triclopyr	• Garlon® • Renovate® • Grazon®	Woody plants, broadleaf weeds. Specifically: Old World climbing fern, melaleuca, Brazilian pepper, Australian pine, seaside mahoe, agave, lather leaf, mother-in-law's tongue, genip, lime berry, tan tan, ginger Thomas, tamarind, noni, aloe, and water hyacinth.	Disturbs plant growth. Absorbed through green bark, leaves, and roots, then moves throughout the plant. It accumulates in the meristem (growth region) of the plant. It mimics the plant hormone, auxin, causing hypertrophy (excessive enlargement of cells).	Ground or aerial foliage spray, basal bark and stem treatment, cut-surface treatment, and/or tree injection.	0.25 to 9 pounds of acid equivalent per acre.	Active in soil; it is absorbed through plant roots. Adsorbed by clay particles and organic matter particles in soil.
Imazapyr	• Arsenal® • Chopper® • Contain® • Habitat® • Stalker®	Annual and perennial grasses, broadleaf weeds, brush, vines, and some deciduous trees. Specifically: Old World climbing fern, melaleuca, Brazilian pepper, seaside mahoe, cogon grass, mother-in-law's tongue, lime berry, Penguin bromeliad, and Monk orchid.	Absorbed through leaves and roots and moves rapidly through the plant. Accumulates in meristem (growth region) of the plant. It disrupts protein synthesis and interferes with cell growth and DNA synthesis.	Aerial and ground foliage methods; low-volume hand-held equipment, high-volume spray equipment, boom equipment, basal treatment, cut-stump treatment, tree injection, and/or frill treatment.	2 to 6 pints per acre.	Can remain active in the soil for 6 months to 2 years. Strongly adsorbed by soil and found only in the top few inches of soil.
Glyphosate	• Roundup® • Rodeo® • Accord® • Aquaneet® • Glypro®	Grasses, herbaceous plants (including deep-rooted perennial weeds), some broadleaf trees and shrubs, and some conifers. Specifically: Old World climbing fern, melaleuca, Brazilian pepper, seaside mahoe, cogon grass, guinea grass, Boerhavia, water hyacinth, and water lettuce.	Inhibits the 5-enolpyruvylshikimate-3-phosphate (EPSP) synthase enzyme; leads to the depletion of key amino acids necessary for protein synthesis and plant growth.	Aerial foliage spraying; ground foliage spraying from a truck, backpack, or hand-held sprayer; wipe application; frill treatment; and/or cut stump treatment.	0.3 to 4.0 pounds of active ingredient per acre.	Not active in the soil; adsorbs strongly to soils and does not move below the 6-inch soil layer; readily degraded by soil microbes.

Small amounts of triclopyr can impact nontarget, native, woody plants if it is absorbed through roots and leaves. It is not especially effective on grasses and other plants with a single seed leaf (IVI 2004d). Triclopyr shows low to moderate acute toxicity in mammals, although Garlon 3A can cause permanent vision impairment, and studies of Garlon 4 in dogs and rodents found kidney and liver effects (SSPM 2001).

Garlon 4 is extremely toxic to rainbow trout and bluegills—concentrations over 500 parts per million (ppm) can cause a 50% mortality rate. Studies on mallard ducks indicate triclopyr is of low, acute oral toxicity, and studies on quail and ducks also report low toxicity. No bird field studies are known to exist (SSPM 2001).

Triclopyr is readily photo degraded in water and microbially degraded in soil into 3,5,6-trichloro-2-pyridinol (TCP), which is persistent and mobile. In 15 soils tested, the persistence ranged from 8 to 279 days with 12 of the tested soils having half-lives of less than 90 days and that degrades to carbon dioxide and organic matter. The half-life in soil is dependent upon the soil type and environmental condition (Extoxnet 1996b). The EPA is concerned about the potential chronic toxicity and persistence of TCP in the aquatic environment and is requiring additional confirmatory data to better characterize the fate of TCP and its chronic toxicity to fish. According to the EPA, the use of currently registered products containing triclopyr, in accordance with labeling instructions, would not pose unreasonable risks of adverse effects to humans or to the environment (EPA 1998).

Imazapyr (e.g., Arsenal)—Imazapyr is a broad-spectrum, nonselective herbicide used to control grasses, brush, vines, and trees. The parks apply it to melaleuca through aerial spraying. Imazapyr is practically nontoxic to fish, terrestrial mammals, and birds. Very small amounts of the spray can impact nontarget native plants if absorbed into the roots through the soil or allowed to contact leaves (IVI 2004b). No information is available on the breakdown products of imazapyr.

Glyphosate (e.g., Roundup, Rodeo, Accord)—Glyphosate is a nonselective herbicide used in the treatment of grasses, herbaceous plants, some broadleaf trees and shrubs, and some conifers. Absorbed through the leaves, it inhibits growth. Small amounts of over-spray can kill or injure susceptible nontarget native plants, and improper use may damage essential habitat by impacting plants (IVI 2004a). Additional study is necessary and "additional data are needed to fully evaluate the effects of glyphosate on nontarget terrestrial plants" (EPA 1993). The chemical is practically nontoxic to birds and mammals, nontoxic to bees, and only slightly toxic to fish and other aquatic organisms.

Roundup formulation is moderately to slightly toxic to freshwater fish and aquatic invertebrate animals. The Accord and Rodeo formulations are practically non-toxic to freshwater fish and aquatic invertebrate animals. Applied according to the label direction rates, or below these rates as is done in the parks, glyphosate would not adversely affect fish, aquatic macrophytes, or aquatic invertebrates. Inert ingredients for the Rodeo formulation have not been disclosed. Glyphosate has been proven safe for applicators as glyphosate is of relatively low oral and dermal acute toxicity; it is not carcinogenic, and is non-volatile (NPS 2004c). According to the EPA, the use of currently registered products containing the isopropylamine and sodium salts of glyphosate, in accordance with labeling instructions, would not pose unreasonable risks or adverse effects to humans or the environment (EPA 1993).

Herbicide treatment

The main break-down product of glyphosate in the soil is aminomethylphosphonic acid, which is broken down further by soil microorganisms. The main break-down product of the surfactant used in Roundup is carbon dioxide (EPA 1993).

The four herbicides discussed above would be among the primary herbicides used under the alternatives analyzed in this draft EPMP/EIS because of their low level of environmental impacts. There are other herbicides, used for agricultural purposes that have more severe environmental consequences, such as Atrazine and 2, 4 D. These, however, because they do have more severe environmental consequences, would not be used by the nine parks included in this draft EPMP/EIS.

Improved herbicides may become available during the life of the exotic plant management plan (10 years) but these would only be used in the parks if they were applied in a similar manner and had similar environmental impacts as described in this document. If the method of application or impacts would be different, additional NEPA compliance and consultations with other federal agencies would be conducted prior to use. Under all alternatives, the NPS would have the flexibility to use any new or updated herbicide as soon as it is registered and approved by the EPA.

Although chemical treatments have the potential to impact native species, the choice of application method can minimize impacts on nontarget species. Generally, the more selective methods are also more labor-intensive. Application methods include the following:

- *Foliar application*—a dilute mixture of herbicide and water is sprayed on leaves; this method can be conducted on the ground or accomplished aerially by helicopter and/or plane.

- *Basal bark application*—the herbicide is sprayed around the circumference of each tree, about one foot above the ground.

- *Girdling or Frilling*—girdling and frilling are individual stem application methods of killing standing trees that may be done with or without an herbicide. Girdling involves cutting a groove or notch into the trunk of a tree to interrupt the flow of sap between the roots and crown of the tree. Frilling is a variation of girdling in which a series of downward angled cuts are made completely around the tree, leaving the partially severed bark and wood anchored at the bottom.

- *Hack and squirt application*—the herbicide is applied to cuts made into the cambium around the surface of the tree.

- *Cut stump treatment*—the herbicide is sprayed or painted on the cut surface, after removing trees or brush.

- *Soil application*—a granular herbicide is spread on the ground (Ferriter et al. 2001).

Cambium—The layer of cells in plant roots and stems that produces new tissue responsible for increased girth; for example, bark.

Selection of a herbicide for site-specific application would depend on its chemical effectiveness on a particular exotic plant species, success in previous similar applications, habitat types, soil types, nearness of the exotic plant infestation to water, and the presence or absence of sensitive plant, wildlife, and fish species. The herbicides used in the parks are applied in accordance with label instructions, specifications, and precautions, as well as any additional NPS guidance. Herbicide characteristics, properties, application rates, and methods of application used in the parks are presented in table 4.

Inert Ingredients and Carriers. The designation as "inert" does not mean an additive is chemically inactive, and it does not convey any information about the toxicity of the ingredient (Tu et al. 2003; EPA 2003b). FIFRA defines an inert ingredient as any ingredient in a product that is not intended to affect a target pest. For example, isopropyl alcohol may be an active ingredient and antimicrobial pesticide in some products, while in other products it functions as a solvent and may be considered an inert ingredient. The law does not require inert ingredients to be identified by name and percentage on the label, but the total percentage of such ingredients must be declared.

Herbicide manufacturers add inert ingredients (or "other ingredients") to enhance the action of the active ingredient. Inert ingredients may include carriers, surfactants (wetting agents), spray adjuvants, preservatives, dyes, and anti-foaming agents, among other chemicals. Because many manufacturers consider inert ingredients in their herbicide formulations to be proprietary, they do not list specific chemicals.

Adjuvant—An ingredient added to a herbicide formulation or spray mixture to aid or modify the action of the herbicide.

The EPA has categorized inert ingredients according to toxicity, from Level 1 to Level 4 (EPA 2004b).

- Level 1 (Inert Ingredients of Toxicological Concern)

- Level 2 (Potentially Toxic Inert Ingredients)

- Level 3 (Inert Ingredients of Unknown Toxicity)

- Level 4A (Minimal Risk)

- Level 4B (No Adverse Effect to Public Health or the Environment)

The listed inert ingredients, with the EPA category of toxicity in parenthesis for the herbicide formulations being considered for use in the parks, include water, ethanol (4B), kerosene (3), isopropylamine (3), propylene glycol (4B), isopropanol (3) and poly ethoxylated tallowamines (3) (EPA 2004b; IVI 2004a, 2004b, 2004c, 2004d). The Level 3 compounds would continue to be evaluated by the EPA and reclassified accordingly, based on further research. If herbicide label instructions are altered as a result of further information regarding toxicity of the inert ingredients, herbicide use in the parks would be adjusted according to label recommendations.

One inert ingredient, polyoxyethylamine (POEA), a surfactant included in a formulation of glyphosate, which is found in Roundup, has raised some concern regarding toxicity to fish and aquatic species. The Roundup formulation has been shown to be moderately to slightly toxic to freshwater fish and aquatic invertebrate animals (IVI 2004a). Based on the label, Roundup is not recommended for use in the aquatic environment and is, therefore, not applied in areas adjacent to aquatic environments. The Rodeo and Accord formulations of this herbicide (which lack POEA) are labeled for use adjacent to water. Applied at the label direction rates, glyphosate would not adversely affect fish, aquatic macrophytes, or aquatic invertebrates. Inert ingredients for the Rodeo formulation have not been disclosed.

Carriers are used to dilute or suspend herbicides during application and allow for proper placement of the herbicide, whether it be to the soil or on foliage. The parks widely use water and vegetable oil as carriers because water and vegetable oil are available, cheap, and the herbicides used by the parks are formulated to be effectively applied with water and/or vegetable oil.

Inert ingredients are not regulated by any federal agency. The *Food Quality Protection Act* of 1996 eliminates the “inert” classification, and requires EPA to review the effects of “inert” ingredients and other additives. However, until research becomes available, the use of best management practices and standard operating procedures and other mitigating application techniques can help prevent or minimize adverse environmental effects (Tu et al. 2003). “Carriers” are used to dilute or suspend herbicides during application and allow for proper placement of the herbicide on stems or foliage. Water is by far the most widely used carrier in the parks, because it is readily available and inexpensive, and the herbicides used by the parks are formulated to be effectively applied with water. Oil is also used as a carrier and is particularly effective for treatment of plants in the Caribbean that have thick leaf cuticles. Nonhazardous dyes would be used in some instances in conjunction with herbicide applications. Dyes help determine whether the herbicide has been applied and where or whether the herbicide has dripped, spilled, or leaked; detect areas that are missed; and prevent an area or plant from being treated more than once (Tu et al. 2003).

Under the alternative A, herbicides are applied with handheld sprayers, portable backpack sprayers, all-terrain vehicles equipped with sprayers, and helicopters (see table 4). Aerial application provides a means to rapidly and effectively treat large (but also small) infestations in insolated areas. Aerial applications of herbicides occur in Big Cypress National Preserve and Everglades National Park to treat infestations of Old World climbing fern and melaleuca. As stated earlier, all aerial applications are performed in accordance with label instructions and specifications and are conducted using NPS best management practices for aerial spraying. Aerial application would be done by spot-spray treatment, in which an

80-foot hose and nozzle, which is gravity set, comes out of the tank. The helicopter would hover over the targeted location and then the pilot would dispense herbicide through the spray nozzle. This technique is very precise in the application of herbicide and reduces overspray that may damage other native vegetation. Aerial applications can also be conducted with a boom that controls the drift of herbicide. The spray boom is capable of applying aqueous solutions of herbicides through nozzles in a continuous flow pattern and with a minimum amount of drift. Aerial applications are not conducted in sensitive areas, such as mangroves or hardwood hammocks in either park. Aerial spraying to treat Old World climbing fern in wetland forests in Big Cypress National Preserve is only conducted when cypress are dormant. Mitigation measures for application of herbicides are described later in this chapter in the "Current Mitigation" section.

Aerial treatment

PRESCRIBED FIRE

Prescribed fires are most effective when the exotic plant is more susceptible to the effects of fire compared to intermingled native species. Under alternative A, prescribed fire is currently used to re-treat areas that are infested with melaleuca and Old World climbing fern. Prescribed fire is successful in treating lygodium when it is used within 12 months of herbicide application, and it is successful for the control of melaleuca when applied between 6 and 18 months after initial treatment. Prescribed fire is also used to reduce the amount of dead plant material following other treatment methods. Fire is used in Everglades National Park to remove lygodium and to reduce the thatch layer so that the application of herbicides is more effective (NPS 2005).

Fire may also be used to control Brazilian pepper seeds, seedlings, and saplings, but provides little control for mature trees. In pine rocklands, Brazilian pepper trees less than one meter in height have shown increased mortality when subjected to fire at 5-year intervals. In Everglades National Park, fire management practices have maintained pine rocklands free of Brazilian pepper by killing seedlings before they reach fire-resistant heights (Ferriter 1997).

INITIAL TREATMENT

The parks currently treat high-priority exotic plant species using one method or a combination of chemical, mechanical, prescribed fire, and biological methods. Treatment methods are specific to the location and species of exotic plants and are based on site evaluations and available methods and techniques. The parks rely on published information on the modes of action, efficacy, and best management practices associated with each treatment method, in addition to professional experience and judgment when selecting appropriate treatments. The NPS also consults with adjacent land managers, resource specialists, university faculty, and weed management crews to help determine appropriate treatment methods.

The parks contain areas of exotic plant infestation that have been previously treated (in 2005 or earlier), as well as areas that have not been treated prior to 2005. Six parks contain areas that have undergone initial treatment: Big Cypress National Preserve, Biscayne National Park, Canaveral National Seashore, Dry Tortugas National Park, Everglades National Park, and Buck Island Reef National Monument. Virgin Islands National Park has performed some small treatments in the past as experimental plots. Exotic plants at Salt River Bay National Historic Park and Ecological Preserve have not been treated prior to 2005.

Under alternative A, it is assumed that all infested areas in the parks would eventually be treated over the life of the exotic plant management plan (10 years). Each park has been divided into areas where exotic plant treatments would occur. The treatment maps provided in appendixes A – I display the treatment areas where infestation occurs in each park and would be treated under alternative A. Following each map is a summary table that describes the exotic plant species to be treated, the number of infested acres in each treatment area (gross infested area), and what methods the parks would employ to treat exotic plants in each area.

The summary tables show how each area was treated in the past and would continue to be treated in the future. This information was obtained through personal communication with park staff and data collected and stored in the NPS APCAM database. For certain areas in Big Cypress National Preserve, Canaveral National Seashore, and Everglades National Park that were not treated prior to 2005, but may be treated at some point in the future, treatment methods were determined based on the exotic plant species present and how those species have been treated in the past in other areas of the parks. Treatment methods for exotic plants at Christiansted National Historic Site, Virgin Islands National Park, and Salt River Bay National Historic Park and Ecological Preserve, were based on methods used in the experimental plots at Virgin Islands National Park or based on methods used at Buck Island Reef National Monument.

The amount of herbicide used within the treatment areas was based either on previous treatment history or was estimated based on an average application rate calculated from past treatments within the parks. If an area was not treated prior to 2005 or for which there is no record of past treatment, the rate of herbicide application (undiluted gallons applied per acre) was estimated based on the average herbicide rate of use for treatments that have occurred in the parks. For example, the average application rate of glyphosate that has been applied for treatment of exotic plants in the parks is 0.14 undiluted gallons per acre. Therefore, to estimate the amount of glyphosate that could be used to treat an infested area, 0.14 was then multiplied by the number of acres infested within that treatment area. In appendixes A – I, a table shows these estimates for each park.

MAINTAINING TREATED SITES (RE-TREATMENT)

The parks do not have a standard system to determine the re-treatment schedule of treated areas. Staffing and funding constraints make it difficult to allocate resources to re-treat sites as often as needed to successfully control exotic plants. After initial treatment in remotes areas of infestation, re-treatment may not take place for several years. For example, because of funding and resource constraints in Everglades National Park, park staff are only able to treat roughly 1,000 of the 10,000 acres of lygodium infestation in treatment area 1 (see appendix E, table E-1) every year without the ability to return for re-treatment. Where there are smaller or easily accessible areas in the parks, or if funding has been made available for re-treatment, park staff re-treat on a more frequent basis, allowing the staff to make progress toward achieving a maintenance level of infestation.

It is expected that without an optimal frequency of re-treatment, some of the targeted exotic plants, such as lygodium, because of their high seed production and adaptability to a variety of physical conditions, would increase in population size and density after initial treatment at a rate in excess of the park staff's ability to maintain the populations at an acceptable level. Other species, such as melaleuca, are slower to return after initial treatment, and fewer and smaller plants re-establish between re-treatments. Even with a re-treatment interval of up to 3 years, progress can be made towards achieving maintenance levels of infestation and the effort to re-treat is far less than the initial treatment.

It was assumed under alternative A that, although the parks would initially treat all infestation, re-treatment would not occur at an optimal frequency and would allow the parks to make only minimal progress in reducing over-all populations of exotic plants. According to NPS staff (NPS 2004c), the optimal re-treatment interval would be 6-months to eradicate or achieve a maintenance level of infestation. Available funding and project logistics, however, have dictated in the past that re-treatment events be spaced further than 6-month intervals. Based on information in the APCAM database site, re-treatment tends to occur within 3 to 5 years of initial treatment. Therefore, under alternative A, it is expected that re-treatment would occur, under a best-case scenario, every 3 years and would occur indefinitely at this rate 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. Exceptions to this would occur in Biscayne National Park, Buck Island Reef National Monument, Christiansted National Historic Site, and Dry Tortugas National Park, as noted below.

Under alternative A, it would be expected that a 3-year re-treatment interval would allow a gradual reduction in total infestation over the life of the plan in all of the five parks that have not yet achieved maintenance levels. This would be the net result of the substantial reduction that would be achieved with species that are slow to return and the gradual increase in infestation of more aggressive species. Figure 2 portrays the conceptual trend in treatment over time that would occur in the five parks under alternative A.

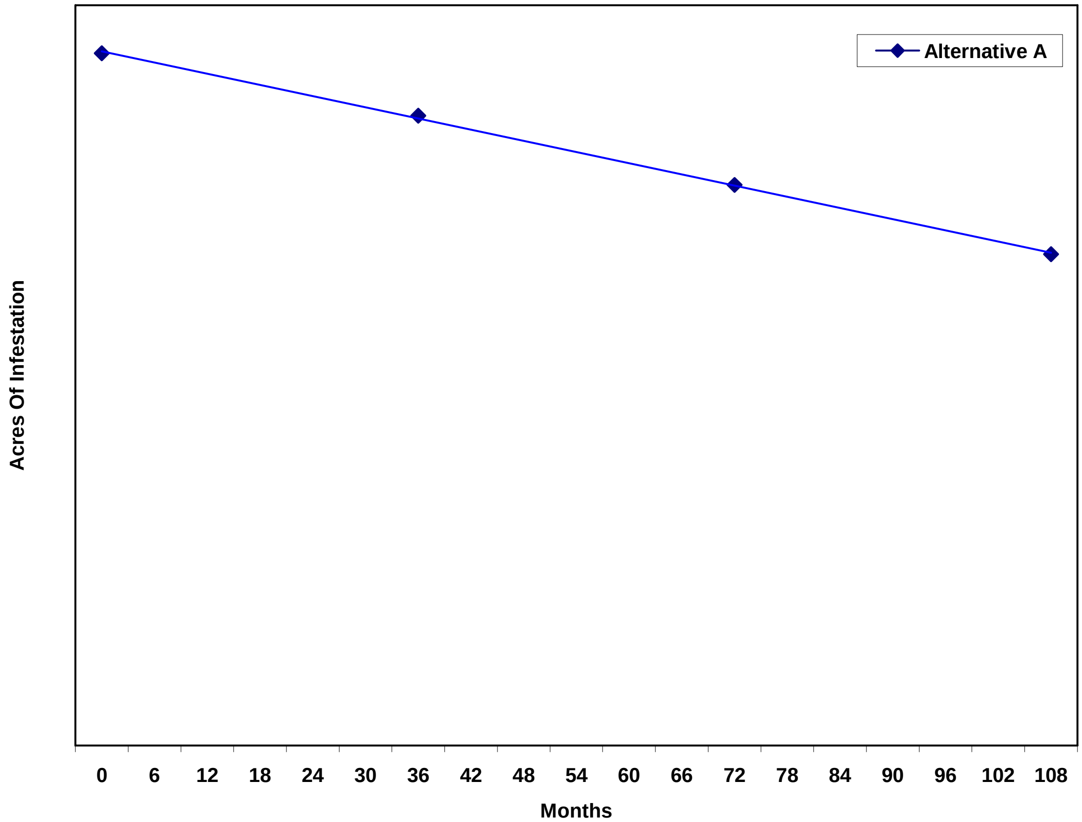


FIGURE 2: CONCEPTUAL REPRESENTATION OF THE CHANGE IN INFESTATION AND TREATMENT INTENSITY UNDER ALTERNATIVE A OVER TIME

It is also assumed that re-treatment every 3 years would enable a gradual decrease in the amount of labor and herbicide needed, but that generally the same methods would be used as with the initial treatment.

Dry Tortugas National Park and Christiansted National Historic Site, however, have approximately 1 acre of infested habitat. Park staff have achieved control of exotic plants to a maintenance level. Therefore, future control activities would entail continued re-treatment on an optimal schedule to either eliminate the exotic plants or keep the infestation at a maintenance level. Biscayne National Park's exotic plant treatment program began in 2000 and Buck Island Reef National Monument's program began in 2004. In both parks, all of the infestation has been initially treated using herbicides and mechanical treatment methods and conducted re-treatments within 6 to 12 months of the initial treatment. In these four parks, re-treatments would continue to occur and be accomplished with hand pulling or less intrusive or intensive methods than used during initial treatment of mature stands of exotic plants.

CULTURALLY SIGNIFICANT PLANTS

Individuals or populations of individuals of exotic plants in the parks have historical or cultural significance, and some exotic plants may be associated with cultural sites because they have become established in archeological sites or ruins. These plants may also remain from prehistoric occupation and, as such, may be indicators of buried resources. Certain species of exotic plants may also be considered ethnographic in nature because they are valued by traditional peoples. Buck Island Reef National Monument has recognized the cultural significance of the tamarind tree, a nonnative plant species that is expanding its population on the island. Under alternative A, the park would preserve in place (no treatment or removal) several old, historic Tamarind trees on the north and west sides of Buck Island. Young trees and seedlings, mostly located in a drainage gut on the north shore of the island, would be controlled, and populations would be managed as described in the 2004 environmental assessment (NPS 2004c).

CURRENT MITIGATION

The nine parks do not have a standard set of mitigation measures that can be implemented when treating exotic plants. Individual parks do implement mitigation measures for the protection of natural and cultural resources during treatment of exotic plants. In an environmental assessment, Buck Island Reef National Monument has defined standard operating procedures when using herbicides in the park to reduce impacts on natural and cultural resources on the island during treatment of exotic plants (NPS 2004c). In Big Cypress National Preserve and Everglades National Park, prescribed fire is conducted according to fire management plans that incorporate mitigation measures for the protection of public health and safety, natural and cultural resources, and sensitive species (NPS 1994e, 2005). The mitigation measures identified in these plans and environmental assessment are also incorporated into this draft EPMP/EIS by reference.

All of the parks also use the mitigation measures employed by the EPMT. Those measures are primarily associated with human health and safety (see table 5). The *Exotic Plant Management Teams Operations Handbook* (NPS 2003m) provides detailed guidelines on the proper storage and transportation of all herbicides and identifies the proper personal protective equipment that must be used during herbicide application and proper disposal of herbicides.

To reduce the potential for worker-related injury, the companies contracted by the NPS to treat exotic plants use accepted, industry-standard methodologies that are approved by the NPS. The companies must possess the necessary technical experience and show they have the training and certifications required for safe handling of the treatment materials and supplies, as well as the supervision and administration critical to project success. The NPS likewise requires that all NPS staff applying herbicides have proper training, licenses, and certification.

TABLE 5: MITIGATION MEASURES CURRENTLY USED BY THE PARKS

Mitigation
• Transportation of exotic species into the parks is prohibited by a management plan.
• Use of native plants is required, as specified within landscape management plans.
• Specific treatment guidelines would be reviewed with all contractors and personnel prior to treatment in order to ensure only target exotic plants are removed.
• Damage to nontarget plant species would be minimized by using ground crews with compression (backpack or hand-held) sprayers, when feasible. All herbicides would be applied by highly trained and certified personnel in accordance with EPA registration label requirements.
• To reduce impacts to health and safety, signage is posted to warn visitors and staff when herbicide treatments are being conducted and to restrict access to some treatment areas.
• Exotic plant treatment activities are timed to not coincide with sensitive and/or protected species' critical periods, such as nesting seasons. Technical experts from the NPS (district rangers, wildlife biologists) and USFWS provide direction for these activities.
• Application of herbicides within a one-mile buffer around red-cockaded woodpecker nests would be implemented.
• A 750-foot to 1-mile buffer would be established around bald eagle nests during the breeding season that would restrict aerial and/or ground crew activities and prescribed fire activities, as recommended in the Habitat Management Guidelines for the Bald Eagle in the Southeast Region guidelines established by the USFWS.
• Treatment actions would be conducted during the dry season (to the extent possible) to reduce the potential of soil or herbicide transport to aquatic habitats.
• The application of herbicides and the use of prescribed fire would only be implemented when weather conditions are optimal. Aerial herbicide applications would not be conducted during temperature inversions.
• Specific label directions, recommendations, and guidelines (i.e., nozzle size and pressure, additives, wind speed, aircraft height, boom length, etc.) would be followed to reduce drift potential from herbicide applications. Typically, aerial spraying is only conducted when wind speeds are less than 10 miles per hour.
• The aerial herbicide application system shall include a positive shut-off valve to prevent over-spray while in flight, and must be adjustable for fast and accurate calibration.
• Buffer zones around any sensitive receptors would be delineated (flagged and mapped) and reviewed with the pilot prior to aerial herbicide application.
• Herbicides used are approved by the EPA and applied according to the label instructions.
• Manual mechanical methods (such as hand-pulling) are used where appropriate. Manual mechanical methods tend to cause harm to structures or cultural resources, thus are not preferred over chemical methods or prescribed fire.
• Workers must comply with aviation safety practices and training requirements of the Department of the Interior.
• Workers are trained in proper use of motor vehicles and vessels when accessing sensitive habitats within the parks.
• Workers are provided with information on identification of sensitive natural and cultural resources, such as the Eastern Indigo Snake, and measures to avoid harm and to avoid impacting these resources.
• Depending on the type of substrate, off-road vehicles (ORVs) must have appropriate tire design (for example, wide diameter or balloon tires).

Wilderness and Minimum Requirements Analysis (Minimum Tool). Exotic plant control involving mechanized equipment would take place within designated wilderness in Everglades National Park, the only one of the nine parks containing wilderness area. A site-specific, minimum tool approach for effectively managing exotic plants with the least impact on wilderness resources, uses, and values would be conducted, per NPS wilderness policy, prior to implementation of each site-specific project.

RESTORATION

The parks do not have a program for active restoration of native species in treated sites. Following long-term re-treatment of sites to reduce the presence of exotic plants, native plant species are able to re-establish in the sites naturally from the presence of seeds in the soils or from propagation of native plants in adjacent habitats. Limited active restoration of sites does occur in Everglades National Park within treatment area 4—the Hole-in-the-Donut site (see appendix E, table E-1). The overall Hole-in-the-Donut restoration effort is guided by the 1997 document, *Restoring Wetlands on Abandoned Agricultural Lands in Everglades National Park* (Doren 1997). Under the Hole-in-the-Donut program, more than 6,000 acres of wetlands would eventually be restored by removing soils and exotic plant seeds with large construction equipment, resulting in a longer hydroperiod in this area. The Hole-in-the-Donut project is now in its second decade, and about 1,225 acres (approximately 21% of the site) now support native plants and animals. In appendixes A – I, table 1 is organized by vegetation category, and shows the number of acres that would be passively restored under alternative A for each park.

CURRENT MONITORING

The individual parks are responsible for their own monitoring and data collection, with no consistency across parks in what is observed or how information is used. Some parks rely on opportunistic observation by staff and visitors. Others use more systematic means such as reconnaissance flights, GIS mapping, inventories, and databases.

No standard program is in place to determine the effect of treatment methods on natural and cultural resources. Monitoring of treated sites for re-establishment of native plants or the success of treatment of exotic plants occurs on an opportunistic basis when staff are inventorying for areas of infestation or returning for re-treatment of an area. Park staff also observe areas while working in the park or driving on park roads.

South Florida parks use EPMT aerial surveys to inventory, and to some degree monitor, the extent of infestation of exotic plant species. Big Cypress National Preserve, Biscayne National Park, and Everglades National Park, have used annual aerial surveys since 2000. Aerial surveys of exotic plant infestation at Canaveral National Seashore are scheduled to begin in 2005. Monitoring the extent of infestation at the other parks occurs through informal park staff observations or through systematic ground surveys. Table 6 contains current monitoring information.

TABLE 6: CURRENT MONITORING

Method Used for Monitoring	BICY[a]	BISC[b]	CANA[c]	DRTO[d]	EVER[e]	BUIS[f]	CHRI[g]	SARI[h]	VIIS[i]
Aerial reconnaissance flights	X	X	X		X				
Exotic plant mapping	X	X	X	X	X	X			
Informal surveys	X	X	X	X	X	X	X	X	X
Opportunistic observation / visitor feedback	X	X	X	X	X	X	X	X	X
Treatment information recorded (acres, species, method) to some degree	X	X	X	X	X	X			
Baseline conditions established	X			X		X			
Structured and detailed monitoring of species composition, soil quality, as well as water quality	X				X[j]	X[k]			X[k]
On-the-spot observation of previously treated sites immediately before re-treatment	X	X	X	X	X	X	X	X	X

a. BICY – Big Cypress National Preserve
b. BISC – Biscayne National Park
c. CANA – Canaveral National Seashore
d. DRTO – Dry Tortugas National Park
e. EVER – Everglades National Park
f. BUIS – Buck Island Reef National Monument
g. CHRI – Christiansted National Historic Site
h. SARI – Salt River Bay National Historic Park and Ecological Preserve
i. VIIS – Virgin Islands National Park
j. The monitoring shown under Everglades National Park is not park-wide; it occurs only at the Hole-in-the-Donut project site.
k. The specific data gathered are from sampling plots that have been established to monitor the return of exotic plant species.

CURRENT EDUCATION PROGRAM

Most parks use one or more methods to inform the public about park activities and to encourage public involvement. Interpretive programs and displays in visitor centers include information about the threat posed by exotic plant species. Public outreach involves distributing brochures, submitting news releases and articles, presenting lectures to organizations, inserting information about exotic plants in annual reports and park newsletters, and hosting focus-group meetings. Meetings with other government agencies, environmental organizations, and native plant societies are held to provide information to a broader audience.

COOPERATION WITH OTHER AGENCIES

The NPS collaborates with state and local agencies to establish common goals for treating exotic plants and to set priorities for funding exotic plant control efforts. Park staff and the EPMT also work collaboratively with neighboring agencies and landowners, providing technical expertise, as well as assistance in treating exotic plants. The EPMT shares information about exotic plant control with representatives from other nations and territories.

CURRENT COMPLIANCE DETERMINATION

Exotic plant treatment actions would continue to be evaluated individually on a project-by-project basis for determination of the appropriate pathway to document the NEPA analysis. In the past, exotic plant management actions within the parks have either qualified as a categorical exclusion or have required an environmental assessment of effects. Under *Director's Order 12*, exotic plant management activities that qualify as a categorical exclusion are those that meet the criterion in which the removal of individual members of a non-threatened/endangered species or populations of pests and exotic plants that pose an imminent danger to park visitors, an immediate threat to park resources, or would have no or minor impacts (NPS 2001a, sec. 3.4.E.3).

In addition to meeting this criterion, the proposed treatment would have no or minor impacts to qualify as a CE. Through the use of an environmental screening form and interdisciplinary teams of NPS resource experts, parks evaluate the potential for effect and make a determination on whether effects are measurable or not. If effects are measurable or exceptional circumstances exist, as described in Section 3.5 of *Director's Order 12*, then preparation of an EA or an EIS would be required. Under alternative A, parks would continue to adhere to this process for each exotic plant treatment project that is proposed. In addition, each park would be responsible for compliance with Section 106 of the *National Historic Preservation Act* and Section 7 of the *Endangered Species Act* for each project that must be completed before implementation of the project.

CURRENT FUNDING AND EXPENDITURES

The parks currently rely on a variety of funding sources to support their IPM programs to control exotic plants. The parks' current funding and expenditures to date for exotic plant management is provided in table 7. The parks can compete for funding for exotic plant control projects through a wide variety of U.S. Department of the Interior (DOI), NPS funding sources, and Florida and other local funding sources. One of the primary funding sources for exotic plant management in the nine park units is the NPS EPMT program. The parks have successfully submitted funding proposals for a variety of other funding sources to control the exotic plant threat. The parks also use a variety of other funding sources to control the exotic plant threat. Figure 3 shows the funding that five of the parks have received since 2000 through the EPMT, Florida Department of Environmental Protection, and the Cooperative Cost-Sharing Initiative.

Appendix P provides more detailed information about the EPMT funding mechanism and other sources of monetary support that have been used by the EPMT and individual park units.

TABLE 7: CURRENT FUNDING AND EXPENDITURES FOR EACH OF THE NINE PARKS

	Current Funding Amount and Source	Expenditures
Big Cypress National Preserve	Park resource management and administrative budgets, the EPMT, and state of Florida (NPS 2004d).	The preserve spends approximately $388,000 annually on exotic plant management.
Biscayne National Park	The park receives 50% of the funding to treat exotic plants from the state of Florida and 50% from the NPS.	The park has spent approximately $730,000 since 2000 treating exotic plants. On average, the park spends $182,500 a year.
Canaveral National Seashore	The park receives 50% of the funding to treat exotic plants from the state of Florida and 50% from the NPS.	The park has spent approximately $500,000 since the year 2000 managing exotic plants. On average, the park spends $125,000 a year.
Dry Tortugas National Park	EPMT	Approximately $4,000 is expended annually to control exotic plants at a maintenance level.
Everglades National Park	Annual funding rates have been between $600,000 and $800,000. Through the Florida Department of Environmental Protection (DEP), the EPMT provides approximately 75% of this funding, with the remaining 25% provided by the U.S. Army Corps of Engineers through their Sparrow Project. In addition, the South Florida Water Management District provides approximately $60,000 annually. The park also received funding from Miami-Dade County. Resources and support may be available from the Florida Department of Transportation for exotic plant control in and near highway right-of-way corridors (Taylor 2004e). Potential funding partners for exotic plant control efforts in Everglades National Park include Miami-Dade County's Department of Environmental Resource Management, Florida Department of Corrections, National Fish and Wildlife Federation, BASF Inc. Funding ($77,550) for the 2002 mangrove habitats project came from the EPMT and Florida DEP ranking and funding process, with Everglades National Park contributing additional resources through personnel efforts.	Approximately $6,562,000 has been spent in the park since 1989 on controlling exotic plants. The overall budget for the last 4 years is shown below: 2001 – $106,150 2002 – $715,000 2003 – $516,000 2004 – $1.225 million
Virgin Islands National Park	Funding has not be expended on treatment of exotic plants.	
Buck Island Reef National Monument	In the spring of 2003, the park obtained funding to complete the initial island-wide treatment. NPS Natural Resources Preservation Program ($25,000) would begin an invasive, nonnative plant control and management program. EPMT – $55,000 The total funding to complete the initial island-wide treatment is $80,000.	The park has spent about $50,000 treating exotic plants.
Christiansted National Historic Site	Christiansted National Historic Site is an urban park, with a manicured landscape. Treatment of exotic plants in the park has been, and would continue to be, accomplished within park operational budgets, using on-site labor.	
Salt River Bay National Historic Park and Ecological Preserve	Funding has not be expended on treatment of exotic plants.	

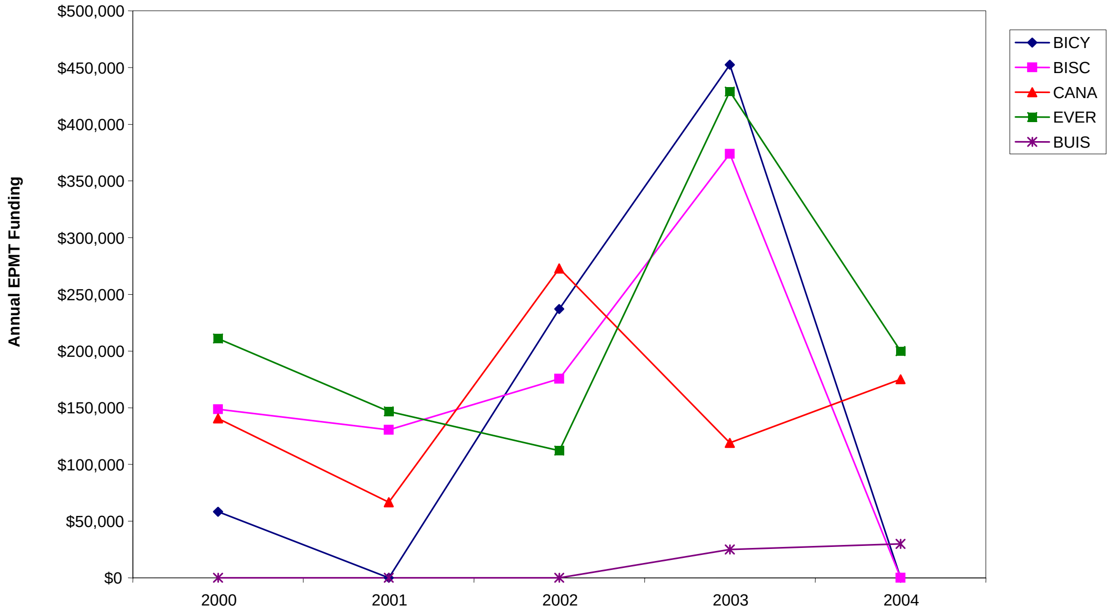


FIGURE 3: FUNDING RECEIVED FOR EXOTIC PLANT CONTROL

COST OF IMPLEMENTATION

The cost of exotic plant management involves the costs of treatment, monitoring, and restoration activities. It has been estimated that the cost of treatment within mainland parks in Florida can range from $136 per acre to $224 per acre through the use of private contractors. This cost includes worker time and materials, including herbicides. To treat exotic plants on island parks in the Caribbean and at Dry Tortugas National Park, the range of costs is higher due to the added costs of transportation of crews, equipment, and supplies to these more remote areas. The costs for treatment can range from $160 to $829 per acre in the Caribbean parks, and between $3,000 and $4,000 for each total treatment at Dry Tortugas National Park.

Under alternative A, there is no formal monitoring of treated sites and, therefore, no costs incurred by the parks under their exotic plant management plan. In addition, no costs would be incurred in allowing treated sites to recover passively. To estimate the cost of treatment under alternative A, it was assumed that every 3 years costs similar to the cost of initial treatment would be incurred by the parks. It is recognized that some projects involve very intensive initial treatments and after 3 years, the cost of re-treatment would be less than initially expended. However, when considering all of the treatment projects within the parks, it is assumed that the average cost of re-treatment is similar to the cost of initial treatment. The cost of implementing alternative A over the next 10 years for each park is provided in table 8.

TABLE 8: TOTAL COSTS OF ALTERNATIVE A OVER THE 10-YEAR LIFE OF THE PLAN

Big Cypress National Preserve	
Initial infestation to be treated	155,445 acres
Treatment at $136 per acre	$72,511,984
Treatment at $224 per acre	$119,964,679
Monitoring	–
Restoration	–
Total	$72,511,984 to $119,964,679
Biscayne National Park	
Initial infestation to be treated	162 acres
Treatment at $136 per acre	$75,570
Treatment at $224 per acre	$125,024
Monitoring	–
Restoration	–
Total	$75,570 to $125,024
Buck Island Reef National Monument	
Initial infestation to be treated	75 acres
Treatment at $160 per acre	$41,160
Treatment at $829 per acre	$213,260
Monitoring	–
Restoration	–
Total	$41,160 to $213,260
Canaveral National Seashore	
Initial infestation to be treated	3,273 acres
Treatment at $136 per acre	$1,526,789
Treatment at $224 per acre	$2,525,938
Monitoring	–
Restoration	–
Total	$1,526,789 to $2,525,938
Christiansted National Historic Site	
Initial infestation to be treated	1 acre
Treatment at $160 per acre	$160
Treatment at $829 per acre	$829
Monitoring	–
Restoration	–
Total	$160 to $829
Dry Tortugas National Park	
Initial infestation to be treated	1 acre
Treatment at $3,000 initial	$10,290
Treatment at $4,000 initial	$13,720
Monitoring	–
Restoration	–
Total	$10,290 to $13,720

TABLE 8: TOTAL COSTS OF ALTERNATIVE A OVER THE 10-YEAR LIFE OF THE PLAN (CONTINUED)

Everglades National Park	
Initial infestation to be treated	177,603 acres
Treatment at $136 per acre	$82,848,247
Treatment at $224 per acre	$137,065,115
Monitoring	–
Restoration	–
Total	$82,848,247 to $137,065,115
Salt River Bay National Historic Park and Ecological Preserve	
Initial infestation to be treated	389 acres
Treatment at $160 per acre	$213,483
Treatment at $829 per acre	$1,106,110
Monitoring	–
Restoration	–
Total	$213,483 to $1,106,110
Virgin Islands National Park	
Initial infestation to be treated	2,846 acres
Treatment at $160 per acre	$1,561,885
Treatment at $829 per acre	$8,092,516
Monitoring	–
Restoration	–
Total	$1,561,885 to $8,092,516

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

GENERAL CONCEPT

As in alternative A, all nine parks would manage exotic plants using a variety of physical, mechanical, chemical, and biological methods. Alternative B, however, increases planning for treatment proposals so that impacts on park resources are efficiently addressed and resolved or mitigated prior to treatment. Under this alternative, management priorities would be established for each treatment area in each park to enhance protection and preservation of natural and cultural resources, as well as enhance the quality of the visitor experience. A decision tool has been developed to determine the appropriate treatment and re-treatment methods, given the exotic species present, the native vegetation category, and the potential habitat of threatened and endangered species. Re-treatment of sites under this alternative would be more rigorous in order to increase the rate of reduction of exotic plants. Re-treatment would occur on an optimal schedule based on the rate of return or re-establishment of the exotic plant species.

Planning would also include a prescribed set of mitigation measures to further protect park resources. Increased monitoring, using a standard monitoring protocol, is also a key component of this alternative. Used in conjunction with adaptive management, monitoring would involve collecting data on the effectiveness of treatments and the rate of return of native species over the long term. This would allow NPS to adjust treatment methods and maintenance of treated areas to achieve long-term objectives for the re-establishment of native plants. The monitoring protocol developed for this alternative is described in greater detail in the section titled “Monitoring and Data Collection.”

Based on the information collected during monitoring, treatment methods and maintenance of treated areas would be adjusted to achieve long-term objectives to re-establish native plant species using an adaptive management approach. Under this alternative, parks would continue to rely on passive restoration of native species within treated areas and would not take substantial measures to actively restore native plants.

Alternative B proposes enhanced cooperation with other agencies to control exotic plants in areas adjacent to the park and enhanced education programs to improve people’s understanding of the impacts exotic plants have on native communities.

GUIDANCE FOR SETTING MANAGEMENT PRIORITIES

The exotic plant species to be treated and the areas to be treated would be established by the priorities set through the use of management decision tools by each park to guide future implementation of site-specific projects. This would help ensure the greatest level of success in preventing or minimizing exotic plant impacts on park resources.

The ranking system for determining the feasibility of implementing a project would be similar to that described under alternative A, in that the criteria used for ranking would be the same regarding the invasiveness of the target species and the impact the exotic plant species is having on sensitive resources. Funding, which was applied as the primary criterion that drives treatment decisions under alternative A, would not be the primary criterion under alternative B when deciding what projects would be conducted. Under alternative B, all infestations in the parks would be treated over the life of the exotic plant management plan (10 years), and using a new framework priorities would be set for the treatment areas. The following criteria were used to determine treatment priorities for existing and new areas of infestation:

- The control of exotic plants would benefit specific threatened or endangered species that inhabit the area or site and would also benefit other sensitive resources.
- The control of exotic plants would benefit park visitors or improve the quality of the visitor experience and appreciation of park resources.
- The site is easily accessible.

This setting of priorities for treatment, together with knowledge of which treatment method is most effective in achieving treatment objectives with the least impact to other resources, would guide the site-specific implementation of exotic plant control projects. For each park, data on potential habitat, visitor-use areas, and roads or trails, were evaluated to determine the treatment priority for each infested area. The summary tables for alternative B identify the priority level for each treatment area in each of the nine parks. In appendixes A – I, the priority for each treatment area has been identified in table 2.

In Big Cypress National Preserve and Everglades National Park, all treatment areas contain potential habitat for threatened and endangered species. Therefore, to determine treatment priorities, the treatment areas were evaluated for the presence of visitor-use facilities (visitor center, picnic area, campground, or marina), trails, and roads. Trails and roads were considered in the priority determination, because treatment of these areas would improve the visitor experience over the long term, and because trails and roads provide easy access to treatment sites. In these two parks, infested areas that were within 1 mile of a road or developed visitor-use area were identified as being priority 1 (highest priority) for treatment. Infested areas within 1 mile of a trail would be treated as priority 2 because these areas receive less visitor use than developed areas, and access to treatment sites via trails is slightly lower. Areas that did not contain roads, visitor-use areas, or trails were assigned priority 3, the lowest priority for treatment. Table 9 provides the total acreage of each priority category for six of the nine parks.

TABLE 9: NUMBER OF ACRES IDENTIFIED AS PRIORITY AREAS IN THE PARKS

Site	Priority 1 (acres)	Priority 2 (acres)	Priority 3 (acres)
Big Cypress National Preserve	127,483	880	27,083
Everglades National Park	55,492	790	118,017
Canaveral National Seashore	3,177	96	
Salt River Bay National Historic Park and Ecological Preserve	70	323	
Virgin Islands National Park	596	2,250	

Note: Biscayne National Park, Buck Island Reef National Monument, Christiansted National Historic Site, and Dry Tortugas National Park have been initially treated and are currently being re-treated under an optimum treatment schedule; therefore, priorities for treatment have not been assigned to these parks.

The rationale for defining priority for treatment areas in Canaveral National Seashore and Biscayne National Park was based on the above three criteria. Because of the smaller size of these parks, only two levels of priority were determined. Areas in the park that had potential threatened and endangered species habitat, were within 1 mile of a visitor-use site, or were near a hiking trail or road, were given the highest priority for treatment (priority 1). All other areas that lacked these features were given a lower priority (priority 2). This same division of priority was applied to Salt River Bay National Historic Park and Ecological Preserve and Virgin Islands National Park. However, the distance to a road, trail, or visitor-use area was reduced to 0.25 miles, given the small size of the parks.

EXOTIC PLANTS TREATED

The priority exotic plant species to be treated under alternative B would be the same as those identified for alternative A.

PROPOSED EXOTIC PLANT TREATMENT METHODS

The parks would continue to use mechanical, biological, chemical, and physical methods to control exotic plants during initial treatment and re-treatment of sites as described under alternative A. Under alternative B, however, a decision tool has been developed and applied to determine the best treatment method for exotic plant control. The decision tool is based on three primary elements: the type of exotic plant species, the vegetation category, and the potential threatened and endangered species habitat. Using GIS analysis, the three elements were recorded for each park in order to define where a particular treatment could be applied to previously untreated areas. The decision tool was also used to define the appropriate re-treatment method (see the section below titled “Treatment Method Decision Tool”). The decision tool was not applied to areas that were treated prior to 2005.

Alternative B assumes that all infested areas would receive an initial treatment, and re-treatments would occur using an appropriate method under an optimal schedule considering the species of exotic plants that were treated. Under this alternative, the total number of treatments that would occur over the life of the plan (10 years) would be greater than what would occur under alternative A, because re-treatment of areas would occur every 4 to 12 months (compared with 3 to 5 years under alternative A), until native vegetation categories were restored to the degree defined as the desired future condition. The level of effort and the intensity needed to control exotic plants would decline over time as the level of infestation decreased. The Florida Department of Environmental Protection assumes that the level of infestation decreases by approximately 50% every time treatment occurs; that is, if the plants are being treated on a schedule appropriate for the particular exotic plant species. Likewise, the amount of herbicide that would be needed for re-treatment would also decrease. The amount of herbicide that is distributed by the Florida Department of Environmental Protection for re-treatment activities is 25% to 50% of the original amount applied. In addition, the methods used for re-treatments would become less invasive over time. For example, initial re-treatments with fire in Big Cypress National Preserve and Everglades National Park would affect a larger area and would result in a greater level of impact than treatments occurring in the future.

In all treatment areas under alternative B, after the second year of treatment, the method for re-treatment would be foliar, ground, or hand-pulling, because only seedlings would be treated, and the number of stems of exotic plants that would need to be treated would be reduced by approximately 50% each time an area is re-treated. This would result in less intensive and intrusive management activities over time. Under this alternative, a maintenance level of infestation would be achieved, and the areas would be monitored and may only need very minimal re-treatment. Figure 4 portrays the conceptual trend in treatment over time that would occur in the 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 B and a comparison to the trend that would occur under alternative A. Exceptions to this would occur in Biscayne National Park, Buck Island Reef National Monument, Christiansted National Historic Site, and Dry Tortugas National Park, as noted above under alternative A, as these parks are currently conducting re-treatments under an optimal treatment schedule. The range of potential amounts of herbicide that would be applied over time under alternative B is growth in each park's appendix (appendixes A – I).

Exotic plants in tropical hammock at Everglades National Park, pre-treatment

Exotic plants in tropical hammock at Everglades National Park, post-treatment

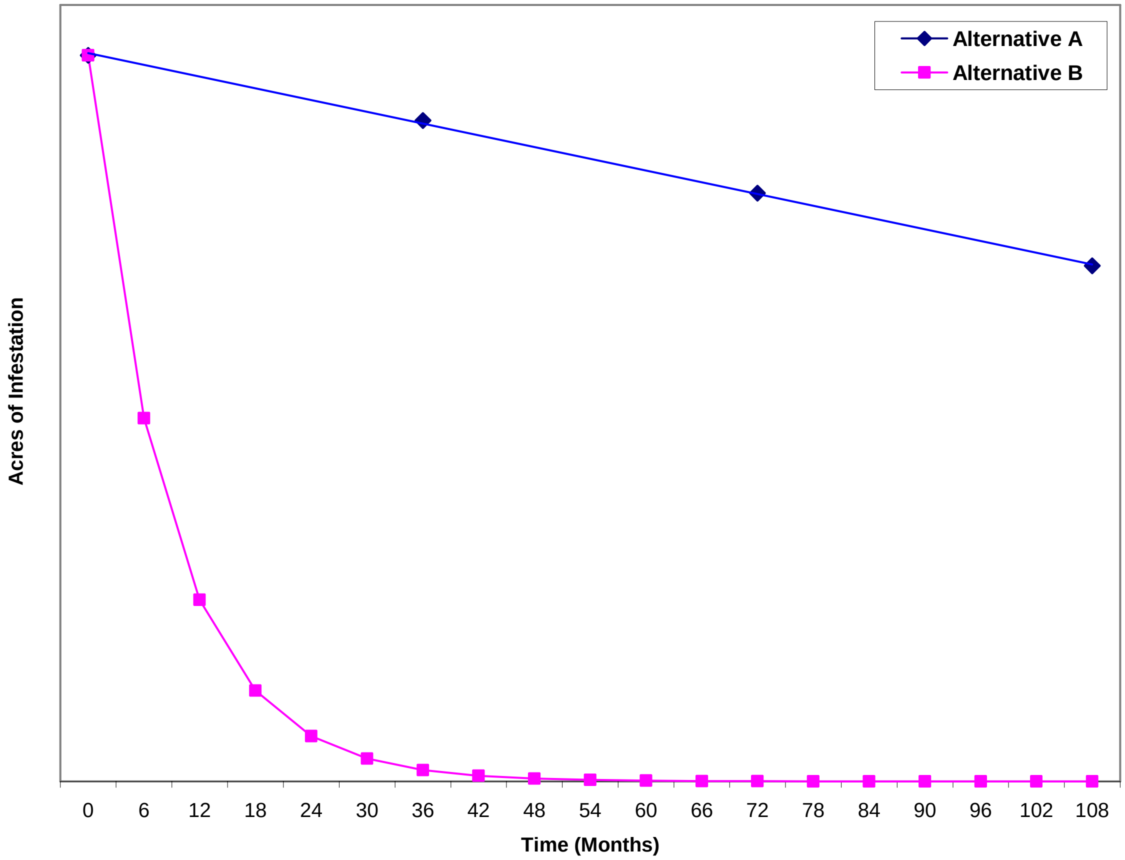


FIGURE 4: CONCEPTUAL REPRESENTATION OF THE CHANGE IN INFESTATION AND TREATMENT INTENSITY UNDER ALTERNATIVE B OVER TIME

TREATMENT METHOD DECISION TOOL

The decision matrix in tables 10 and 11 was used for determining the appropriate initial and follow-up treatment methods. The decision matrix shows the type of potential habitat of threatened and endangered species, the exotic plant species present, and in what vegetation category an infestation occurred. Each treatment method would only be used when the conditions identified were present. Prior to a site-specific project, resource managers must take into consideration the type of sensitive species that are present, the type of exotic plant to be treated, and the vegetation category in which the infestation is occurring. This matrix considers a limited number of federally listed or candidate species and exotic plant species to illustrate how the tool would be applied. The federally listed or candidate species presented in the matrix represent a broad range of habitats and sensitivities to various treatment methods. Using the decision tool and the information layers for each park, the appropriate treatment method has been defined for each treatment area. These methods would also be applied under alternative B, as shown in each park's appendix (see tables in appendixes A – I.)

TABLE 10: DECISION MATRIX FOR IDENTIFYING APPROPRIATE INITIAL TREATMENT METHODS
(NOTE: THE KEY TO THIS DECISION MATRIX IS PROVIDED AT THE BOTTOM OF THIS PAGE)

Treatment Method	Initial Treatment		
	Threatened and Endangered Species	Exotic Plant Species	Vegetation Category
Basal bark – leave in place	1, 2, 3, 5	1, 2, 3, 4, 5, 6, 9	Appropriate for all vegetation categories listed in the key.
Foliar – ground treatment and remove	Appropriate for all threatened and endangered species listed in the key.	1, 2, 3, 4, 5, 6, 9	Appropriate for all vegetation categories listed in the key.
Foliar – ground and leave in place	1, 2, 3, 5	1, 3, 4, 5, 6, 7, 8, 9	Appropriate for all vegetation categories listed in the key.
Foliar – aerial	2, 3, 5	1, 2, 3, 4	1, 3, 4, 7
Hack and squirt, frill and girdle, and cut-stump – remove	Appropriate for all threatened and endangered species listed in the key.	1, 2, 3, 5, 6, 9	Appropriate for all vegetation categories listed in the key.
Hack and squirt, frill and girdle, and cut-stump – leave in place	1, 2, 3, 5	1, 2, 3, 5, 6, 9	Appropriate for all vegetation categories listed in the key.
Biological	Appropriate for all threatened and endangered species listed in the key.	3, 4	Appropriate for all vegetation categories listed in the key.
Hand-pulling	Appropriate for all threatened and endangered species listed in the key.	Appropriate for all exotic plant species listed in the key.	Appropriate for all vegetation categories listed in the key.

TABLE 11: DECISION MATRIX FOR IDENTIFYING APPROPRIATE RE-TREATMENT METHODS
(NOTE: THE KEY TO THIS DECISION MATRIX IS PROVIDED AFTER THIS TABLE)

Treatment Method	Re-treatment		
	Threatened and Endangered Species	Exotic Plant Species	Vegetation Category
Foliar – ground and leave in place	Appropriate for all threatened and endangered species listed in the key.	Appropriate for all exotic plant species listed in the key.	Appropriate for all vegetation categories listed in the key.
Biological	Appropriate for all threatened and endangered species listed in the key.	3, 4	Appropriate for all vegetation categories listed in the key.
Fire	1, 2, 3, 4, 5, 6, 7, 10, 11	2, 3, 4	1, 4, 5, 6, 7
Hand-pulling	Appropriate for all threatened and endangered species listed in the key.	Appropriate for all exotic plant species listed in the key.	Appropriate for all vegetation categories listed in the key.

Key to Decision Matrix

Threatened and Endangered Species	Exotic Plant Species	Vegetation Category
1. Wood stork	1. Brazilian pepper	1. Coastal Marsh
2. Eastern indigo snake	2. Australian pine	2. Mangrove
3. Florida panther	3. Melaleuca	3. Sawgrass Marsh / Wet Prairie / Freshwater Marsh
4. Cape Sable seaside sparrow	4. Old World climbing fern	4. Wetland Forest
5. American crocodile	5. Tan tan	5. Upland Dry / Mesic Forest
6. Everglade snail kite	6. Lime berry	6. Shrubland
7. Red-cockaded woodpecker	7. Mother-in-law's tongue	7. Grassland / Coastal Strand
8. St. Thomas' prickly ash	8. Guinea grass	8. Beach / Dune
9. St. Thomas' lid flower	9. Lather leaf	
10. South Florida pine rockland plants		
11. Florida scrub jay		
12. Schaus swallowtail butterfly		

Prior to a site-specific action, park resource managers would consider the federal, state, or territorial listed species or their habitats that occur in a treatment area and determine which treatment method would cause the least amount of disturbance or damage by comparing them to the species identified in the matrix. Not all exotic plants which occur in the parks were listed in the decision matrix. However, the exotic plant species that are included are representative of the types of plants that can be effectively treated by the various treatment methods that would be implemented under alternative B. Again, the park resource managers would refer to the matrix, determine if the exotic species is similar to one that is listed, and determine what treatment method would be effective and appropriate, given the environmental setting.

To determine the appropriate treatment method, the environmental conditions must meet all three categories to be deemed appropriate. For example, basal bark leave in place is appropriate in areas with potential habitat for the wood stork, Eastern indigo snake, Florida panther, and American crocodile, and it is an appropriate method for the exotic plant species listed, except for mother-in-law's tongue and guinea grass, and can be used in any vegetation category. Where an entry is listed as "All," that means that the treatment method is appropriate for all listings under that particular category.

Foliar treatments with herbicides and cut-surface treatments were further broken down under this alternative into treatments where the treated plants would be left in place to decay, or where they would be removed. "Removed" could mean that the treated plant material would be stacked in the treatment area and left to decay, or the material would be mulched and the mulch material left in the area to decay. Mulching the vegetation and leaving it in the treatment area can be beneficial, because a layer of mulch can reduce exotic plant seed-germination and slow the re-infestation of the area. An explanation of what treatment methods would be appropriate, given a specific threatened and endangered species habitat present in the parks, is provided in the "Rationale for Selecting Initial Treatment Methods" section, below.

The decision tool for determining appropriate treatment methods was applied to parks where infestations have not been determined to be reaching a maintenance level of control or that have not been previously treated. These parks include Big Cypress National Preserve, Canaveral National Seashore, Everglades National Park, Salt River Bay National Historic Park and Ecological Preserve, and Virgin Islands National Park. Exotic plant infestations in Biscayne National Park, Christiansted National Historic Site, Dry Tortugas National Park, and Buck Island Reef National Monument, have been initially treated and are now only being re-treated and are achieving a level of success in maintaining control over the infestation. The methods used in these parks are discussed later in the "Maintaining Treated Sites (Re-treatment)" section.

RATIONALE FOR SELECTING INITIAL TREATMENT METHODS

BASAL BARK LEAVE IN PLACE

The basal bark treatment is appropriate for woody species, such as Brazilian pepper, Australian pine, and lather leaf. Treatments can be applied year-round and to a range of stem sizes, from saplings to large trees. This treatment is suitable when native vegetation is dense and provides habitat for sensitive species. Application is directly targeted to specific plants, which results in minimal human impact on the surrounding environment. This method can, therefore, be used in all vegetation categories and in all sensitive species habitats.

See tables 10 and 11 showing the decision matrix for identifying appropriate treatment and re treatment methods given the environmental setting.

Mitigation measures for all treatment methods are described, below, in the "Proposed Mitigation Measures" section.

HACK AND SQUIRT, FRILL AND GIRDLE, AND CUT-STUMP TREATMENT

Hack and squirt, frill and girdle, and cut-stump treatments are common cut-surface applications for the management of woody exotic plants, such as Brazilian pepper, Australian pine, and tan tan. Herbicides are applied carefully to the exotic plants, and overspray on native plants is minimal. This method is safe to use in all vegetation types and in all sensitive species habitats. This treatment method is especially effective in areas where active restoration is planned for the future. In all treated areas, the park would remove the treated plant materials, or leave the treated materials in place to decay, thus providing structural habitat and decreasing disturbance in wood stork, indigo snake, panther, and crocodile habitat.

Removing tan tan (Leucaena leucocephala) from Anneberg sugar plantation wall at Virgin Islands National Park

FOLIAR GROUND APPLICATION

Foliar treatments can be applied to individual plants or broadcast over large areas of infestation. The foliar ground treatment is appropriate for low-growing exotic plant species or small saplings as an initial treatment, because of the size and height of the plants, thereby giving the ability to apply the herbicide to the leaves. This treatment would be appropriate in all vegetation categories, because it is very effective, and accidental overspray is less likely to affect nontarget species of animals and native plants.

Foliar ground treatment is also appropriate for all threatened and endangered species presented. After foliar treatment, the exotic plant material left after treatment could be removed in all threatened and endangered species habitat, but in some instances, the material could be left in place in wood stork, eastern indigo snake, Florida panther, and American crocodile habitat. 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 (Rodgers et al. 1995, 1996). 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 the vegetation treatment and removal activity would potentially cause the panther to abandon her cubs or would frighten potential prey animals. Some of the panthers are radio collared, so areas known to be inhabited by these panthers may be easily avoided.

The American crocodile builds nests on upland areas adjacent to water. The crocodile tends to her nest and guards it from predators. If the noise and human activity associated with treatment and vegetation removal disturbs the crocodile enough that she abandons her nest, it would likely result in the destruction of the nest. Therefore, treatment and removal of the exotic plants in American crocodile habitat would not be conducted during nesting season. The appropriate treatment methods for each threatened and endangered species is discussed below in the "Treatment Methods in Threatened and Endangered Species Habitat."

Treated guinea grass and mother-in-law's tongue would be left in place following treatment to avoid the potential for resprouting, as these species are rhizomatous and respond to removal, if the roots have not been affected by the herbicide, by aggressively resprouting, even if only small root fragments are left in the soil.

FOLIAR AERIAL APPLICATION

Foliar aerial application of herbicide can be done as a broadcast or a spot-spray application. Broadcast application of herbicides using fixed-wing aircraft or helicopters would be appropriate in very specific environmental conditions. Aerial application provides an effective means of treating large (or sometimes small infestations in insolated areas) mono-specific infestations rapidly and efficiently. Broadcast aerial application would be used to treat Brazilian pepper, lygodium**,** and melaleuca. An aerial spot-spray treatment used to target individual plants would be used to treat Australian pine, in addition to these other species when infestations are not monocultures but are mixed with a high number of native species to reduce the risk of non-target damage. Aerial spraying could be used in indigo snake, panther, and crocodile habitat.

Broadcast aerial spraying would be appropriate only in the coastal marsh; sawgrass marsh / wet prairie / freshwater marsh; wetland forest; or grassland / coastal strand, but would not be used in areas designated as upland dry / mesic forest; mangrove; or shrubland vegetation categories. For the purpose of this draft EPMP/EIS, the category of upland dry / mesic forest includes pine flatwoods, hardwood hammocks, xeric oak, and other forested systems dominated by evergreen or semi-evergreen trees and shrubs. Mangroves include the three types of mangroves and buttonwood, all of which are evergreen. Shrublands include thorn scrub, thickets, and other classifications and are comprised predominantly of evergreen. In these vegetation categories, evergreen species are dominant, and aerial spraying in these areas would increase the chance of overspray of herbicide onto native evergreen plant foliage.

In addition, epiphytic orchids and bromeliads grow on tree trunks in the mesic (moderately moist) areas of forested uplands and hydric wetland forests. Broadcast aerial spraying in areas where these plants are present would increase the likelihood of nontarget damage to these plants, many of which are considered special status species in Florida. Because the aerial spot-spray method can be used to treat individual exotic plants from the air, it can be used in mangrove areas, as the risk of non-target damage is greatly reduced. This method would be used in Everglades National Park and Big Cypress National Preserve where other methods of treatment may be infeasible because of the inability of personnel to access sites to perform ground treatments. Some areas dominated by deciduous trees (such as cypress) and shrubs could be treated aerially in the winter when there is no foliage.

Aerial spraying was not considered to be an appropriate method for use in Caribbean parks because of the infestation size and composition, and the physical conditions present in the region. For example, the prevailing trade winds and steep topography are likely to inhibit the efficacy of this chemical delivery method; targeted species would be missed, and nontargeted species would suffer excessive damage. In addition, areas containing exotic plants are found in mosaic patches intermixed with desirable native plants. These patches are of small enough size to be more effectively and economically treated by ground crews with compression sprayers.

BIOLOGICAL CONTROL

Biological control methods for melaleuca and lygodium (Old World climbing fern) would continue to be used in Big Cypress National Preserve and Everglades National Park. Biological controls are rigorously screened for impacts on sensitive native plant species and threatened and endangered species by APHIS, and a determination of the host specificity is made before being released into the field. As a result of this process, it was concluded that potential threatened and endangered habitat would not be impacted by the use of biological control agents and that these agents could be used in any vegetation category where the exotic species are present.

HAND-PULLING

Hand-pulling is one of the most benign methods of removing exotic plants. It is not the most practical method, because it requires a great deal of labor. It is not always the most effective method, because portions of the roots left in the soil may re-sprout and require additional treatment. In park areas where the potential for damage from overspray is high, or where there are only a few exotic plant species present, hand-pulling is very effective. Hand-pulling is a very selective method, with minimal impact on surrounding environments; therefore. This method can be used in all vegetation categories and in all sensitive species habitats.

TREATMENT METHODS IN THREATENED AND ENDANGERED SPECIES HABITAT

CAPE SABLE SEASIDE SPARROW

This endangered species nests from February through August and prefers fresh to brackish marshes, vegetated with Muhly grass, clumped short cordgrass, or sparse sawgrass. The nests are built between 1 and 3 feet above the ground and are difficult to see. Cut-stump and foliar ground applications are used when ground crews avoid known or potential habitat during nesting season to avoid trampling or running over the nests. Prescribed fire could be used as a potential re-treatment tool to maintain the habitat of the sparrow free of woody plant species. Woody species should be removed, either manually or by fire, from the sparrow habitat, because it interferes with breeding, nesting, and foraging.

With regards to the use of prescribed fire in Everglades National Park, an interagency, interdisciplinary symposium was convened to develop a wildland fire management strategy regarding the Cape Sable seaside sparrow. As a result of this symposium, an interdisciplinary, interagency working group comprised of USFWS, NPS, SFNRC (South Florida Natural Resource Center), FFWCC (Florida Fish and Wildlife Conservation Commission) and researchers, has been established and convenes yearly to evaluate the status of the sparrow and to direct anticipated fire management actions that would take place in occupied sparrow habitat within the park in the coming year. Under this alternative, any use of fire within Cape Sable seaside sparrow habitat would need to be approved by this interagency team, and subsequently by the USFWS, before implementation.

RED-COCKADED WOODPECKER

The red-cockaded woodpecker nests between April and August in tree cavities located 20 to 50 feet above the ground. Impacts to nesting birds can be avoided in this habitat by not aerial spraying exotic plants. Woody understory species, such as Brazilian pepper, should be removed after treatment, because red-cockaded woodpeckers require an open understory for breeding and foraging. In addition, leaving the dead material in place creates a fuel load that increases the risk of a catastrophic fire, which could damage or destroy cavity trees, seriously impacting the species. Herbicide treatments should not be undertaken during nesting season to avoid disturbance to the breeding activity.

WOOD STORK

The wood stork nests in colonies in cypress or mangroves swamps. Egg laying begins in October, and fledging of young birds occurs in February or March. Aerial spraying of herbicides in these habitats should be avoided, especially during breeding and nesting season, to prevent disturbing the rookery.

EASTERN INDIGO SNAKE

The eastern indigo is a large, slow-moving snake that avoids contact with humans, if given time and opportunity to escape. Because they are so slow, they can easily be run over by fast-moving all terrain vehicles (ATVs) and maintenance vehicles. The indigo prefers tropical hardwood hammocks and pine forests, so accessing or traversing these habitats should be done at slow speeds. The eastern indigo snake can survive in almost any habitat, and it forages on a number of different animals. Thus, it has plenty of available habitat in the parks in which to take refuge during treatment activities. The snake also uses ruts, stream undercuts, or fallen logs when there are no gopher tortoise burrows present to hide in. This may also help it avoid impacts from aerial spraying and prescribed fire. For these reasons, all treatment methods would be appropriate in eastern indigo snake habitat, when additional mitigation measures are implemented.

FLORIDA PANTHER

Florida panthers mainly use pine flatwood and hardwood hammock habitats in south Florida. The hammocks are important foraging areas, and the pine flatwoods, with a dense understory, are important for denning and resting. Most panther births occur between March and July, and the den sites are used for 2 months after birth; known panther habitat would be avoided during this time. Panthers are typically shy, secretive animals that normally avoid human interaction. These characteristics make it possible to use ground crews for treatment in panther habitat. It is important to maintain vegetated corridors between habitats to avoid fragmentation. Between March and August, aerial spraying and fire treatments are appropriate in panther habitat, because the panthers can usually avoid these areas during treatment. Also, it is not necessary to remove the treated vegetation in panther habitat, because the dead plant material would not substantially affect their foraging behavior. Panthers prefer vegetated areas to open land for movement, and rarely move through open areas except at night.

AMERICAN CROCODILE

The American crocodile courtship and breeding period in south Florida extends from February to March. After building a nest and depositing her eggs, a female remains near her nest and checks on it frequently. After an average of 86 days, the female returns and dismantles the nest to allow the hatchlings to emerge. It is important that known nesting habitat is not disturbed during this time period to avoid any potential interruption of the breeding activity. During nonbreeding and nonnesting periods, crocodile habitat can be accessed and treated by ground crews, because crocodiles normally avoid human interaction. Aerial applications of herbicides can also be used in crocodile habitat when they are not breeding or nesting. Crocodiles would benefit from the removal of the dead exotic plant material, especially Australian pine, because they can interfere with nesting activities. Prescribed fire is an appropriate methodology to remove the dead vegetation as long as the fires are not conducted during the nesting season.

EVERGLADE SNAIL KITE

These birds nest from November to July in shrubs and small trees near the shallow open marshes where they forage. Everglade snail kites occasionally build nests in herbaceous vegetation, but they almost always build their nests over standing water to reduce egg predation. They have been known to nest in melaleuca, so precautions must be undertaken to avoid their habitat during nesting season. Disturbance from aerial spraying or ground crews may cause the birds to abandon their nests. Fires during the nesting season could be catastrophic to the Everglade snail kite, Cape Sable seaside sparrow, and other ground-nesting species, but fires are appropriate, and even beneficial, to their habitats during other times of the year. The kites need shallow, open areas for foraging. In fact, tall herbaceous material, such as cattails, can preclude foraging for the apple snail, the primary food source for the Everglade snail kite. Therefore, it is important to the continued existence of this species to remove dead exotic plant material from the snail's habitat. Aerial applications of herbicides during the nesting season would seriously impact the kites and their young by causing the parents to leave the nest or by damaging the vegetation in which the nest was built.

ST. THOMAS PRICKLY ASH

There are no specific known restrictions or conditions under which exotic plant control should be undertaken with this particular plant. Aerial spraying of foliage would potentially affect this species, but this activity is not conducted in Virgin Islands National Park and would likely not be conducted in the future. This plant usually occurs as an individual, or small group of individuals, in an otherwise intact vegetation category. It would be too risky to conduct aerial spraying because of the likelihood of an accidental overspray, especially considering the typical windy climate of the Virgin Islands. Prescribed fire cannot be used in the park, because these communities are not fire-adapted like those in Florida, and a fire would kill all vegetation.

ST. THOMAS LID FLOWER

There are no specific known restrictions or conditions under which exotic plant control should be undertaken with this particular plant. It usually occurs as an individual, or small group of individuals, in an otherwise intact vegetation category. It would be too risky to conduct aerial spraying, because of the likelihood of an accidental overspray, especially considering the typical windy climate of the Virgin Islands. Prescribed fire cannot be used in the park because these communities are not fire-adapted like those in Florida, and a fire would kill all vegetation.

SOUTH FLORIDA PINE ROCKLANDS

The pine rockland plants are predominantly low-growing plant species that have adapted to the harsh conditions of the habitat. These plants are often intermingled with the targeted exotic plant species and are difficult to see. Aerial spraying of exotic plants is not generally appropriate in these habitats because of a high potential to impact nontarget plants. Ground treatment methods are appropriate when crews know the vegetation in these areas, or they are supervised by someone who can identify the plants and make sure they are not impacted. It would be highly beneficial to endemic species if exotic plants were removed from the habitat because of the shading and competitive effects the vegetation (even dead vegetation) can have. Also, leaving the vegetation to decay would add nutrients to the soil, which would interfere with the delicate balance of this vegetation category. Prescribed fire as a re-treatment method may be used in these communities, but they must be infrequent, low-energy fires.

FLORIDA SCRUB JAY

Florida scrub jays predominantly nest in oaks, approximately 3 to 6 feet above the ground. Nesting occurs from early March to the end of June, so exotic plant treatment in their habitat should not be conducted during this time. Ground crews using cut-surface treatment methods and removing treated plant material are the most effective methods of treatment in the scrub jay habitat, because the exotic plants are usually intermingled with oaks and other beneficial vegetation of similar size. Aerial spraying in these habitats may result in an accidental overspray and cause damage to nontarget species. The jays require open expanses for courtship and foraging. Over-grown areas can increase raptor predation, potentially causing a decline in Florida scrub jay colonies.

When prescribed fire is used as part of exotic plant treatment, it should not exceed more than 25% of the jay's habitat every 4 or 5 years. This allows the oaks to mature to acorn-producing age and maintain a sustainable forage bank, since acorns provide the majority of the scrub jay's diet. Fires conducted every 10 to 20 years are important for sustaining the optimal habitat for this species, so prescribed fires should be incorporated into the exotic plant control program, as appropriate.

SCHAUS SWALLOWTAIL BUTTERFLY

The Schaus swallowtail butterfly requires hardwood hammocks for their breeding and foraging habitat, and no seasonal variations are recorded. They require certain native hammock plant species for survival, so the careful eradication of exotic plants would benefit the butterfly by benefiting the plants. Torchwood and wild lime are the native species on which the female butterfly lays her eggs, so it would benefit the species if impacts to these two plants were avoided. Cut-surface treatment by ground crews and removal of dead plant material are most appropriate for these communities, because it is best if the treated plants are removed to reduce shade and competition with the native plant species. In addition, the effect of herbicides on invertebrates is not well known. The accuracy with which the herbicide is applied would make it highly unlikely that the Schaus swallowtail butterfly would be directly affected by the spray or by residual herbicide left on or in the foliage where it may be ingested. Prescribed fire is not appropriate as a control, because these are not fire-adapted communities.

MAINTAINING TREATED SITES (RE-TREATMENT)

A standardized maintenance regime was established for re-treating sites under alternative B. Based on the rate of return of the exotic plant species, managers would use the defined schedule for re-treatment of sites as opposed to alternative A, where re-treatment is not defined and is sometimes only done on an opportunistic basis. A defined protocol for re-treatment would ensure that treated sites are maintained on a regular basis, which would improve the ability of managers to reduce populations and densities of exotic plants to an acceptable level and to reach the desired future condition of the vegetation categories within the site. Based on the life history of each exotic plant species, re-treatments in the parks would need to occur 4 to 12 months following the initial treatment. Considering the growth rate of each exotic plant species, the number of re-treatments necessary to control an infestation and bring it to a maintenance level would range between 3 and 10 months. Old World climbing fern (lygodium) is difficult to control because of its ability to produce spores and spread rapidly. The number of re-treatments needed to control lygodium infestation could be as high as 10.

The decision matrix above (table 11) was also used to determine the appropriate re-treatment method, given the exotic plant species present and the environmental conditions for treatment areas within the parks. Table 12 provides the optimal schedule that would be used to re-treat exotic plants in the parks under alternative B.

TABLE 12: OPTIMAL RE-TREATMENT SCHEDULE AND APPROPRIATE METHODS BY EXOTIC PLANT SPECIES

Exotic Species	Estimated Time Interval between Re-treatments	Number of Re-treatments Potentially Needed	Re-treatment Methodology
Australian pine	12 months	3 to 4	Foliar ground treatment of new growth, fire, and/or hand-pulling
Brazilian pepper	6 months	4 to 5	Foliar ground treatment of new growth, fire, or hand-pulling
Guinea grass	6 months	3 to 4	Foliar ground treatment of new growth
Lather leaf	6 months	4 to 5	Foliar ground treatment of new growth, hand-pulling seedlings
Lime berry	6 months	4 to 5	Foliar ground treatment of new growth or hand-pulling
Melaleuca	6 to 18 months	3 to 4	Foliar ground treatment, fire, or hand-pulling
Melaleuca	12 months	5 to 6	Release of additional snout beetles or sap-sucking psyllid
Mother-in-law's tongue	6 months	4 to 5	Foliar ground treatment of new growth or hand-pulling
Old World climbing fern	12 months	5 to 6	Release of additional numbers of a nonindigenous moth
Old World climbing fern	4 to 5 months	6 to 10	Foliar ground treatment of new growth, fire, or hand-pulling
Tan tan	6 months	4 to 5	Foliar ground treatment of new growth or hand-pulling

As indicated in the decision matrix, all infestations could be re-treated using foliar ground methods and by the hand-pulling of seedlings. With a re-treatment schedule for all exotic plant species of between 6 and 12 months, the exotic plants that return would be in the seedling stage and could be treated by spraying herbicide on the foliage. Hand-pulling exotic plants would be conducted for all treatments, where feasible. In particular instances, prescribed fire may be used for re-treatment.

Biological controls would continue to be re-released approximately every 12 months, if necessary, to supplement the population, depending on the hatching of a new brood of insects from eggs laid by the previous generation. Biological controls would continue to be used to facilitate the control of melaleuca and may be released in the parks to supplement chemical, physical, and mechanical treatments of lygodium.

Prescribed fire can be used when re-treating areas with Australian pine, melaleuca, and lygodium. As stated previously, fire is effective as a re-treatment method in controlling exotic species, as well as a means to reduce biomass of treated materials and prevent wildfires. Prescribed fire to control exotic plants would be applied in Big Cypress National Preserve and Everglades National Park where large infestations of these exotic plants occur in remote locations. Fire has been shown to be an effective tool in treating large infestations in these conditions.

Because of the small scale of infestation and the scattered distribution of exotic plants that would be treated in Biscayne National Park, Canaveral National Seashore, and Dry Tortugas National Park, fire would not be used as a re-treatment tool, because the control of exotic plants could be accomplished using less invasive methods, such as hand-pulling and foliar ground treatments with herbicides. Fire would not be used as a re-treatment method in the Caribbean parks because the vegetation categories in those parks are not fire-adapted, as are the parks in Florida.

Prescribed fire would be used in areas of lygodium infestation to reduce the dead plant material in the treatment area. Lygodium would be pulled from the canopy prior to burning to prevent fire climbing into the canopy and causing crown fires. Fire has been shown to be an effective tool in reducing seedlings of the other species. In particular, fire would be used within 1 year of herbicide treatment on melaleuca, because after saplings reach about 3 feet in height, fire would not be effective. Prescribed fire to control exotic plants would be coordinated with the park's fire management team.

CULTURALLY SIGNIFICANT PLANTS

All parks may identify some species of exotic plants that have historical or cultural significance that would be maintained, such as is done on Buck Island Reef National Monument. These plants would be considered character-defining elements of a cultural landscape or critical to interpreting the history of a particular area. The exotic plant program manager would make recommendations on how to retain these plants while reducing their potential to expand from the area. For example, the century plant at Canaveral National Seashore may be retained in areas such as the House of Refuge, Eldora, and Seminole Rest. Genip trees would be retained at Annaberg in Virgin Islands National Park. To prevent the spread of these exotic plants into other areas, the exotic plant program manager would also recommend mitigation measures, such as cutting any flowering stalks.

PROPOSED MITIGATION MEASURES

Mitigation is a key concept in resource management planning. Mitigation measures and best management practices are regularly used to ensure that the parks' natural and cultural resources are protected and preserved. In the legislation that created the NPS, Congress charged it with managing lands under its stewardship "in such manner and by such means as will leave them unimpaired for the enjoyment of future generations" (*NPS Organic Act of 1916*, 16 USC 1). As a result, the NPS routinely evaluates and implements mitigation whenever conditions could occur that would adversely affect the sustainability of park resources.

Mitigations were included throughout the formulation of the two action alternatives included in this draft EPMP/EIS. As with alternative A, alternative B would also implement the *Exotic Plant Management Teams Operations Handbook* (NPS 2003m) guidance on the proper storage and transportation of all herbicides, proper personal protective equipment that must be used during herbicide application, and proper disposal of herbicides. In addition, all contractors and staff working on exotic plant management activities would need to have the proper training, licenses, and certification for applying herbicides and for the safe handling of materials and supplies.

Table 13 describes the standard mitigation measures for park resources that would apply to alternative B.

TABLE 13: MITIGATION MEASURES AND BEST MANAGEMENT PRACTICES UNDER ALTERNATIVE B

Native Plants / Vegetation Categories

- All equipment would be cleaned before leaving the treatment site when operating in areas infested with exotic plants.
- Equipment entering natural areas would be inspected and cleaned prior to entry to prevent new introduction of exotic plants.
- All exotic plants that are mechanically or hand-excavated after bud stage would be bagged and properly disposed.
- New 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.
- When transporting biological control insects with host plant material, containers would be used that prevent premature release of the insects and release of seeds from the exotic plant.
- All exotic plant treatment areas would be assessed or field surveyed for sensitive native plants prior to treatment. No chemical would be directly applied on sensitive plants during spot applications, and a buffer zone (100-foot radius) would be applied to sensitive plant populations during aerial applications.
- Damage to nontarget plant species would be minimized by using ground crews with compression (backpack or hand-held) sprayers, when feasible. All herbicides would be applied by highly trained and certified personnel in accordance with EPA registration label requirements.
- Specific treatment guidelines would be reviewed with all contractors and personnel prior to treatment in order to ensure only target exotic plants are removed.
- All herbicides used would be approved through the NPS Pesticide Use Proposal System and designated Integrated Pest Management Coordinator, as required by NPS policy. Annual Pesticide Use Logs tracking the type, amount, location, and targeted species would be maintained and submitted to the IPM coordinator.

Soils

- A spill containment kit would always be on hand during chemical treatments and, in case of an accidental herbicide spill, specific spill procedures, as outlined in the EPMT Operations Handbook, would be followed.
- Project vehicles would be inspected regularly to make sure the vehicles have no oil or fuel leaks, which could result in contamination of the park environment. An adequate hydrocarbon spill, containment system would be available on site in case of unexpected fuel or oil spills in the project area.

Water Quality and Hydrology

- All herbicides would be applied in accordance with EPA registration label requirements and restrictions. Herbicides would not be applied over open water, unless the label specifically allows such applications.
- Herbicide applicators would obtain a weather forecast for the area prior to initiating a spraying project to ensure no extreme precipitation or wind event could occur during or immediately after spraying, which could allow runoff or drift into water bodies.

Wildlife and Special Status Species

- Exotic plant treatments would be timed to avoid sensitive seasons for wildlife and would be coordinated to avoid sensitive wildlife areas or nesting sites.
- If herbicides are to be sprayed within potential habitat for any threatened, endangered, or sensitive plant species, a survey of that habitat would be conducted, if possible. If no survey is conducted, the potential habitat would be treated as if occupied by the threatened, endangered, or sensitive plant species, and the mitigation that follows (for occupied habitats) would apply.
- Within 25 feet of any occupied threatened, endangered, or sensitive plant species habitat, there would be no spraying of herbicides from vehicles, and herbicides must be applied by hand to individual weeds (e.g., wand from backpack sprayer or on gloves, wicks, rags).

Air Quality

- The application of herbicides and use of prescribed fire would only be implemented when weather conditions are optimal. Aerial herbicide applications would not be conducted during temperature inversions.
- Specific label directions, recommendations, and guidelines (e.g., nozzle size and pressure, additives, wind speed, aircraft height, boom length, etc.) would be followed to reduce drift potential from herbicide applications. Typically, aerial spraying is only conducted when wind speeds are less than 10 miles per hour.
- The aerial application system shall include a positive shut-off valve to prevent overspray while in flight and must be adjustable for fast and accurate calibration.
- Buffer zones around any sensitive receptors would be delineated (flagged and mapped) and reviewed with the pilot prior to aerial herbicide application.

TABLE 13: MITIGATION MEASURES AND BEST MANAGEMENT PRACTICES UNDER ALTERNATIVE B (CONTINUED)

Cultural Resources
• Before any ground-disturbing activity occurs, the immediate area would be visually surveyed for shell middens or any historic structural remains, and if cultural deposits are identified, the park's cultural resource specialist would be notified. Findings would help guide treatment methodology.
• Close coordination among EPMT and park, regional, and Southeast Archeological Center (SEAC) staff would help identify and evaluate cultural resources in proposed treatment areas, choice of best possible treatment methodology, and identification and implementation of protective measures.
• Methodology for removing exotic plant materials from historic ruins and archeological sites would be developed in consultation with NPS cultural resource specialists (park, region, SEAC) prior to treatment. Protective measures for treatment areas within and adjacent to structures would be developed to prevent staining or other ancillary structural damage from herbicide applications. Chemical controls would not be used directly on historic fabric or historic structures in order to avoid staining.
• The exotic plant removal field crew would consult with the park archeologist before commencing work within the boundaries of historic districts or cultural landscapes. "Marker" species (either exotic or native species) for prehistoric and historic archeological sites in the park would be identified, and a listing provided to EPMT. When "marker" or ethnographically valued species are identified at a potential treatment site by EPMT: (1) the site location would be recorded; (2) park resource staff/archeologist would be notified by the EPMT of species presence and location; (3) the park would arrange for the area to be inventoried and sites to be documented and evaluated; (4) the park would consult with concerned traditional groups/tribes as appropriate; and (5) based on the above, protocols for future treatment and protection methods appropriate to the site would be developed, and alternative methods of exotic plant management would be sought.
• Archeological resources would be considered when accessing treatment sites to avoid damage from vehicles or other equipment. If previously unknown archeological resources were discovered during treatment, monitoring, or restoration activities, SEAC would be notified immediately.
• The effects of herbicides on archeological resources, such as shell, charcoal, and bone, are poorly known; however, some petroleum products can affect C 14 analyses. Sites containing these types of resources would not be treated until SEAC has an opportunity to visit the site, conduct appropriate investigations and documentation, and site importance has been determined.
• No treatment would occur within defined or potential cultural landscape areas until resources have been properly documented and evaluated. Should any species linked to historic agricultural practices (e.g., key limes, pineapples, tomatoes) be located, an individual from the park's cultural resource program would be notified prior to their removal.
• Altering hydrologic conditions could potentially result in deterioration or loss of archeological resources. This method would not be used in areas with unevaluated cultural resources or in areas containing sites that are eligible for inclusion in the National Register of Historic Places.
• Altering fire regimes through prescribed fire can damage cultural landscapes and vegetation categories valued by tribes and traditional groups and destroy archeological sites and undocumented ruins. The use of prescribed fire would be closely coordinated with the park's fire management plan, cultural resource staff, and SEAC, to prevent damage to cultural resources.
• Mechanical removal of plants and/or soils can cause damage to buried, or partially buried, archeological sites. Mechanical treatment activities would only occur on archeological sites if closely supervised by, and coordinated with, SEAC.
Visitor Use and Experience
• All treatment areas would be properly identified with signage and flagging, and, if necessary, access would be restricted to appropriate personnel.
• The use of helicopters and heavy equipment would be limited during heavy visitation periods and in high visitor-use areas.
• Park interpretive staff would make visitors aware of treatment activities and integrate the exotic plant management program into educational and interpretive activities. Signs would be placed around treatment areas to notify/educate the public about projects.
• To minimize visual impact in high visitor-use areas, exotic plant stumps would be cut to ground level when possible, or alternatively, the remaining stumps would be left with an irregular/ragged edge to imitate a natural break.
Wilderness
• A minimum tool analysis would be conducted for all projects located in designated or proposed wilderness areas. This analysis would help determine the minimum tool that is needed in order to achieve treatment objectives, while minimizing impacts to wilderness values.
• The frequency of trips and operation of equipment and vehicles would be limited in wilderness areas. Transportation to and from the treatment site would be coordinated between all personnel working on a project to limit the number of vehicles.

TABLE 13: MITIGATION MEASURES AND BEST MANAGEMENT PRACTICES UNDER ALTERNATIVE B (CONTINUED)

Public Health and Safety
• In treatment areas where motorboats or airboats operate, trees would be left standing or “marker trees” would be used to provide visual evidence of treated vegetation.
• Herbicides would only be applied by trained and licensed personnel, and the manufacturer’s instruction for mixing, loading, and disposal of chemicals would be followed. A Material Safety Data Sheet (MSDS) for all chemicals would be readily available at storage facilities and in vehicles. Personnel would strictly adhere to the storage and labeling requirements outlined in the EPMT Operations Handbook.
• The precautions set forth in the EPMT Operations Handbook for the safe transport and mixing/loading of herbicides would be followed.
• Appropriate personal protective equipment (e.g., safety glasses, gloves, special footwear), which varies according to chemical, would be worn during the mixing and application of herbicides, as suggested on the chemical’s label. In many areas, long pants and long-sleeved shirts would be required to protect against harmful native plants (such as poison ivy, cactus, and manchineel).
• A spill containment kit would always be on hand during chemical treatments; the kit would include a shovel, absorbent pads, absorbent material, and plastic bags. Herbicide applicators would be familiar with and carry spill procedures to reduce the risk and potential severity of an accidental spill. The spill procedures (as outlined in the EPMT Operations Handbook) identify methods to report and clean up spills in the event they occur.
• All treatment areas would be identified with signage and flagging, and, if necessary, access would be restricted to appropriate personnel.
• Adjacent landowners would be notified in advance of herbicide applications.

PROPOSED RESTORATION PROGRAM

The restoration program in alternative B would be the same as alternative A; that is, native plant species would be left to re-establish naturally from the presence of seeds in the soil or from the propagation of native plants in adjacent habitats. Treated areas would be monitored to determine the efficacy of the treatment and the rate of native plant species recovery. If monitoring indicates that the rate of recovery is lagging, and objectives for the desired future conditions for that particular vegetation category were not being met, the treatment method used to maintain the area, and/or the frequency with which the area is being maintained, may be modified. In appendixes A – I, table 1 shows that the number of acres for each park passively restored under alternative B would be the same as in alternative A.

DESIRED FUTURE CONDITIONS

This section describes the exotic plant management objectives or desired future conditions for each vegetation category that has been assessed in this draft EPMP/EIS. Desired future conditions are those target conditions indicating that the restoration has been successfully achieved following the treatment and removal of exotic plants. Prior to site-specific action, park resource managers would define the desired future condition of the treated site with regards to the native vegetation community to be recovered or rehabilitated and the level of exotic plant species that would be acceptable if eradication of the infestation is not possible. Using this site-specific goal for site recovery, managers would define indicators by which to monitor treatment activities to determine if treatment methods are being successful, and the site is passively restoring to the desired future condition.

There are 40 different vegetation categories in the parks that are described as unique natural systems. These vegetation categories were retrieved from a digital vegetation and land cover data set for Florida derived from 2003 Landsat Enhanced Thematic Mapper satellite imagery created by the Florida Fish and Wildlife Conservation Commission and published in March 2004. Add to this the local differences in habitat definitions and terminology, and the list of unique vegetation categories increases. Many of the vegetation categories, however, have similarities that enable the development of broader vegetation categories for which desired future conditions can be described. For all vegetation categories, passive restoration would be achieved when the following conditions have been achieved:

- There is a stable, native vegetation category that supports a relative dominance (85%) of the native species.
- Natural succession is occurring in a manner that indicates the long-term success of the restoration project.
- Invasive exotic plant species compose less than 5% surface cover within the treated area for one full year of exotic species monitoring without human intervention or treatment.

Table 14 shows the estimated time frames for achieving desired future conditions of a stable native vegetation category within treated areas, using the passive restoration approach. Appendix Q presents a detailed description of the desired future conditions (including the time frame for restoring each community type and a list of species that would be dominant in that particular community) for each broad vegetation category.

TABLE 14: TIME FRAME FOR ACHIEVING DESIRED FUTURE CONDITIONS THROUGH PASSIVE RESTORATION

Vegetation Category	Estimated Time for Achieving Desired Future Conditions through Passive Restoration
Sawgrass Marsh / Wet Prairie / Freshwater Marsh	3 to 5 years
Mangrove	5 to 7 years
Grassland / Coastal Strand	3 to 5 years
Shrubland	10 to 15 years
Wetland Forest	
Cypress swamps	7 to 12 years
Hardwood swamps	7 to 12 years
Upland Dry / Mesic Forest	
Pine rocklands	7 to 12 years
Pine flatwoods	7 to 12 years
Mesic tropical forest	7 to 12 years
Dry tropical forest	7 to 12 years
Tropical hardwood hammock	7 to 12 years
Xeric oak scrub	7 to 12 years
Subtropical hardwood hammock	7 to 12 years

Note: Desired future conditions are defined as the time that native vegetation categories are stable within treated areas.

WILDERNESS AND MINIMUM REQUIREMENTS ANALYSIS (MINIMUM TOOL)

Wilderness and minimum tool analysis for treating exotic plants in Everglades National Park would be the same as that described under alternative A.

MONITORING AND DATA COLLECTION

According to Barry Mulder of the USFWS, a monitoring program must consist of collecting data, summarizing that data into useful information, and interpreting the data so that it advances managers' understanding and knowledge for improved decision-making. Monitoring is the process of recording observations and collecting information to assess the effects of a previous action. It is also integral to adaptive management. As such, monitoring is a key component of alternatives B and C. It is important to know, in great detail, the condition of an area before and after treatment in order to assess the effectiveness of treatment and to change treatment methods, if necessary. The information gathered by monitoring enables the NPS to manage exotic plants in the best manner possible, at present, and it also provides reference and guidance for future projects.

For this draft EPMP/EIS, monitoring would consist of three primary approaches once baseline data is collected: implementation monitoring, effectiveness monitoring, and monitoring of the affected environment. Table 15 describes the three approaches to monitoring that would be used upon implementation of the exotic plant management plan. Each of the assessment criteria listed would be monitored annually. However, it is necessary to monitor the reduction in infestation and the success of native plant recovery every 4 to 12 months, depending on the re-treatment schedule for that area. Once sites have reached the desired future condition, that condition would also be monitored on an annual basis. The monitoring information would be entered into a database to facilitate organization of, and easy access to, the information.

Monitoring activities to determine the extent of infestation, or new infestations, of exotic plants in the parks would continue as described in alternative A. Monitoring would be used to gather data on any new or expanding exotic plant infestations, the density and rate of spread, apparent effects on other park resources, and the setting of priorities for the appropriate treatment and treatment method. A high priority for monitoring would be given to areas where the potential for new infestation is greatest, including areas along roadways, trails, boundaries with infested lands, and recent anthropogenic (human-caused) disturbances. Data recorded would include infestation location, date of discovery, species, condition, and distribution.

TABLE 15: PROPOSED MONITORING UNDER ALTERNATIVE B

Monitoring Approach	Assessment Criteria	Purpose
Implementation	• Location, timing, and method of treatment • Herbicide used (if applicable) and species targeted • Acreage of area treated • Condition of area at time of treatment (percentage cover of infestation) • Weather conditions at time of treatment	To create a record of all treatments so that effects of particular methods and conditions can be assessed and information can be used in adaptive management design.
Effectiveness	• Effect of treatment on target species • Whether goals of reduced exotic plant spread are met • Success of native plants in recovering	To determine the effectiveness of the treatment in reaching plan objectives.
Affected Environment	• Effects of treatment and passive restoration on wildlife • Effects of treatment on nontarget plant species • Effects of treatment and passive restoration on threatened or endangered species • Effects of treatment on cultural resources • Presence of herbicide (if applicable) in water • Persistence of herbicide (if applicable) in soil	To determine how the treatment has affected the environment; if thresholds were exceeded, this would be taken into consideration and used in adaptive management design.

ADAPTIVE MANAGEMENT

Successful management of natural systems is a challenging and complicated undertaking. The DOI requires that its agencies ". . . use adaptive management to fully comply" with the CEQ's guidance that requires "a monitoring and enforcement program to be adopted . . . where applicable, for any mitigation" (516 DM 1.3 D(7); 40 CFR 1505.2). Adaptive management—management by experiment—is based on the assumption that current resources and scientific knowledge are limited. Nevertheless, an adaptive management approach attempts to apply available resources and knowledge and adjusts management techniques as new information is revealed. Holling first described the principle of adaptive management as requiring management decisions and policies to be viewed as hypotheses subject to change—as sources of continuous, experimental learning (Holling 1978).

The adaptive management approach can be divided into the following basic steps: (1) assessment, (2) design, (3) implementation, (4) monitoring, (5) evaluation, and (6) adjustment or continuation (Nyberg 1998). Ideally, the resulting management of an ecosystem would improve as more information is gathered, analyzed, and incorporated into the process. Adaptive management integrates setting quantitative objectives, exploring alternative management strategies, monitoring progress, and evaluating performance in terms of risks and benefits (Goodman and Sojda 2004). Implementation of an adaptive management approach requires constant evaluation and includes an amount of uncertainty. Uncertainty inherent in this approach stems from four sources: (1) uncontrollable environmental variation, (2) partial controllability (discrepancy between intended and actual management), (3) lack of understanding among those responsible for implementation, and (4) precision of monitoring, i.e., the applicability and success of decisions are dependant on the frequency and precision of monitoring (Williams 1997).

Adaptive management incorporates the scientific experimental method in the management process, while remaining flexible enough to adjust to changes in the natural world, as well as the policy that governs it. The goal is to give policy makers and resource managers a better framework for applying scientific principles to complex environmental decisions (Wall 2004). Figure 5 illustrates an adaptive management approach.

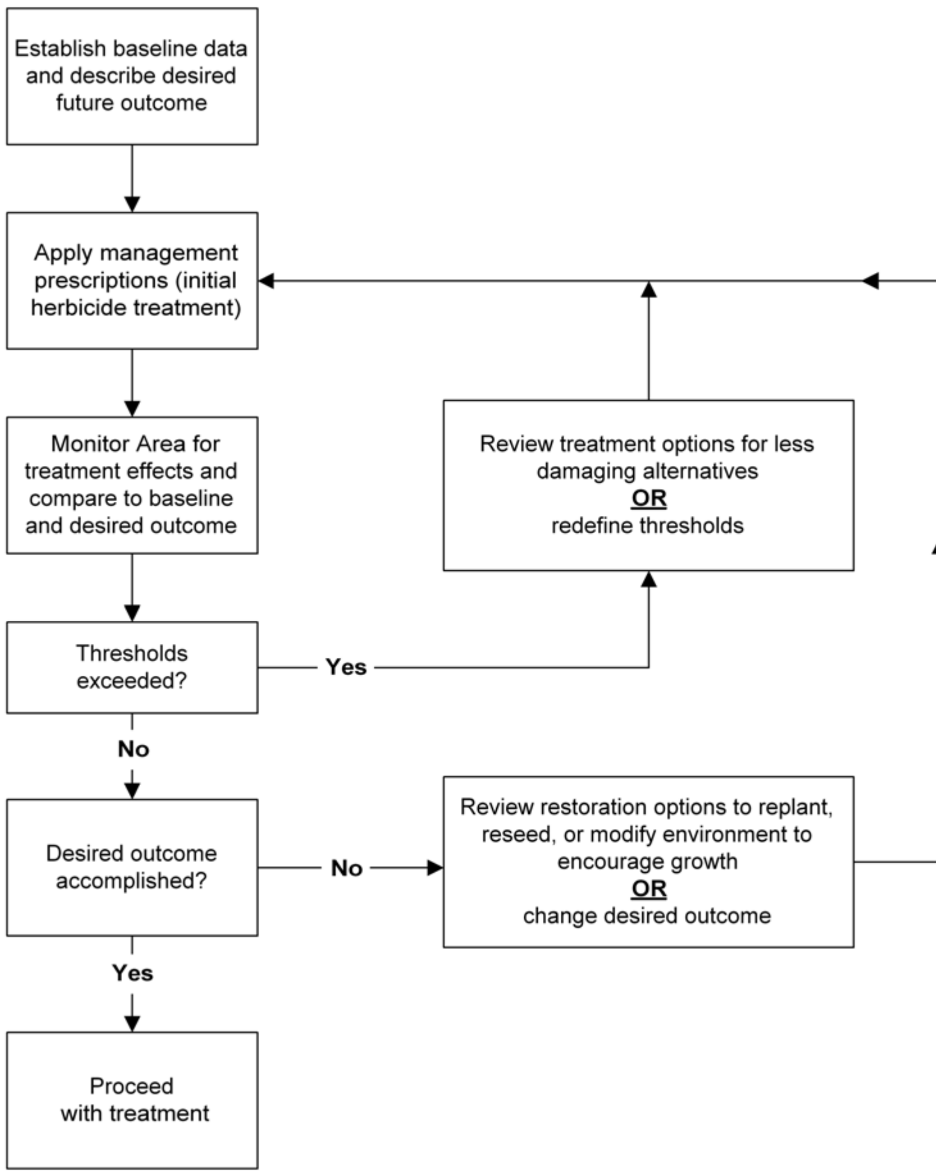


FIGURE 5: AN ILLUSTRATION OF THE ADAPTIVE MANAGEMENT APPROACH

Under this draft EPMP/EIS, the following six steps would be followed when applying an adaptive management approach:

1. Monitor the baseline data. Existing conditions would be recorded and monitored to establish a set of baseline conditions for future comparison.

2. Apply the management action. Areas would be treated using one, or a combination, of the methods described in this document; for example, treating Brazilian pepper with Garlon.

3. Monitor the effectiveness of the treatment. Monitoring would be conducted to determine whether the method used for treatment were successfully reducing the level of infestation in a treatment area.

4. Monitor for effects of the treatment on other resources. Resources in the treatment area would be monitored during and after treatment to determine the effects of the methods. Monitoring would be conducted to determine whether the treatment methods were having an unacceptable effect on native vegetation, wildlife, sensitive species, aquatic resources, and cultural resources.

5. If monitoring indicates that thresholds of acceptable level of impact on these resources have been exceeded, reconsider the treatment method. If effects on the environment are exceeding thresholds, a different method of treatment, or a combination of methods would be considered. This may involve using a different herbicide, or a different concentration of the same herbicide, or discontinuing a particular method, such as herbicide use, and switching to mechanical or prescribed fire methods. For example, if native vegetation in a treatment area were dying-off after treatment with Garlon, the NPS may stop using Garlon and, instead, use mechanical treatment methods.

6. If the treatment worked effectively, and no thresholds were exceeded, no change would be made to the process. For example, if Garlon effectively killed Brazilian pepper and did not harm other species or the surrounding environment, Garlon would continue to be applied in that treatment area and may be applied in other treatment areas with similar environmental conditions. However, if the level of infestation is not being reduced, and native plant species in the area are not being restored naturally at an acceptable rate, then a different method would be employed to control the exotic plants. This may involve using a different herbicide or a different concentration of the same herbicide, or using a new combination of methods, such as an initial herbicide treatment followed by the use of prescribed fire as a re-treatment.

PROPOSED EDUCATION PROGRAM

An objective of this draft EPMP/EIS is to increase public awareness of the impacts that exotic plants have on park resources and to build public support for managing exotic plants in the parks. Essential components of the integrated pest management program are nontreatment practices, such as educational programs and collaborative partnerships. Education programs under either action alternative would target both internal and external audiences.

Internal programs would serve to educate NPS staff, volunteers, and concessioners about exotic plant management. A training program, with an overview of this draft EPMP/EIS, would be established so staff, volunteers, and concessioners may gain an understanding of the decision-making process, exotic plant identification and prevention measures, treatment options available to control exotic plants, and impacts of exotic plants and treatments on park resources and ecosystems. The parks' exotic plant program managers would interpret and communicate to resource managers, interpreters, maintenance personnel, and others, the results of the latest research on exotic plants and the status of the exotic plant management program in the parks.

External programs would be used to inform and educate the public about exotic plant issues in and around the national parks; the effects that exotic plants 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. The parks would develop interpretative programs, exhibits, and public outreach programs, as well as common interpretative materials that would be applicable throughout the region. Such materials would be used to present programs to park visitors, schools, and special-interest groups.

If park exotic plant control projects were located near popular access routes, interpretative signs could be erected. Written materials, such as brochures, would be available at park visitor centers and used for presentations and program. Park websites would be enhanced to include educational information on the threat of exotic plants, management actions to treat exotic plants within the parks, and updated to provide information on the progress of exotic plant management in the parks. An interested and informed public can greatly assist with the early detection and monitoring of exotic plant infestations and help with the prevention of additional infestations. Programs can also be established with volunteers who would actively help with the treatment and control of exotic plants.

COLLABORATION AND PARTNERSHIP

As an objective of this draft EPMP/EIS, the parks would continue to foster communication and collaboration (this is done currently under alternative A) among federal and state agencies, private landowners, and other agencies, in an effort to build a regional front against the invasion of exotic plants. Ecosystem processes operate over multiple spatial and temporal scales. Thus, the traditional model of land management that focuses only on the narrow strata of vegetation stands and political units can be very ineffective. Exotic plant infestations are not constrained by arbitrary boundaries, so effective resource monitoring and management must likewise extend across park boundaries. This can best be achieved through collaboration with other park units, land management agencies, scientists, and nongovernment entities, and by ensuring public outreach and education (NPS 2002c). Collaboration is important for achieving shared goals, sharing knowledge of latest technologies and research, and providing feedback on successful management techniques—all critical elements of this draft EPMP/EIS.

According to *Inventory and Monitoring for Invasive Plants Guidelines* (NPS 2002c), collaboration allows the NPS and others to:

- Exchange data
- Improve efficiency
- Educate and be educated
- Create opportunities for cooperative work
- Increase political and public support
- Build a holistic understanding of the ecosystems and land management strategies outside parks
- Benefit from the synergy of multiple perspectives and expertise

Through this draft EPMP/EIS, monitoring information and data would be compiled in a systematic way by each park and compiled into one database. This information would be made available to other agencies and organizations to further improve exotic plant management on a broader scale. When data from many sources are available in one place, resource scientists can analyze and interpret a much larger and holistic view of the ecosystem than is available with limited park data (NPS 2002c). Effective communication and information exchange can also further the development of cooperative projects with other agencies and organizations.

As described for alternative A, the parks would continue to collaborate with local, state, and federal agencies in efforts to control exotic plants on a regional level. The NPS would continue to participate in organizations, such as the Noxious Exotic Weed Task Team (NEWTT) and the South Florida Water Management District, in order to establish common goals for the control of exotic plants and for ecosystem restoration. The NPS would continue to assist adjacent landowners by providing staff support and technical advice, and the parks would continue to collaborate with nongovernment organizations and agencies to provide expert knowledge in focused sessions and field demonstrations. The NPS may also enter into collaborative efforts with the USDA to release biological control agents, either those that are already being applied in areas adjacent to the parks, or for new APHIS-approved biological controls that may be developed, within the parks.

Due to the joint management responsibilities of resources within Canaveral National Seashore (see the "Purpose of and Need for Action" chapter for a description of this management) between the NPS and the USFWS, exotic plant management activities that would affect natural resources within Canaveral National Seashore, within a jointly managed area of the park, would need to be conducted with the collaboration and cooperation of the USFWS.

Collaboration among NPS divisions would also need to occur within park units. Under both action alternatives, the exotic plant resource specialists would work closely with the NPS Inventory and Monitoring (I&M) program to increase efficiency in monitoring parks for new infestations and to combine efforts, where possible, to collect information on resources in treated areas. Exotic plant managers would collaborate with I&M managers to obtain information about the type and distribution of sensitive resources in new treatment areas prior to using the optimum tool decision matrix tree (refer to table 10) to determine the appropriate treatment method at each site.

In addition, exotic plant program managers would consult with cultural resource specialists in the parks, region, or other NPS offices, as well as the State or Territory Historic Preservation Office, to determine the appropriate treatment methods prior to treating exotic plants that are affecting or have the potential to affect cultural resources, such as historic structures and archeological resources.

Exotic plant managers would also coordinate with any NPS division that plans for, contracts, oversees, or drives heavy equipment in the parks. Exotic plant managers would help review construction plans for all construction-related disturbances in the parks. Contract specifications would be reviewed by resource personnel, especially with regard to plant material sources for landscaping, fill, topsoil and gravel sources, and cleaning of equipment before they are brought into the parks. Compliance with these specifications would also be reviewed after construction is finished. Additionally, exotic plant program managers would coordinate with maintenance and construction personnel during work that involves moving dirt or disturbing natural vegetation. Activities that involve soil and vegetation disturbance can be conducted in a manner that would encourage native plants and discourage exotic plants from establishing.

IMPLEMENTATION OF SITE-SPECIFIC PROJECTS

As discussed in the description of elements of alternative B, a number of steps would be implemented under this alternative to determine and implement the appropriate treatment method on a site-specific level. These steps are:

- Assess the degree of infestation
- Set priorities for the treatment areas
- Site survey or assessment for sensitive resources
- Determination of appropriate treatment methods

- Define desired future condition
- Define monitoring program
- Define subsequent compliance

In this draft EPMP/EIS, a number of these steps have been performed so that an environmental analysis could be performed. For example, the infestation of exotic plants across vegetation categories and potential sensitive species habitat has been described at a broad level. Based on this knowledge and information pertaining to other park resources, the priority for treatment has been assigned to the various treatment areas within the parks. However, when a project is proposed, a survey or assessment of the site would be conducted to refine the information of sensitive species and the exact location of the exotic plant infestation so that the appropriate treatment methods can be determined by using the decision matrix.

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, and the results of all surveys and decisions would be documented.

With regards to selecting a treatment method for use in areas where sensitive species or their critical habitat is known to be present, criteria would be used to assist in selecting the appropriate method of treatment and monitoring activity. If a state- or territory-listed species is located during the survey, the treatment method chosen with appropriate mitigation measures must not have adverse impacts beyond a minor level. The effects of treatment may impact individual plants, but would not contribute to a trend toward federal listing, or cause a loss of viability to the population or species. If a federally listed species is located or the action is to take place in critical habitat of a federally listed species, the treatment method would be required to have no effect or may affect but are not likely to adversely affect the species or its habitat. These same criteria were applied when using the decision tool matrix to define treatment methods for the treatment areas identified in the parks in this draft EPMP/EIS.

A survey or assessment would also be conducted to document the presence or the potential for cultural resources within the treatment area. If resources are present and would be affected by treatment activities, collaboration would occur among the exotic plant manager, cultural resource specialists, and other agencies, to determine the appropriate treatment methods and mitigation measures to minimize, to the extent possible, any adverse impacts to those resources.

This process would be implemented in the future if conditions have changed, such as if new infestations of exotic plants occur, either of an exotic plant known to occur in the park that has spread to new areas of the park not already identified, or, based on the monitoring program, a new exotic plant species enters the park. Park managers would determine the priority for treatment of this new infestation and using the decision matrix determine what the appropriate treatment method would be that would allow for the effective treatment of the plant, while reducing impacts on sensitive park resources.

After the site has been surveyed or assessed, park resource managers would collaborate to determine the specific, desired future condition that is to be achieved through exotic plant management of the particular site. From this, managers would then define a monitoring program that would establish indicators that would be monitored to determine whether treatment activities were allowing the native vegetation to recover or restore to the predetermined conditions, and how these resources would be monitored. Once decisions have been made on the appropriate treatment method, and surveys have been conducted for sensitive resources, park managers must then determine the appropriate NEPA compliance pathway, which is described in the following section.

DETERMINATION OF SUBSEQUENT COMPLIANCE

A decision tree would be used to confirm that the selected treatment or restoration method for site-specific projects complies with NEPA (see figure 6). The resource manager would confirm that the selected treatment method has been considered in this draft EPMP/EIS or under another current and up-to-date environmental document. The manager would also confirm whether environmental conditions have or have not changed from what is presented in this draft EPMP/EIS. If a new method of treatment (such as a new herbicide or biocontrol) were developed and considered for use, the manager must confirm that this new method is similar to the one addressed in this draft EPMP/EIS and that the effects would also be similar. To assist exotic plant managers in determining the appropriate NEPA pathway, a new environmental screening form has been developed that is tailored to exotic plant projects (see appendix R). This form would be completed for future site-specific projects. Other federal, state, and local laws may also have information requirements that overlap with NEPA. The compliance review should also confirm that the proposed project has addressed these other requirements.

If the proposed treatment has not been addressed in this draft EPMP/EIS or in another environmental document, or if the document is out-of-date, preparation of a new NEPA compliance document would be required. For example, new treatments may become available that were not available at the time this document was prepared, in which case, a new NEPA document would have to be prepared.

Alternative B would involve the establishment of a programmatic consultation agreement between the parks and the USFWS and the National Marine Fisheries Service (NMFS) to meet consultation requirements, as required by Section 7 of the ESA. These agreements would apply to exotic plant management activities that would occur within the parks in locations of known occurrences of federally listed species detailed in this document or their habitat. These agreements would outline specific measures that 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. Projects that meet the no effect and not likely to adversely affect criteria set forth in this document, would be covered by blanket concurrence letters issued by the USFWS and NMFS and would not require further consultation.

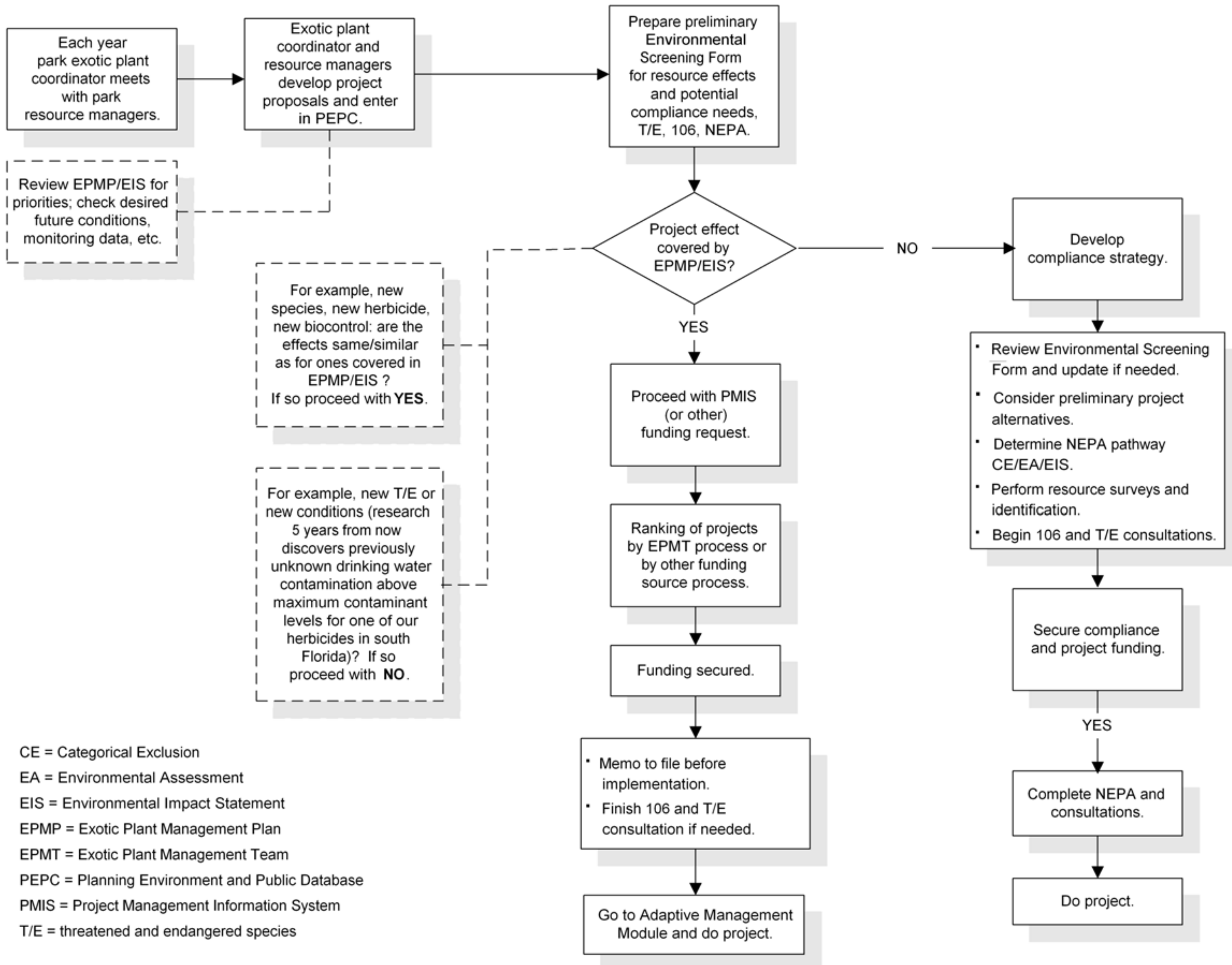


Figure 6: Exotic Plant Treatment and Restoration Decision Tree

A programmatic memorandum of agreement would be also 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 be consistent with provisions of the 1995 Programmatic Agreement among the NPS, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers.

The programmatic agreement for treatment of exotic plants would define specific types of undertakings that the signatories of the agreement mutually agree would be excluded from further review beyond the park level. These stipulations would be based on information adequate to identify and evaluate affected cultural resources. Decisions regarding these undertakings would be made and carried out in conformity with applicable NPS policies, standards, and guidelines. This agreement would outline specific mitigation measures to ensure the identification, evaluation, and protection of National Register-eligible properties that would potentially be affected by future exotic plant treatment activities. The programmatic agreement for treatment of exotic plants would also identify special circumstances under which further Section 106 compliance would be necessary.

COST OF IMPLEMENTATION

The cost of exotic plant management involves the costs of treatment, monitoring, and restoration activities. As described in alternative A, the estimated cost of treatment for mainland sites in Florida parks can range from $136 per acre to $224 per acre, through the use of private contractors. For the Caribbean parks, the estimated cost of treatment can range from $160 per acre to $850 per acre, and in Dry Tortugas National Park, the cost per year ranges from $3,000 to $4,000.

Under alternative B, it was assumed that re-treatment of sites would cost approximately 50% less than the cost of the previous treatment. Under an optimal re-treatment schedule, it is expected that the number of stems to be treated would be 50% less than treated previously. The cost was therefore a summation of the initial treatment and re-treatment that would occur every 6 months over a 10-year period. Monitoring the treated sites for success of treatments, return of native species, and effects on non-target species, was estimated to be approximately 15% of the operating costs (Geritzlehner 2000). Allowing sites to restore passively would not result in a cost to the parks. The cost of implementation of alternative B for each park over the next 10 years is provided in table 16.

TABLE 16: TOTAL COSTS OF ALTERNATIVE B OVER THE 10-YEAR LIFE OF THE PLAN

Big Cypress National Preserve	
Initial infestation to be treated	155,445 acres
Treatment at $136 per acre	$42,281,020
Treatment at $224 per acre	$69,950,217
Monitoring	$6,342,153 to $10,492,532
Restoration	$48,623,173 to $80,442,749
Total	$72,511,984 to $119,964,679
Biscayne National Park	
Initial infestation to be treated	162 acres
Treatment at $136 per acre	$44,064
Treatment at $224 per acre	$72,900
Monitoring	$6,610 to $10,935
Restoration	—
Total	$50,674 to $83,835
Buck Island Reef National Monument	
Initial infestation to be treated	75 acres
Treatment at $160 per acre	$24,000
Treatment at $829 per acre	$124,350
Monitoring	$3,600 to $18,652
Restoration	—
Total	**$27,600 to $143,002**
Canaveral National Seashore	
Initial infestation to be treated	3,273 acres
Treatment at $136 per acre	$890,256
Treatment at $224 per acre	$1,472,849
Monitoring	$133,538 to $220,927
Restoration	—
Total	$1,023,794 to $1,693,777
Christiansted National Historic Site	
Initial infestation to be treated	1 acre
Treatment at $160 per acre	$160
Treatment at $829 per acre	$829
Monitoring	$24 to $124
Restoration	—
Total	**$184 to $953**
Dry Tortugas National Park	
Initial infestation to be treated	1 acre
Treatment at $3,000 initial	$6,000
Treatment at $4,000 initial	$8,000
Monitoring	$900 to $1,200
Restoration	—
Total	$6,900 to $9,200

TABLE 16: TOTAL COSTS OF ALTERNATIVE B OVER THE 10-YEAR LIFE OF THE PLAN (CONTINUED)

Everglades National Park	
Initial infestation to be treated	177,603 acres
Treatment at $136 per acre	$48,307,993
Treatment at $224 per acre	$79,921,312
Monitoring	$7,246,199 to $11,988,197
Restoration	—
Total	$55,554,192 to $91,909,509
Salt River Bay National Historic Park and Ecological Preserve	
Initial infestation to be treated	389 acres
Treatment at $160 per acre	$115,145
Treatment at $829 per acre	$410,020
Monitoring	$17,272 to $61,503
Restoration	—
Total	$132,416 to $471,523
Virgin Islands National Park	
Initial infestation to be treated	2,846 acres
Treatment at $160 per acre	$842,420
Treatment at $829 per acre	$2,999,787
Monitoring	$126,363 to $449,968
Restoration	—
Total	$968,783 to $3,449,755

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

GENERAL CONCEPT

Alternative C adopts the same principles and methods described in alternative B for the proposed exotic plant management program, proposed treatments to manage exotic plants, mitigation measures, monitoring plan, education program, and collaboration and partnership.

The difference between alternatives B and C lies in the restoration plan, with some alterations to the monitoring plan and the criteria used to determine success of treatment. Under alternative C, a decision tool would be applied to determine areas that are appropriate for active restoration, which would occur in park areas that have been previously disturbed and in areas with potential threatened and endangered species habitat or sensitive vegetation categories where a more rapid recovery would be desirable. Other areas in the parks would recover passively. as described in alternative B. If, however, monitoring reveals that recovery is not meeting objectives in areas identified for passive restoration, then active restoration may be implemented. The restoration plan and the altered monitoring plan are described below.

GUIDANCE FOR SETTING MANAGEMENT PRIORITIES

Exotic plant treatment priorities would be set to guide site-specific implementation, which is similar to setting priorities as described under alternative B.

EXOTIC PLANTS TREATED

The priority species for treatment in the parks would be the same as those identified under alternative A.

PROPOSED EXOTIC PLANT TREATMENT METHODS

The parks would continue to use biological, physical, chemical, and mechanical methods to control exotic plants during initial treatment and for the re-treatment of sites, as described under alternative A. However, under alternative C, the decision tool described for alternative B would be applied to determine the best treatment method for exotic plant control, based on the type of exotic plant species, the vegetation category, and the potential threatened and endangered species habitat, present in the treatment area.

As with alternative B, this alternative assumes that all exotic plants would receive an initial treatment, and re-treatments would occur using an appropriate method under an optimal schedule considering the exotic plant species present. Under this alternative, the total number of treatments that would occur over the life of the exotic plant management plan (10 years) would be greater than what would occur under alternative A, because re-treatment of areas would occur every 4 to 12 months until native vegetation categories were restored to the degree defined as the desired future condition. However, the level of effort and the intensity needed to control exotic plants would decline over time, as the level of infestation decreased. The decrease in infestation would be approximately 50% every time treatment occurred, if the exotic plants were treated on a schedule appropriate for the exotic plant species. Likewise, the amount of herbicide that would be needed for re-treatment decreases every time a treatment occurs.

In all treatment areas under alternative C, after the second year of treatment, the method for re-treatment would be foliar ground or hand-pulling, because only seedlings would be treated, and the amount of infestation that would require treatment would be reduced by about 50% after each re-treatment. This would result in less intensive and intrusive management activities over time. Also, these areas would require less treatment activity for exotic plant species, because a portion of each treatment area would undergo active restoration. Therefore, the amount of area that would have to be re-treated over time under alternative C would be less than the amount described under alternative B.

Figure 7 portrays the conceptual trend in treatment over time that would occur in the 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 in comparison to alternatives A and B. Exceptions to this would occur in Biscayne National Park, Buck Island Reef National Monument, Christiansted National Historic Site, and Dry Tortugas National Park. As noted above under alternative A, these parks are currently conducting re-treatments under an optimal treatment schedule.

TREATMENT METHOD DECISION TOOL

The decision matrix described in alternative B would also be used in alternative C to define the appropriate treatment method within treatment areas given the exotic plant species present, the threatened and endangered potential habitat, and the vegetation categories present.

Using the decision tool and the information layers for each park, the appropriate treatment method has been defined for each treatment area. These methods would also be applied under alternative C (see the tables in appendixes A – I).

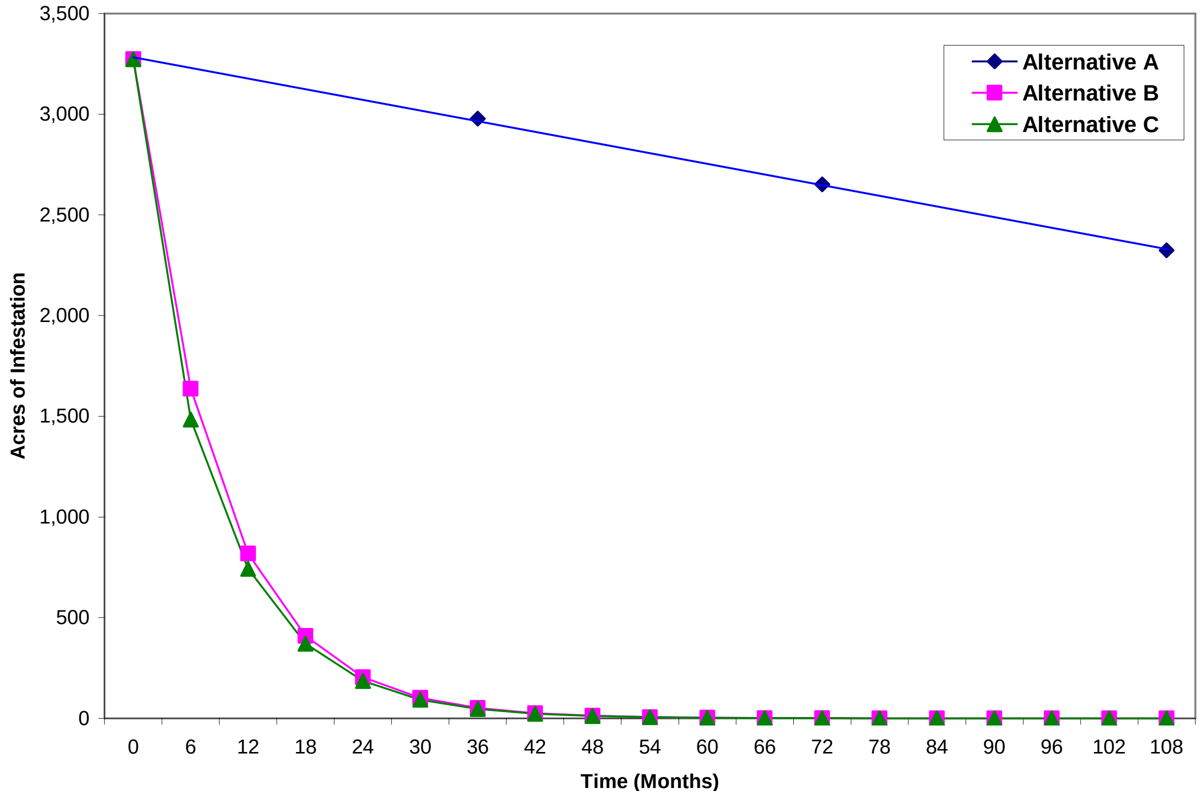


FIGURE 7: CONCEPTUAL REPRESENTATION OF THE CHANGE IN INFESTATION AND TREATMENT INTENSITY UNDER ALTERNATIVE C OVER TIME

MAINTAINING TREATED SITES (RE-TREATMENT)

Alternative C would employ the same standardized maintenance regime for re-treating sites as was described under alternative B. In appendixes A – I, tables show the amount of herbicide that would be applied over time under alternative C.

CULTURALLY SIGNIFICANT PLANTS

Retention of exotic plant species in the parks that are culturally significant would be accomplished as described above under alternative B.

PROPOSED RESTORATION PROGRAM

Under alternative C, a decision-making tool would be applied to assist the parks in determining whether a treated site would be restored using active and/or passive means. Priority setting to determine locations for restoration would be standardized for the nine parks. Active restoration of treated sites would enhance the exotic plant control program by increasing the competitive advantage of desirable species and decreasing the competitive advantage of undesirable species. The framework for determining what sites to restore and how to restore the sites would be based on the following:

- The degree of infestation prior to treatment
- The ability and time frame of the native system to recover on its own
- Whether the treatment area is in a location with high visitor use and visibility
- Whether the treatment area is in an area containing sensitive resources and if there is a desire for a faster recovery of habitat for these resources over what would occur if the system were left to recover on its own
- The level of prior disturbance to the area
- The accessibility of the site
- The cost to actively restore a treated site

The exotic plant project managers must consider the degree of infestation of a treatment area. If the infestation in a treatment area is extensive (greater than 50%), there is a greater likelihood that the native seed bank no longer exists or is greatly diminished, and the likelihood of achieving the desired future condition for native vegetation would not be probable without some form of active restoration. Park areas that have been disturbed (such as the agricultural lands acquired by Everglades National Park) would be an example of areas that have a large infestation that would recover more quickly using active restoration methods.

Consideration would also be given to the amount of time it would take for the native system to recover on its own. The rate of recovery for the vegetation categories described in this draft EPMP/EIS can be classified as slow, medium, or fast. For example, vegetation in a sawgrass prairie would have a fast recovery rate, because the native plants in this system would re-establish within 2 years under optimal conditions. On the other hand, vegetation associated with pine rocklands in south Florida would become established in 5 years under optimal conditions and would take at least 30 years to reach maturity. An area that would have a slow recovery rate would, therefore, be a priority for active restoration. The recovery rates for vegetation categories are provided in appendix Q. It was determined that vegetation in pine rocklands and xeric oak hammocks in Florida and upland dry / mesic forests in the Caribbean parks would be a high priority for active restoration because of their slow rate of recovery, and they provide unique habitat for native plants and animals. In appendixes A – I, table 1 shows the number of acres that would be actively and passively restored under alternative C for each park.

Treated areas that are in, or close to, high visitor-use areas or along roads and, therefore, highly visible to the public, would also be an area of priority for active restoration. Quicker re-establishment of native vegetation in these areas would reduce the effect that treatment would have on visitor appreciation of the parks. It was determined that treated areas within 300 feet of a road or visitor-use area would be a priority for active restoration.

The same consideration was applied to treatment areas that are in locations of sensitive resources, such as habitat for native sensitive species or cultural sites. It is a high priority in all parks to preserve and protect cultural resources. Sites within parks that are threatened by the presence of exotic plants or would be exposed by exotic plant removal would become a high priority for active restoration. For example, within Canaveral National Seashore, two archeological sites would be a high priority for restoration. Castle Windy, a 1-acre area infested with Brazilian pepper and kalanchoe, would be reseeded to avoid leaving the midden exposed. Turtle Mound, encompassing about 4 acres infested with mostly Brazilian pepper, would also benefit from active restoration. Depending on available funding, a second priority would be Brazilian pepper infestation along the roadways into the park on the south end to maintain the scenic vista. The road running north and south along the two beaches, an estimated 17 to 18 miles, would also be a priority to preserve fragile dune habitat (Hamilton 2004).

It would also be a higher priority to restore sensitive species habitats faster when taking into consideration the amount of native habitat available in the park or regionally and the level of benefit to the particular sensitive species. The red-cockaded woodpecker, Everglade snail kite, Florida scrub jay, and Cape Sable seaside sparrow habitat in the parks would be high-priority areas for active restoration.

Finally, parks would set priorities for areas for active restoration based on the amount of funding that would be required to accomplish the restoration. Funding is directly related to site accessibility, because more funding would be needed to restore areas that are difficult to access. In large part, this is because of the logistical difficulties of moving equipment and to the number of man-hours it may take to accomplish restoration in remote areas. Areas that would be a priority for active restoration were defined by combining the estimated funding requirements for restoration with the information layers for each park (see table 2 in appendixes A – I).

Active site restoration would be accomplished using plants that are of native, local, genetic stock, with the objective of achieving the desired future condition associated with a vegetation category at a quicker rate than would occur through passive restoration (which would occur under alternatives A and B). Some native plant varieties used in restoration could be obtained through local or state nurseries, or nurseries could be contracted to grow plants directly from park plant stock. Restoration could be accomplished using native seeds, planting plants at various growth stages (such as seedlings or trees), and by more extreme measures, such as soil removal to change the water level of an area and to remove the exotic seed bank. (See appendix Q for a detailed description of the method of restoration that would be most appropriate for a given vegetation category or specific plant varieties within a category.) Table 17 provides the total acreage within seven of the nine parks that would be actively restored.

TABLE 17: NUMBER OF ACRES IDENTIFIED FOR ACTIVE RESTORATION UNDER ALTERNATIVE C

Site	Potential acres for active restoration (acres)
Big Cypress National Preserve	30,508
Biscayne National Park	21
Buck Island Reef National Monument	55
Canaveral National Seashore	304
Everglades National Park	13,516
Salt River Bay National Historic Park and Ecological Preserve	340
Virgin Islands National Park	2,045

Note: Dry Tortugas National Park and Christiansted National Historic Site have been initially treated and are currently being re-treated under an optimum treatment schedule. Because of the small size of the infestation that remains within the parks, active restoration is not proposed.

ACTIVE RESTORATION METHODS

Active restoration of sites would entail one method, or a combination of methods to facilitate the recovery of native plant species. Active restoration could involve soil or site amendments, seeding sites with native seed sources, planting with native plant species, or system-level alteration. Baseline conditions of the area would be determined prior to any restoration activity. This would help managers determine what restoration method would be most appropriate. For example, soils would be sampled to determine the capacity of the soils as a medium for growing native plants. Based on this analysis, the parks would determine the adequacy of soils and possible ways to improve soil conditions, such as nitrogen metabolism, nutrient cycling, and organic matter accumulation with respect to levels for these parameters.

Amendments

Amendments—Any additions to soils that would result in a better medium for plants to grow.

Amendments would be used to prepare safe sites within treatment areas for subsequent colonization by desirable species from native seed sources in adjacent areas. Amendments are any additions to soils that would result in a better medium for plants to grow. These amendments may include macro- or micronutrient additions (fertilizers), organic matter increases or decreases, and/or altering soil pHs. Fertilizers may be used to improve the nutrient status of the soils. Organic matter additions may include the use of mulch or wood chips, compost materials, or manure. Removing organic materials in some instances, such as in areas previously infested with Brazilian pepper or melaleuca, would help restore soils to a natural nutrient cycling by improving the level of oxygen and restoring the soil microbial community. Lime or acids may be used to alter the pH of the root-zone material (Munshower 1994).

Seeding

Seeding a treated site would be done using either a broadcast or drill seed method. Broadcast seeding is any method of seed dispersal that drops the seeds on the ground instead of placing them in the ground (Munshower 1994). Broadcast seeding would be most effective for restoring native plants in remote areas that are not easily accessible for ground crews and for large treatment areas where more seeds could be dispersed quickly. Drill seeding involves placing seeds at specified depths in the soil. Seeds are put into the ground using a drill seeder, which is a large piece of machinery that creates furrows to a predetermined depth and drops the seeds into the soil. A set of discs on the machine then pushes the dirt over the seeds. This method may be needed if conditions are dry, or foraging by birds would increase the potential for seeds being removed from the treatment area if they were spread on the ground.

Seeding would be appropriate for remote areas because it would be more practical to transport seeds than plants. Seeding would also be appropriate for large treatment areas that do not have an adjacent native seed source to colonize the area. Seeding from fast-growing plants (such as grasses, sedges, and rushes) would be used.

Planting

Planting native species would involve the use of container-grown or locally harvested, bare-root plants. Herbaceous species, such as grasses, sedges, and rushes, are available in 2-inch, 4-inch, and 1-gallon containers. Trees and shrubs are available in one-gallon containers up to just about any size needed. Harvested plants must be collected from an approved location, and permits from state agencies are usually required for this activity.

Plantings would be used to restore those species or communities that have a slower growth rate and would be more difficult to establish through passive means. In the parks, canopy species tend to have a slower growth rate. Examples of these species or communities include tropical hardwood hammock canopy species and rockland pines in Florida. In the Caribbean, lignum vitae, gumbo limbo, pigeon plum, and other trees would benefit from active restoration. Pine rocklands and tropical hardwood hammocks in Florida are also considered threatened habitats, because they provide habitat for threatened, endangered, or sensitive plant and animal species, further requiring the need to set priorities to actively restore those areas. In the Caribbean parks, plantings would also be used to stabilize slopes and prevent soil movements into marine environments.

Coastal dune plants also tend to be slow growing, because the harsh conditions along the shore make it difficult for seeds to germinate and establish. Establishing appropriate native plants in this environment would increase potential for successful restoration of the community. In coastal areas of Salt River Bay National Historic Park and Ecological Preserve, for example, dunes that contain important cultural resources could be targeted for active restoration with native species to prevent damage to the cultural resources from exposure to soil and wind erosion and the unauthorized collection of artifacts. Dune areas in Canaveral National Seashore could be targeted for active restoration through planting native species to maintain these areas that support the barrier islands and provide important habitat for several threatened and endangered species.

Active planting of treated sites would be most appropriate in highly visible areas and in areas that can be easily accessed. Faster re-establishment of native vegetation in highly visible areas (such as around campgrounds, along roadways, or visitor-use centers) would improve the aesthetics of the area and would improve visitor appreciation of the parks' native vegetation categories.

Physical Site Alteration

Physical site alterations would involve the removal or addition of soils or hydrologic alterations in treatment areas. These methods would tend to involve the use of heavy construction machinery to alter the physical structure of the site.

Removing soil through shallow surface grading would be the most effective method to remove exotic plant seeds. In this instance, clean soils could then be added and native plants either allowed to recolonize naturally, or additional replanting or seeding could occur. Soils could also be added to treated areas to re-establish tropical hardwood hammocks in the Florida parks that traditionally existed in areas of slightly increased elevations. In Everglades National Park and Big Cypress National Preserve, altering the hydrologic condition of a treated area could also be used to inhibit the re-establishment and growth of exotic plants. This is similar to what was done for the Hole-in-the-Donut project currently taking place in Everglades National Park. Hydrologic alterations of an area could be accomplished by changing the elevation of the area through soil removal.

These physical site alterations would be most appropriate in disturbed areas or in areas where a large exotic plant seed bank exists and the restoration of native species would be very slow and not guaranteed. Along the eastern boundary of Everglades National Park, for example, the soils in abandoned agricultural or developed areas are prone to exotic plant invasion, and research has shown that the only effective way to restore native vegetation is by removing the disturbed soils and improving the hydrologic condition.

DESIRED FUTURE CONDITIONS

Desired future conditions are those target conditions that would indicate that vegetation category restoration has been successfully achieved following treatment and removal of exotic plants and active restoration of native plant species. Under alternative C for all vegetation categories, restoration would be achieved when the following conditions are present:

- There is a stable native vegetation category that supports a relative dominance (85%) of the native species.
- Natural succession is occurring in a manner that indicates the long-term success of the restoration project.
- Invasive exotic species compose less than 5% of the vegetative cover in the treated area for 1 full year of exotic species monitoring, without human intervention or treatment.
- In sites that have been actively restored, 85% of the planted species have survived for 1 year, without human intervention.

Table 18 provides a summary of the time frame to achieve desired future conditions of a stable native vegetation category in treated areas by using a passive and active restoration approach. A detailed description of the desired future conditions, including the time frame for restoration of each community type and the list of species that would be dominant in that particular community, are presented for each broad vegetation category included in appendix Q.

PROPOSED MITIGATION MEASURES

The mitigation measures identified under alternative B would also be implemented under alternative C. In addition, mitigation measures and best management practices have been identified for activities involving active restoration.

Table 19 describes the additional mitigation measures for park resources that would apply to alternative C.

WILDERNESS AND MINIMUM REQUIREMENTS ANALYSIS (MINIMUM TOOL)

Wilderness and minimum tool analysis for treatment of exotic plants in Everglades National Park would be the same as that described under alternative A.

PROPOSED MONITORING AND DATA COLLECTION

Monitoring related to active restoration in the parks would be similar to the monitoring described under alternative B, in that it would include implementation monitoring, effectiveness monitoring, and monitoring of the affected environment. Table 20 describes the three monitoring approaches that would be implemented in areas of active restoration, in addition to the monitoring associated with exotic plant species control methods and passive restoration, for alternative B. Each of the criterion listed in the table would be monitored annually, or when re-treatment activities are occurring. The monitoring information would be entered into a database to facilitate organization of, and easy access to, the information. Data recorded would include active restoration location, date of initial activity, method of restoration, native species planted, and the physical condition of the site.

ADAPTIVE MANAGEMENT

The steps listed in alternative B for exotic plant control would be followed in alternative C when applying an adaptive management approach for treatment. In addition, an adaptive management approach would be applied, as well, to the active restoration component of alternative C.

TABLE 18: TIME FRAME FOR ACHIEVING DESIRED FUTURE CONDITIONS THROUGH PASSIVE AND ACTIVE RESTORATION

Vegetation Category	Estimated Time for Achieving Desired Future Conditions* through Passive Restoration	Estimated Time For Achieving Desired Future Conditions* through Active Restoration	Most Effective Species for Planting in Active Restoration (Additional species are listed in "Appendix Q: Desired Future Conditions")	
Coastal Marsh	3 to 5 years	1 year	*Juncus roemerianus* *Salicornia virginica*	*Batis maritima* *Spartina patens*
Sawgrass Marsh / Wet Prairie / Freshwater Marsh	3 to 5 years	1 to 2 years	*Cladium jamaicense* *Eleocharis* spp. *Sagittaria lancifolia* *Thalia geniculata*	*Pontederia cordata* *Rhynchospora* spp. *Spartina bakeri* *Scirpus* spp.
Mangrove	5 to 7 years	3 to 5 years	*Rhizophora mangle* *Laguncularia racemosa*	*Avicennia germinans* *Conocarpus erectus*
Grassland / Coastal Strand	3 to 5 years	1 to 3 years	*Uniola paniculata* *Ipomea pes-caprae* *Helianthus debilis*	*Muhlenbergia capillaris* *Paspalum distichum* *Remirea maritima*
Shrubland	10 to 15 years	5 to 7 years	*Malphigia woodburyana* *Melocactus intortus* *Zanthoxylum thomasianum* *Erithalis fruticosa* *Jacquinea arborea*	*Hippomane mancinells* *Piptocoma antillana* *Pilocereus royenii* *Byrsonima lucida* *Bursera simaruba*
Wetland Forest Cypress swamps	7 to 12 years	5 to 7 years	*Taxodium distichum* *Gordonia lasianthus* *Magnolia virginiana*	*Cephalanthus occidentalis* *Itea virginica* *Psychotria sulzneri*
Wetland Forest Hardwood swamps	7 to 12 years	5 to 7 years	*Acer rubrum* *Gordonia lasianthus* *Magnolia virginiana*	*Itea virginica* *Psychotria sulzneri* *Myrica cerifera*
Upland Dry / Mesic Forest Pine Rocklands	7 to 12 years	5 to 7 years	*Coccoloba diversifolia* *Citharexylum fruticosum* *Chrysophyllum oliviforme* *Tetrazygia bicolor*	*Bursera simaruba* *Eugenia axillaris* *Randia aculeata* *Rapanea punctata*
Upland Dry / Mesic Forest Pine Flatwoods	7 to 12 years	5 to 7 years	*Pinus elliottii* *Persea borbonia* *Quercus laurifolia* *Myrica cerifera*	*Ilex glabra* *Lyonia fruticosa* *Lyonia lucida* *Sabal palmetto*

Table 18: Time Frame for Achieving Desired Future Conditions through Passive and Active Restoration (continued)

Vegetation Category	Estimated Time for Achieving Desired Future Conditions* through Passive Restoration	Estimated Time For Achieving Desired Future Conditions* through Active Restoration	Most Effective Species for Planting in Active Restoration (Additional species are listed in "Appendix Q: Desired Future Conditions")	
Upland Dry / Mesic Forest Mesic tropical Forest	7 to 12 years	5 to 7 years	*Buchenavia capitata* *Bucida buceras* *Ceiba pentandra* *Inga fagifolia* *Eugenia procera*	*Miconia laevigata* *Mammea americana* *Spondias mombin* *Sapium laurocerasus* *Exotheca paniculata*
Upland Dry / Mesic Forest Dry Tropical Forest	7 to 12 years	5 to 7 years	*Pisonia subcordata* *Plumeria alba* *Swietenia mahogoni* *Zanthoxyllum martinicense*	*Bursera simaruba* *Coccoloba diversifolia* *Citharexylum fruticosum* *Bourreria cassinifolia*
Upland Dry / Mesic Forest Tropical Hardwood Hammock	7 to 12 years	5 to 7 years	*Sideroxylon salicifolium* *Simarouba glauca* *Chrysophyllum oliviforme* *Swietenia mahogoni* *Eugenia foetida*	*Guaiacum sanctum* *Ilex krugiana* *Bourreria succulenta* *Calyptranthes pallens* *Capparis cynophallophora*
Upland Dry / Mesic Forest Xeric Oak Scrub	7 to 12 years	5 to 7 years	*Quercus virginiana* *Bourreria cassinifolia* *Quercus chapmanii*	*Quercus myrtifolia* *Quercus geminata* *Serenoa repens*
Upland Dry / Mesic Forest Subtropical Hardwood Hammock	7 to 12 years	5 to 7 years	*Celtis laevigata* *Juniperus silicicola* *Magnolia grandiflora* *Persea borbonia* *Quercus laurifolia*	*Ardisia escallonoides* *Eugenia axillaris* *Myrcianthes fragrans* *Sabal palmetto* *Quercus virginiana*

* Desired future conditions are defined as the time that native vegetation categories are stable within treated areas. A more detailed description of the desired future condition for each vegetation category can be found in appendix Q.

TABLE 19: MITIGATION MEASURES AND BEST MANAGEMENT PRACTICES UNDER ALTERNATIVE C

Native Plants / Vegetation Categories

- Areas of ground disturbance resulting from exotic plant treatment activities would be revegetated with an appropriate native plant seed mix, as necessary. No seeding of exotic plant materials would be permitted.

Soils

- To reduce erosion from surface disturbance, the park or contractor would be required to implement storm water pollution -prevention plan (SWPPP) measures prior to, during, and following ground-disturbing activities.
- Soils contaminated with exotic plant seeds or reproductive vegetative material would be fully contained at the project site until removed for proper disposal at a previously determined landfill or other suitable waste management location.
- If imported soil is required to provide substrate for new vegetation, it would be obtained from an NPS-approved source and certified weed-free.

Water Quality and Hydrology

- The project contractor would be responsible for installation and maintenance of all erosion and sediment control measures and the quality and quantity of offsite discharges during excavation. Excavation, topsoil storage, and revegetation operations would be carried out in such a manner that erosion and water pollution would be minimized. All applicable federal, state, territorial, and local laws would be complied with at all times.
- The contractor would be responsible for ensuring that turbidity levels downstream are not increased, and the project site is protected from erosion.
- Prior to beginning ground-disturbing activities for a large-scale restoration effort, the contractor would provide a SWPPP in accordance with the proposed sequence of operations and consistent with National Pollution Discharge Elimination System criteria. Prior to submittal to the NPS and appropriate state or territorial governing agency, the contractor would obtain written approval from an engineer. A notice to proceed would not be granted until a SWPPP is approved.
- For each phase of project implementation, the contractor would install erosion-control measures after performing clearing and grubbing necessary for installation of erosion-control measures but before beginning other work for the restoration phase.
- The contractor would not remove erosion-control measures until all upstream areas are permanently stabilized in accordance with the plans and specifications.
- Structural measures for erosion control would be in place before disturbing soil upstream of the control measures. Structural measures must include at least the following, unless otherwise approved by the engineer: silt fencing, inlet protection, sediment basins, and storm water ponds.
- Stockpiles of excavated topsoil and materials would be enclosed at the perimeter of the stockpile area, with silt fencing in accordance with appropriate state and territorial standards.

Wildlife and Special Status Species

- Active restoration activities would be timed to avoid sensitive seasons for wildlife and would be coordinated to avoid sensitive wildlife areas or nesting sites.

Air Quality

- The park or contractors would implement vehicle emissions controls, such as keeping equipment properly tuned and maintained in accordance with manufacturers' specifications, and implementing best management construction practices to avoid unnecessary emissions (e.g., engines would not idle).
- In order to reduce the generation of dust, loose, stockpiled soil would be covered, and, if necessary, watering activities would be implemented.
- Workers would be encouraged to use carpooling and other techniques to minimize the trip generation of the construction activity. Shipment of materials in full loads would also be encouraged, and heavy equipment and vehicles would be maintained to minimize pollution generation.

Visitor Use and Experience

- All construction equipment would be fitted with mufflers that are kept in proper operating condition, and, when possible, equipment would be shut off rather than allowed to idle. Standard noise-abatement measures would include a schedule that minimizes impacts to adjacent noise-sensitive areas, use of the best available noise control techniques wherever feasible, and use of hydraulically or electrically powered impact tools, when feasible.

TABLE 20: MONITORING ELEMENTS FOR ACTIVE RESTORATION SITES AND ACTIVITIES

Active Restoration Monitoring	Assessment Criteria	Purpose
Implementation	• Location, timing, and method of active restoration • Acreage of area actively restored • Condition of area at time of restorative treatment (percentage cover of exotic plant infestation, soil conditions, hydrologic conditions)	To create a record of all active restoration activities so that success or failure of particular methods, and the conditions under which restoration activities have taken place, can be assessed, and the information can be used in adaptive management design.
Effectiveness	• Effectiveness of restoration method on achieving desired future condition both in terms of native species recovery and the time frame	To determine the effectiveness of the restoration activity in reaching plan objectives.
Affected Environment	• Effects of active restoration on wildlife • Effects of active restoration on threatened or endangered species • Presence of herbicide (if applicable) in water • Persistence of herbicide (if applicable) in soil	To determine how the treatment has affected the environment; if thresholds were exceeded, this would be taken into consideration and used in adaptive management design.

Under this draft EPMP/EIS, the steps listed below would be followed when applying an adaptive management approach to active restoration of treated sites:

1. Establish baseline condition. Existing conditions would be recorded and monitored to establish a set of baseline conditions for future comparison.

2. Apply the restoration action. Areas would be actively restored using one, or a combination of, active restoration methods, such as seeding, planting, or soil removal.

3. Monitor for establishment of native species. The restoration site would be monitored to determine if the desired future conditions were being achieved. Monitoring would assess whether the restoration method was successful, in that the native plants are persisting and the rate of return of native species recruitment (determined as percent cover) was being accomplished within the defined time frame.

4. If monitoring indicates that desired future conditions were not being achieved, reconsider the restoration method. If the results of monitoring indicated that the desired future conditions were not being achieved, the NPS would evaluate the need for additional restoration actions to take place, such as re-seeding, planting additional specimens, planting a different species of plant, augmenting the soils, or changing the hydrologic condition, if appropriate.

5. If the restoration efforts worked effectively, and it would be expected that desired future conditions would be met, no change would be made to the process.

PROPOSED EDUCATION PROGRAM

An education program would be developed to increase public awareness of the impacts that exotic plants have on park resources and to build public support for management of exotic plants in the parks. In addition, materials describing the active restoration program would be produced and disseminated to the public and other agencies. The parks' exotic plant program managers would interpret the results of the latest research concerning active restoration projects and the status of the active restoration program taking place in the parks. The managers would communicate the results to resource managers, interpreters, maintenance personnel, and others.

COLLABORATION AND PARTNERSHIP

Enhanced or increased collaboration and partnership would occur, as described under alternative B. At Canaveral National Seashore, collaboration and agreement between the NPS and USFWS would need to occur prior to implementation of any site-specific, active restoration project, as USFWS is responsible for the management of natural resources within the jointly managed areas of the park.

IMPLEMENTATION OF SITE-SPECIFIC PROJECTS

Site-specific project implementation regarding determining area priority for treatment, appropriate treatment method, and site surveys and assessments for sensitive resources, would be as described in alternative B. Prior to project implementation, resource managers would determine whether or not a treated site would be actively restored. The decision tool provided above was used to define the areas in the park that meet the criteria and would be candidates for active restoration. This tool would also be used to guide this decision process in the future, if new areas of infestation are discovered. Sites could be actively restored to enhance scenic vistas and visitor experience, protect cultural resources, or to provide habitat for sensitive resources. Once it is determined by resource managers that restoration is a goal for a treated site, collaboration between exotic plant managers and other park resource specialists and other agencies, as appropriate, would occur to define how active restoration would take place and what native species would be used, based on what is appropriate for that specific site and to meet the desired future condition goal.

With regards to selecting an active restoration method in areas where sensitive species or their critical habitat is known to be present, criteria would be used to assist in selecting the restoration method. If a state- or territory-listed species is located during the site survey, the restoration approach chosen with mitigation measures must not have adverse impacts beyond a minor level. The effects of treatment may impact individuals of a species, but would not contribute to a trend toward federal listing, or cause a loss of viability to the population or species. If a federally listed species is located, or the action is to take place in critical habitat of a federally listed species, the restoration approach with mitigation measures would be required to have no greater than a minor adverse effect to the species or its habitat, which would equate to a "no effect or may affect but are not likely to adversely affect" determination, as defined by the USFWS.

A survey or assessment would also be conducted to document the presence or the potential for cultural resources within the area to be actively restored. If resources are present and would be affected by restoration actions, collaboration would occur among the exotic plant manager, cultural resource specialists, and other agencies, to determine the appropriate restoration methods and mitigation measures to minimize to the extent possible any adverse impacts to those resources.

This process would be implemented in the future if conditions have changed, such as if new infestations of exotic plants occur, either of an exotic plant known to occur in the park that has spread to new areas of the park not already identified, or, based on the monitoring program, a new exotic plant species enters the park. Park managers would determine the priority for treatment of this new infestation, and using the decision tool, determine what the appropriate restoration method would be that would allow for the restoration of native vegetation categories while reducing impacts on sensitive park resources. Park managers would also define a monitoring program that would establish indicators that would be monitored to determine whether active restoration actions were successful or if additional measures need to be taken to facilitate reaching the desired future condition goals set for the site.

DETERMINATION OF SUBSEQUENT COMPLIANCE

As described under alternative B, a decision tool would be used to confirm that the selected treatment and/or restoration method for site-specific projects complies with NEPA.

Alternative C would also involve the establishment of a programmatic consultation agreement between the parks and the USFWS, and the NMFS. In addition to the measures discussed in alternative B, these agreements under alternative C would outline specific measures to protect federally listed species from adverse impacts during active restoration activities. As in alternative B, projects that meet the no effect and not likely to adversely affect criteria set forth in this document would be covered by blanket concurrence letters issued by the USFWS and NMFS and would not require further consultation.

A programmatic memorandum of agreement would be also be developed among the parks, and others, as appropriate, including tribal historic preservation officers, the state historic preservation officers of Florida and Virgin Islands National Park, and the Advisory Council on Historic Preservation. In addition to the stipulations and provisions outlined in alternative B, the agreement under alternative C would outline specific measures to protect National Register-eligible properties that would potentially be affected by future active restoration projects.

COST OF IMPLEMENTATION

The cost of exotic plant management for treatment and monitoring treated sites was calculated in a similar manner as alternative B. As in alternative B, this alternative assumed that re-treatment of sites would cost approximately 50% less than the cost of the previous treatment; under an optimal re-treatment schedule it is expected that the number of stems to be treated would be 50% less than treated previously. The cost was therefore a summation of the initial treatment and re-treatment that would occur every 6 months over a 10-year period. The area of infestation under alternative C that would be re-treated is less than described under alternative B, as it was assumed for analysis purposes that only those areas that have not been subject to active restoration would be re-treated. Under alternative C, parks would incur a cost to actively restore sites within treated areas. The cost of active restoration varies widely, depending on the method of restoration. The cost of replanting sites could range from $8,000 per acre to replant areas of sawgrass, to over $25,000 for other vegetation categories, because the cost for individual trees or shrubs can range up to $8 per plant.

The cost for active restoration that involves large-scale physical site alteration could also range up to $8,000 per acre (Norland 2004). Because there is such a wide range of possible costs, and it is likely that a combination of active restoration methods may be employed under this alternative, the cost of actively restoring an acre of land was estimated to be $10,000. Alternative C would include the construction of a central nursery in which appropriate native plant species would be propagated. The nursery would serve the active restoration needs for all of the parks. The capital cost for the nursery would be between $150,000 and $200,000. The cost of implementation of alternative C over the next 10 years for each park is provided in table 21.

TABLE 21: TOTAL COSTS OF ALTERNATIVE C OVER THE 10-YEAR LIFE OF THE PLAN

Big Cypress National Preserve	
Initial infestation to be treated	155,445 acres
Infestation to be re-treated	124,937 acres
Treatment at $136 per acre	$38,131,936
Treatment at $224 per acre	$63,085,923
Monitoring	$5,719,790 to $9,462,888
Restoration	$305,080,000
Total	$348,931,726 to $377,628,812
Biscayne National Park	
Initial infestation to be treated	162 acres
Infestation to be re-treated	141 acres
Treatment at $136 per acre	$41,208
Treatment at $224 per acre	$68,175
Monitoring	$6,181 to $10,226
Restoration	$210,000
Total	$257,389 to $288,401

TABLE 21: TOTAL COSTS OF ALTERNATIVE C OVER THE 10-YEAR LIFE OF THE PLAN (CONTINUED)

Buck Island Reef National Monument	
Initial infestation to be treated	75 acres
Infestation to be re-treated	20 acres
Treatment at $160 per acre	$15,200
Treatment at $829 per acre	$78,755
Monitoring	$2,280 to $11,813
Restoration	$550,000
Total	$567,480 to $640,568
Canaveral National Seashore	
Initial infestation to be treated	3,273 acres
Infestation to be re-treated	2,969 acres
Treatment at $136 per acre	$848,912
Treatment at $224 per acre	$1,404,449
Monitoring	$127,337 to $210,667
Restoration	$3,040,000
Total	$4,016,248 to $4,655,117
Christiansted National Historic Site*	
Initial infestation to be treated	1 acre
Infestation to be re-treated (acres)	1 acre
Treatment at $160 per acre	$160
Treatment at $829 per acre	$829
Monitoring	$24 to $124
Restoration	–
Total	$184 to $953
Dry Tortugas National Park*	
Initial infestation to be treated	1 acre
Infestation to be re-treated	1 acre
Treatment at $3,000 initial	$6,000
Treatment at $4,000 initial	$8,000
Monitoring	$900 to $1,200
Restoration	–
Total	$6,900 to $9,000
Everglades National Park	
Initial infestation to be treated	177,603 acres
Infestation to be re-treated	164,087 acres
Treatment at $136 per acre	$46,469,819
Treatment at $224 per acre	$76,880,215
Monitoring	$6,970,473 to $11,532,032
Restoration	$135,160,000
Total	$188,600,292 to $223,572,247

TABLE 21: TOTAL COSTS OF ALTERNATIVE C OVER THE 10-YEAR LIFE OF THE PLAN (CONTINUED)

Salt River Bay National Historic Park and Ecological Preserve	
Initial infestation to be treated	389 acres
Infestation to be re-treated	47 acres
Treatment at $160 per acre	$69,733
Treatment at $829 per acre	$361,303
Monitoring	$10,460 to $54,195
Restoration	$3,421,700
Total	$3,501,893 to $3,837,198
Virgin Islands National Park	
Initial infestation to be treated	2,846 acres
Infestation to be re-treated	801 acres
Treatment at $160 per acre	$583,520
Treatment at $829 per acre	$3,023,362
Monitoring	$87,528 to $453,504
Restoration	$20,450,000
Total	$21,121,048 to $23,926,867

Note: Dry Tortugas National Park and Christiansted National Historic Site have been initially treated and are being re-treated under an optimum treatment schedule. Because of the small size of the infestation that remains within the parks, active restoration is not proposed and the acres initially treated and re-treated under this alternative are the same.

HOW ALTERNATIVES MEET OBJECTIVES

As stated in the "Purpose of and Need for Action" chapter, all action alternatives selected for analysis must meet all objectives to a large degree. The action alternatives must also address the stated purpose of taking action and resolve the need for action. Therefore, the alternatives, and the effects they would have on native plants and other park resources in the study area, were individually assessed in light of how well they would meet the objectives for this draft EPMP/EIS. Alternatives that did not meet the objectives of the draft EPMP/EIS were rejected as inappropriate (see the "Alternatives Eliminated from Further Consideration" section in this chapter). The objectives of this draft EPMP/EIS were organized into six categories, as follows:

PRESENCE OF EXOTIC PLANTS

- Establish priorities for exotic plants to be treated and treatment locations in parks.
- Reduce the number of targeted exotic plants to minimize the threat to natural resources (native habitat, plants, and wildlife).
- Reduce, to the greatest extent possible, the introduction and establishment of new exotic plants into parks.
- Ensure that park exotic plant management programs support, and are consistent with, south Florida ecosystem restoration goals.

CULTURAL RESOURCES

- Reconcile potential conflicts between preservation of significant cultural landscapes and removal of exotic plants.
- Preserve plants and sites valued by Native Americans and other traditional cultures, while reducing the spread of exotic plant species.
- Protect archeological and historic resources, while reducing the spread of exotic plant species.

OPERATIONS TO CONTROL EXOTIC PLANTS

- Conduct the exotic plant management plan so it is (1) continually monitored and improved, (2) environmentally safe, (3) incorporates best management practices, and (4) supports, and is supported by, science and research.
- Minimize unintended impacts of control measures on park resources, visitors, employees, and the public.
- Use federal resources with increased efficiency.

- Ensure that control measures are consistent with the *Wilderness Act* and *NPS Wilderness Policy*.

VISITORS AND THE PUBLIC

Increase visitor and public awareness of the impacts exotic plants have on native habitat and species and on cultural resources, building support for NPS management efforts.

GOVERNMENT PARTNERS / NEIGHBORING COMMUNITIES

Coordinate efforts with partners and neighbors (nationally and internationally) to establish compatible goals and provide assistance to achieve them.

RESTORATION

Restore and protect native vegetation categories in ways that allow natural processes, function, cycles, and biota to be re-established and maintained in perpetuity.

SUMMARY

Table 22 summarizes the elements of the alternatives being considered. Table 23 compares how each of the alternatives described in this chapter would meet the objectives for this draft EPMP/EIS. The "Environmental Consequences" chapter describes the effects on each impact topic under each of the alternatives, including the impact on recreational values and visitor experience. These impacts are summarized in table 24. (Tables 22, 23, and 24 are located at the end of this chapter.)

ALTERNATIVES ELIMINATED FROM FURTHER CONSIDERATIONS

Several actions suggested by the public were not incorporated into this draft EPMP/EIS. Consistent with Section 1502.14 of the CEQ regulations for implementing NEPA, this section identifies those actions and explains why they were eliminated from further consideration.

As described in the "Consultation and Coordination" chapter, the identification of issues and development of alternatives provided opportunities for public and partner input through responses to newsletters, at public meetings, and via the Internet. However, not all actions suggested by the public and partners are included in this draft EPMP/EIS. Actions or alternatives were eliminated from further consideration because they:

- were not feasible.

- are already prescribed by law, regulation, or policy.

- would be in violation of laws, regulations, or policies.
- would be more appropriately addressed in lower-tier park plans, such as implementation plans.

This section describes two alternatives that were eliminated from further consideration and the basis for excluding them from analysis in this draft EPMP/EIS.

No Treatment of Exotic Plants. Some members of the public suggested discontinuing the current management of exotic plants should be considered as an alternative in this planning effort. This alternative was not considered for further evaluation, because it would not meet the purpose and need for the plan or the objectives. It is also inconsistent with NPS policy and plans that mandate the exotic plants and their effects on park resources be managed, and it violates executive orders.

No Application of Herbicide. Members of the public also suggested that the plan consider an alternative that would not involve the use of herbicides. This alternative was eliminated from further consideration, because only using mechanical, biological, or physical means to treat exotic plants would not be efficient, and in some instances, would not be feasible for treating exotic plants in remote locations. If parks were unable to apply herbicides in remote locations where access is limited and transporting crews and equipment would be costly, areas of the parks, such as in Everglades National Park, would go untreated. This would result in the expansion of exotic plant infestations into other areas of the parks, thus furthering impacts to native park resources. It was therefore determined that this alternative would also not meet the purpose and objectives of the plan. In addition, the incorporation of the "optimum tool" approach into the action alternatives should relieve concerns expressed by the public about the use of herbicides or the application of more herbicides than necessary. This tool allows exotic plant managers to use the least disruptive, but effective, treatment method (or methods) to accomplish management objectives, while causing the least impact to other park resources or to the public.

CONSISTENCY WITH SECTIONS 101(B) AND 102(1) OF THE NATIONAL ENVIRONMENTAL POLICY ACT

The NPS requirements for implementing NEPA include an analysis of how each alternative meets or achieves the purposes of NEPA, as stated in Sections 101(b) and 102(1). Each alternative analyzed in a NEPA document must be assessed as to how it meets the following criteria:

1. Fulfill the responsibilities of each generation as the trustee of the environment for succeeding generations.

2. Ensure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings.

3. Attain the widest range of beneficial uses of the environment, without degradation, risk of health or safety, or other undesirable and unintended consequences.

4. Preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment that supports diversity and variety of individual choice.

5. Achieve a balance between population and resource use that would permit high standards of living and a wide sharing of life's amenities.

6. Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

Council on Environmental Quality Regulation 1500.2 establishes policy for federal agencies' implementation of NEPA. Federal agencies shall, to the fullest extent possible, interpret and administer the policies, regulations, and public laws of the United States in accordance with the policies set forth in NEPA (Sections 101(b) and 102(1)). Therefore, other acts and NPS policies are referenced as applicable in the following discussion. In addition, NPS *Management Policies 2001* addresses the application of NEPA to wilderness planning (NPS 2001e, 6.3.4.3).

Alternative A (Continue Current Management) partially meets these criteria. Under alternative A, exotic plant management would continue to occur, and this provides protection for native plant species and other natural and cultural resources that are adversely affected by these plants. Under this alternative, the NPS is fulfilling, to some degree, the responsibility as trustee of the environment for future generations and is providing protection of the parks natural and cultural resources. In addition, the treatment of exotic plants that are known allergens or create hazardous environmental conditions, such as melaleuca, which would continue to be controlled under this alternative, would also enhance public health and safety, as described in the "Public Health and Safety" section of the "Environmental Consequences" chapter.

Although the treatment of exotic plants would occur under this alternative, it would not be conducted at optimal frequency. Thus, some infestations within the parks may be controlled, whereas other infestations would continue to spread or rebound after treatment to pretreatment levels and, consequently, adversely affecting park resources. This alternative also does not provide a framework for setting priorities for areas within the parks that would provide the greatest benefit to natural and cultural resources, as well as to enhancing the visual quality of the parks for visitors. As such, areas with sensitive resources would continue to be adversely affected by exotic plants, to varying degrees, as identified in the "Environmental Consequences" chapter.

This alternative also does not provide a means for monitoring and identifying effects of treatment actions on park resources, so that undesirable effects on nontarget resources may continue to occur. In addition, this alternative would not attain the widest benefits without an increased risk to the environment and to health and safety over the long-term. Under this alternative, because exotic plant infestations are not being controlled to the greatest extent, there would continue to be a high level of treatment occurring within the parks and, as such, treatment intensities and the amount of herbicides that would be applied over the life of the plan, would remain at higher levels when compared to other alternatives. Although with mitigation and appropriate applications of herbicides according to labels and regulations, the risk to the environment is minimized from treatment actions, there would be a higher use of chemicals and a need to use more intensive treatment methods over a longer time period than other alternatives.

Alternative B (New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation) provides a structured plan for the treatment of exotic plants that would meet the purposes of the above criteria to a large degree. This alternative would result in the treatment of exotic plants under an optimal schedule, thereby allowing park managers to reduce exotic plants to a maintenance level within a 5- to 10-year period. The rapid reduction of exotic plants that would occur under this alternative would allow for the passive restoration of native vegetation within the parks, which would ensure an increased diversity of native habitats and wildlife to be enjoyed by many generations.

By using a priority setting system for determination of what areas of infestation to treat and application of a decision tool that determines appropriate treatment methods, given the environmental setting and conditions, this alternative provides a high level of protection to park resources. Under this alternative, the use of a framework designed specifically for the protection of sensitive resources within the parks, ensures that these resources are preserved and maintained to a high degree over time. In addition, areas of high visitor use would become a priority for exotic plant treatment. Treatment of exotic species and the restoration of native vegetation would enhance esthetics in these areas, improving the quality of the visitor experience. As under alternative A, the control of exotic plants that are known allergens or create hazardous environmental conditions, such as melaleuca, would also enhance public health and safety, and this would be better ensured under alternative B, as control of exotic plants within the park would be achieved within the life of the plan.

As in alternative A, this alternative would employ the use of mechanical, chemical, and prescribed fire treatment methods that would be intensively used, particularly in the early phase of the plan that presents short-term risks to the environment and to health and safety. Under this alternative, there would be more personnel needed in the field to treat exotic plant infestation and to monitor treatment success and effects. Having more personnel in the field increases the potential risk worker health and safety. However with implementation of mitigation measures and BMPs, the risks to the environment and to workers are minimized to negligible to minor. Over time, treatments would become less intensive as the level of infestation is dramatically decreased, which would reduce dramatically the amount of herbicide needed and the number of personnel to perform treatments. Thus, the risk to workers and the environment would be further reduced and would eventually be lower than the risks present under alternative A. The implementation of a monitoring program and an adaptive management plan would also ensure the protection of non-target resources from any unintended consequences of treatment activities and would ensure that the most effective method for treating exotic plants is used to achieve native vegetation restoration to the fullest extent.

Prescribed fire at Everglades National Park

Alternative C (New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants) provides a structured plan for the treatment of exotic plants, as well as a framework for actively restoring infested areas within the parks that would meet the purposes of the criteria to the greatest degree. Similar to alternative B, this alternative would result in a reduction of exotic plant infestation within the parks to a maintenance level within 5 to 10 years and would implement a decision framework to determine priority areas for treatment, and the appropriate treatment methods, to achieve and ensure the highest level of protection of natural, cultural, and visitor resources within the parks. Rapid reduction of exotic plant infestations to a maintenance level also reduces the potential for adverse effects on public health and safety due to the presence of these plants.

Alternative C also implements a decision framework for determining appropriate areas for active restoration that would allow for a faster recovery of native vegetation to provide the greatest degree of benefit to sensitive natural and cultural resources, as well as improving the visual landscape resulting in more esthetically pleasing surroundings. Short-term consequences may result during implementation of restoration activities. However, the potential for complete recovery of native systems, which may otherwise not occur due to a lack of adjacent seed source or the naturally slow recovery rate, would provide major level benefits.

As in alternatives A and B, this alternative would employ the use of chemical, mechanical, and prescribed fire treatment methods which would be intensively used particularly in the early phase of the plan that presents short-term risks to the environment and to health and safety. As under alternative B, by having more personnel in the field to implement alternative elements, there is an increased risk to worker health and safety. However, with implementation of mitigation measures and BMPs, the risks are minimal. Over time, treatments would become less intensive, as the level of infestation is dramatically decreased, as well as the amount of herbicide needed to treat infestations.

Because areas within the parks have been identified for active restoration, which would help to prevent establishment of exotic plants, the amount of herbicide that potentially would be used under this alternative, is slightly less than that proposed for alternative B, which further reduces the potential for undesirable and unintended consequences. The implementation of a monitoring program and an adaptive management plan would also ensure the protection of nontarget resources from any unintended consequences of treatment or restoration activities, and would ensure that the most effective method for exotic plant treatment and restoration is used to the fullest extent to achieve recovery of native habitats.

ENVIRONMENTALLY PREFERRED ALTERNATIVE

The NPS is required to identify the environmentally preferred alternative in its NEPA documents for public review and comment. The NPS, in accordance with the DOI policies contained in the Department Manual (516 DM 4.10) and the Council on Environmental Quality's Forty Questions, defines the environmentally preferred alternative (or alternatives) as the alternative that best promotes the national environmental policy expressed in NEPA (Section 101(b)) (516 DM 4.10). The Council on Environmental Quality's Forty Questions (Q6a), further clarifies the identification of the environmentally preferred alternative, stating, "simply put, this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources." Alternative C best protects the biological and physical environment by effectively and rapidly reducing the level of exotic plant infestation, reducing the level of threat to nontarget resources during plan implementation, and restoring, to the greatest extent, the native vegetation community.

TABLE 22: ALTERNATIVES ELEMENTS SUMMARY

Element	Alternative A — Continue Current Management	Alternative B — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation	Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants (Preferred Alternative)
Wilderness and Minimum Requirements Analysis (Minimum Tool)	Exotic plant control involving mechanized equipment would take place within designated wilderness in Everglades National Park. A minimum tool analysis would be conducted prior to implementation of each project or year's program per the NPS Wilderness Policy.	Exotic plant control involving mechanized equipment would take place within designated wilderness in Everglades National Park. A minimum tool analysis would be conducted prior to implementation of each project or year's program per the NPS Wilderness Policy.	Exotic plant control and restoration activities involving mechanized equipment would take place within designated wilderness in Everglades National Park. A minimum tool analysis would be conducted prior to implementation of each project or year's program per the NPS Wilderness Policy.
Adaptive Management	No standard adaptive management program is in place for exotic plant control. Park staff have altered treatment methods when it was determined that treatment success was low or non-target species damage was occurring.	Establish a standard adaptive management program for controlling exotic plants. Adaptive management would be used to guide exotic plant control activities, while drawing on the best available science, emergent technologies, and an increasing database on the effectiveness of treatment methods and the effects of exotic plant treatment on park resources.	Establish a standard adaptive management program for controlling exotic plants and restoring native vegetation. Adaptive management would be used to guide exotic plant control and restoration activities, while drawing on the best available science, emergent technologies, and an increasing database on the effectiveness of treatment and restoration methods and the effects of exotic plant treatment and restoration efforts on park resources.
Determination of Subsequent Compliance	Currently, each park unit determines the appropriate level of compliance based on inter-disciplinary team evaluation and through use of an environmental screening form.	Develop a standard compliance determination pathway and environmental screening form specific to control of exotic plants.	Same as alternative B.
General Concept			
Exotic Plant Management Program	Under this alternative, the parks would continue to manage exotic plants using a variety of physical, mechanical, chemical, and biological methods. Currently, much of what drives decisions for treatment is available funds, focusing on periodic treatment to remove exotic plants and then returning to re-treat (maintain) a site so that exotic plants are controlled. There currently is no formal program to treat exotic plants in Christiansted National Historic Site, Salt River Bay National Historic Park and Ecological Preserve, or Virgin Islands National Park. However, those parks would follow the direction of the EPMT.	Under alternative B, staff would continue to treat areas of the park infested with exotic plant species that have not been previously treated. Those areas that have been treated for exotic plants in the past would be monitored for the effectiveness of the control method on reducing exotic plant density and distribution and for the rate of return of native species into the area. Re-treatment of sites would occur as needed. The program would also enhance cooperation with other agencies to control exotic plants in areas adjacent to the park and to enhance education programs to improve the public's understanding of the impacts exotic plants have on native communities.	Under alternative C, the parks would continue to treat areas of the park infested with exotic plant species. Those areas that have been treated for exotic plants in the past would be re-treated and maintained to control the reoccurrence of exotic plant species. The monument would also continue to survey the island for new infestations. Staff would monitor the effectiveness of the control methods for reducing exotic plant density and distribution, the rate of return of native species into the area, and the success of replanting activities. In addition, the new program would enhance cooperation with

TABLE 22: ALTERNATIVES ELEMENTS SUMMARY (CONTINUED)

Element	Alternative A — Continue Current Management	Alternative B — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation	Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants (Preferred Alternative)
General Concept (continued)			
Exotic Plant Management Program (continued)			other agencies to control exotic plants in areas adjacent to park and to increase education programs to improve the public's understanding of the impacts that exotic plants have on native communities.
Management Framework	Currently parks do not have a standard management framework for prioritizing exotic plant treatment projects. Projects tend to be prioritized by the likelihood of the parks to procure additional outside funding. Under alternative A, the parks that receive funding through the EPMT would apply the EPMT priority setting protocol with the following criteria: The targeted exotic species for control are recognized as having a high invasive potential. Exotic plant species that have current technologies already established for their control are also ranked as high priority for treatment. The control project would benefit specific threatened or endangered species that inhabit the area or site. The site has a relatively high restoration potential. Opportunities for public involvement, and Park commitment to follow-up monitoring and treatment exist. Cooperative cost-sharing matching funds are available. This applies only to projects in Florida parks.	Under alternative B, treatment areas would be prioritized using a new framework to enhance protection of park resources. The following criteria were used to determine treatment priorities for existing and new areas of infestation: The control of exotic plants would benefit specific threatened or endangered species that inhabit the area or site and would also benefit other sensitive resources, such as cultural resources. The control of exotic plants would benefit park visitors or improve the quality of the visitor experience and appreciation of park resources. The site is easily accessible. This treatment prioritization, together with knowledge of which treatment method is most effective in achieving treatment objectives with the least impact to other resources, would guide the site-specific implementation of exotic plant control projects.	Same as alternative B.

TABLE 22: ALTERNATIVES ELEMENTS SUMMARY (CONTINUED)

Element	Alternative A — Continue Current Management	Alternative B — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation	Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants (Preferred Alternative)
General Concept (continued)			
Determination of treatment methods	Treatment methods are determined based on the following criteria: Location and accessibility of the site, Whether or not the site is a cultural landscape, and Whether or not the site is within a research natural area or area containing sensitive natural resources. The following criteria are also used Site conditions, Density of the infestation, or Type of species.	Treatment methods are determined based on the same criteria as identified in alternative A. A decision tool would be used to determine the appropriate initial and follow-up treatment methods given the environmental conditions within the treatment area. The appropriate method for each site is determined by the type of potential habitat of threatened and endangered species that is present, the exotic plant species present, and in what vegetation category an infestation occurs. Use of the decision tool would further enhance protection of park resources including sensitive species within the parks by using the least invasive or damaging treatment method.	Same as alternative B.
Exotic Plant Treatments	Parks would continue to use chemical, physical, mechanical or biological treatment methods or combinations of methods to control exotic plants.	Same as alternative A.	Same as alternative A.
Implementation	Exotic plant infestation within the parks would undergo initial treatments over the next 10 years. Re-treatment of sites would occur on an opportunistic basis determined by funding and resources available. It is estimated that re-treatments would occur on average every 3 to 5 years.	Exotic plant infestation within the parks would undergo initial treatments within 3 years of implementation of the exotic plant management plan. To gain control over exotic plant infestations, re-treatments would occur using an appropriate method under an optimal schedule considering the species of exotic plants. Re-treatments would occur every 4 to 12 months dependent upon the exotic plant species and the recovery of native plants.	Same as alternative B.
Mitigation	Standard mitigations would be implemented in each park through work conducted through the EPMT to protect worker safety and for the proper storage and handling of chemicals. Parks would not implement standard mitigations for the protection of natural and cultural resources. Park specific mitigations would be implemented for protection of sensitive and cultural resources (see table 5).	In addition to the mitigations implemented under alternative A, a standard list of mitigation measures for the protection of natural and cultural resources and to further protect public health and safety would be developed and implemented for exotic plant management actions in each park (see table 13).	The mitigation measures identified under alternative B would also be implemented under alternative C. In addition, mitigation measures and best management practices have been identified for activities involving active restoration (see table 19).

TABLE 22: ALTERNATIVES ELEMENTS SUMMARY (CONTINUED)

Element	Alternative A — Continue Current Management	Alternative B — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation	Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants (Preferred Alternative)
General Concept (continued)			
Monitoring Program	At individual parks, monitoring for exotic plants occurs opportunistically when re-treating sites. Formal and informal monitoring of roadsides is also conducted. At Buck Island National Monument monitors the return of exotic plants, return of native plants, and soil loss in treated areas. Data collection and reporting are not done systematically and vary by park. Regionally, through the EPMT, monitoring of exotic plants in south Florida is conducted through systematic reconnaissance flights.	Under alternative B, a systematic monitoring and data collection program would be developed for all parks. This program would include monitoring and collecting data regarding the following: Extent of infestation within the parks; Effectiveness of control method on reducing the density and distribution of exotic plants; Effects of treatment on other resources; Effectiveness of mitigation measures to prevent or reduce impacts on other resources; Rate of return of native species into the treated sites; Occurrence of new areas of infestation or the presence of new exotic species; and Natural recovery rate of native species.	The monitoring and data collection program would include the same elements described under alternative B. In addition, the program would include: Effectiveness of restoration method in achieving prescribed levels of area restoration; and Response of native fauna to restored areas.
Restoration Program	Restoration of treated sites is dependent upon the natural return and growth of native species from native seed sources that naturally establish within the treated area (passive restoration).	Same as alternative A.	Restoration of some treated sites would occur passively as described under alternative A. Under alternative C, a decision-making tool would be applied to assist the parks in determining whether a treated site would be actively restored. The framework for determining what sites to restore and how to restore the sites would be based on the following: The degree of infestation prior to treatment. The ability and time frame of the native system to recover on its own. Whether the treatment area is in a location with high visitor use and visibility. Whether the treatment area is in an area containing sensitive resources and if there is a desire for a faster recovery of habitat for these resources over what would

TABLE 22: ALTERNATIVES ELEMENTS SUMMARY (CONTINUED)

Element	Alternative A — Continue Current Management	Alternative B — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation	Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants (Preferred Alternative)
General Concept (continued)			
Restoration Program (continued)			occur if the system were left to recover on its own. The level of prior disturbance to the area. The accessibility of the site. The cost to actively restore a treated site. Sites would be actively restored through the use of amendments, seeding, replanting, and/or physical site alteration.
Education Program	No educational enhancements would be included in this alternative. Currently park staff use the following to varying degrees: Signage indicating exotic plant control activities are being undertaken. Interpretive programs on exotic plants and treatments. Exhibits presented in visitor centers. End-of-year report provides information on the exotic plant control program. Informal brochures prepared on exotic plants. Presentations to focus groups.	Improvements and enhancements would occur to educate the public on the problems with exotic plants as well as what the parks are doing to control the infestation. Information would be provided as to what the public can do to prevent the establishment and spread of exotic plants.	Same as alternative B but would include materials and programs dedicated to explaining the importance of restoration activities and how they are being conducted within the parks.
Cooperation with Other Agencies	Parks would collaborate with local, state, and federal agencies in efforts to control exotic plants on a regional level. The NPS would participate in organizations such as NEWTT and the SFWMD in order to establish common goals for the control of exotic plants and for ecosystem restoration. The NPS would assist adjacent landowners by providing staff support and technical advice, and the parks would collaborate with non-government organizations and agencies to provide expert knowledge in focused sessions and field demonstrations. Through the EPMT, the NPS would also collaborate with international agencies in the control of exotic plants and exchange information.	The parks would continue to foster communication and collaboration between federal and state agencies, private landowners, and other agencies in an effort to build a regional front against the invasion of exotic plants as is done under alternative A. The parks would increase their sharing of knowledge of latest technologies and research, and providing feedback on successful management technique based on data collected from the monitoring program. Collaboration between NPS divisions including the inventory and monitoring program, interpretation, and cultural and natural resources specialists would be increased.	Same as alternative B.

TABLE 22: ALTERNATIVES ELEMENTS SUMMARY (CONTINUED)

Element	Alternative A — Continue Current Management	Alternative B — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation	Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants (Preferred Alternative)
General Concept (continued)			
		Exotic plant managers would also coordinate with any NPS division that plans for, contracts, oversees, or drives heavy equipment in the parks.	
Cost of Implementation	See table 8.	See table 16.	See table 21.

TABLE 23: ANALYSIS OF HOW ALTERNATIVES MEET OBJECTIVES

	Objectives	Alternative A — Continue Current Management	Alternative B — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation	Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants (Preferred Alternative)
Presence of Exotic Plants				
1	Establish priorities for exotic plants to be treated and treatment locations in parks.	Partially meets the objective. The parks currently employ ranking criteria that provide guidance as parks choose the exotic plant species and infested areas to treat. However, application of the criteria is inconsistent, with some parks emphasizing the risk to threatened and endangered species, others accenting the threat to natural areas, and still others giving highest consideration to the availability of funds. Determination and prioritization of areas for re-treatment is not standardized, resulting in re-treatments occurring on an opportunistic basis.	Meets objective to a large degree. Priority setting for exotic plant treatment areas and for re-treatment projects would be standardized for the nine parks using a defined set of criteria to enhance protection of natural and cultural resources, and visitor use. Using an adaptive management approach, information gained through monitoring would enable managers to make the most effective decisions about which control methods to employ and areas to treat to best control exotic plants within each park.	Meets objective to a large degree. In addition to the outcomes under alternative B, this alternative establishes criteria to prioritize areas for active restoration. Establishing priorities for active restoration further promotes protection of natural and cultural resources, and visitor use. Using an adaptive management approach, information gained through monitoring would enable managers to make the most effective decisions about which restoration methods to employ to best facilitate the return of native plant species.
2	Reduce the number of targeted exotic plants to minimize the threat to natural resources (native habitat, plants, and wildlife).	Partially meets the objective. Parks currently treat exotic plants using chemical, mechanical, biological, and physical methods. Peer-reviewed literature, on-the-ground experience, and/or collaboration with other agencies identify effective, environmentally safe treatment strategies. Reducing the density and number of exotic plants improves native habitat for plants and animals. However, due to funding and resource constraints, treatments do not occur on an optimal schedule to successfully control all exotic plant species. No standard monitoring program is in place to determine the effect of treatment methods on natural resources or the success of mitigation measures to minimize non-target resource impacts.	Meets objective to a large degree. Parks would continue to treat exotic plants using chemical, mechanical, biological, and physical methods. Data obtained through monitoring would show the success of various treatments on each target species, allowing modification of treatment methods, as necessary, to reduce target populations more effectively, thus increasing the benefits to natural resources. Monitoring the passive recovery of treated areas would provide information about recovery of native habitat, plants, and wildlife. Monitoring would allow managers to adjust mitigation measures accordingly to enhance protection of natural resources during treatment activity.	Meets objective to a large degree. Same as alternative B; however, monitoring of passive vs. active recovery efforts would provide information about which approach is most effective for a given set of conditions. In many areas, active restoration measures would speed the return of native plant species to treated areas, simultaneously reducing the area available to exotic plants and promoting the return of natural resources. Using an adaptive management approach, methods of treatment and restoration could be adjusted to promote recovery of native habitat.

TABLE 23: ANALYSIS OF HOW ALTERNATIVES MEET OBJECTIVES (CONTINUED)

	Objectives	Alternative A — Continue Current Management	Alternative B — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation	Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants (Preferred Alternative)
Presence of Exotic Plants (continued)				
3	Reduce to the greatest extent possible the introduction and establishment of new exotic plants into parks.	Partially meets the objective. An executive order prohibits planting exotic species within national parks, and project-specific measures reduce the possibility of accidentally introducing such species. In addition, superintendent compendiums identify appropriate plantings for park landscapes. Parks also participate with other agencies in programs that focus on preventing the spread of exotic plants across park boundaries. However without a standard monitoring program to allow for identification of newly established exotic plants, there is an inability to respond rapidly with treatment thereby increasing the risk of spreading within a park.	Meets objective to a large degree. In addition to the measures under alternative A, standardized monitoring would increase the probability of discovering newly introduced exotic plants before they establish extensive colonies. Monitoring protocols would be established for areas with high potential for infestation. Enhanced collaboration between parks and other land-owners to share data and information could alert all parks to the presence of a new species within the region, allowing for early implementation of appropriate preventive measures. Monitoring could also determine the relative effectiveness of various approaches for preventing introduction, allowing for more effective planning.	Meets objective to a large degree. In addition to the monitoring under alternative B, actively restored sites would be monitored for reinfestation by exotic plants, including species not yet known in the parks. Under this alternative, however, there is an increased risk of introduction of new species through seed or plants used to actively restore sites. Monitoring would allow for detection of newly established exotic plants in these areas and rapid treatment response.
4	Ensure that park exotic plant management programs support, and are consistent with, south Florida ecosystem restoration goals.	Meets the objective. As a member of the Noxious Exotic Weed Task Team (NEWTT), which was established by the South Florida Ecosystem Restoration Working Group, the National Park Service has restoration goals consistent with those of the state. Big Cypress National Preserve, Dry Tortugas National Park, and Everglades National Park participate in restoration planning with the South Florida Water Management District; Dry Tortugas National Park and Everglades National Park also work on restoration issues with the Florida Exotic Pest Plant Council.	Meets objective to a large degree. Activities described under alternative A would continue; information gained through increased monitoring would allow parks to provide better-informed support for south Florida ecosystem restoration goals.	Fully meets objectives. These activities would continue as under alternative A; information gained through increased monitoring would allow parks to provide better-informed support for south Florida ecosystem restoration goals. The active restoration of lands within the parks which could include large-scale restoration projects that return areas to pre-disturbed conditions further enhances the consistency with the south Florida ecosystem restoration goals.
Cultural Resources				
5	Reconcile potential conflicts between preservation of significant cultural landscapes and removal of exotic plants.	Meets objective to a large degree. All parks would continue to consult with cultural resource specialists and the State Historic Preservation Office regarding management of exotic plants within cultural landscapes to resolve any potential conflict.	Meets objective to a large degree same as alternative A.	Meets objective to a large degree same as alternative A.

TABLE 23: ANALYSIS OF HOW ALTERNATIVES MEET OBJECTIVES (CONTINUED)

	Objectives	Alternative A — Continue Current Management	Alternative B — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation	Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants (Preferred Alternative)
Cultural Resources (continued)				
6	Preserve plants and sites valued by Native Americans and other traditional cultures while reducing the spread of exotic plant species.	Meets objective to some degree. Parks would continue to identify plants and sites valued by Native American and traditional cultures and would make determinations on treatment and preservation of plants on a site-by-site basis.	Meets objective to a large degree same as described in alternative A. Monitoring would improve identification of plants or sites valued by traditional cultures, enhancing the ability of parks to implement appropriate preservation measures.	Meets objective to a large degree. In addition to monitoring that would occur as described under alternative B, the potential for active restoration of sites that contain cultural resources that are important to Native American and traditional cultures would further enhance the preservation of these resources as they would be protected from the environment as well as from human activities.
7	Protect archeological and historic resources while reducing the spread of exotic plant species.	Partially meets the objective. Parks currently consult with cultural resource experts and the State Historic Preservation Office on a project-by-project basis to determine appropriate treatment methods to reduce the adverse effects to archeological and historic resources. Reducing the density and number of exotic plants also reduces the damage that exotic plants have on these resources. However, due to funding and resource constraints, treatments do not occur on an optimal schedule to successfully control all exotic plant species and damage may continue to occur in untreated areas of infestation. In addition, no standard monitoring program is in place to determine the effect of treatment methods on archeological or historic resources or the success of mitigation measures to minimize resource impacts.	Meets objective to a large degree. Parks would consult the State Historic Preservation Office under a programmatic agreement and continue to gain input from cultural resource experts to determine appropriate treatment methods to reduce the potential adverse effects to archeological and historic resources. Data obtained through monitoring would show the success of various treatments on each target species, the effect of treatment of archeological and historic resources and allowing modification of treatment methods, as necessary to reduce any adverse effects. Monitoring would also allow managers to adjust mitigation measures accordingly to enhance protection of archeological and historic resources during treatment activity. The control of exotic plants that would be achieved under this alternative would more effectively reduce or eliminate the effects of exotic plants on archeological and historic resources.	Meets objective to a large degree. Parks would consult the State Historic Preservation Office under a programmatic agreement and continue to gain input from cultural resource experts to determine appropriate treatment and restoration methods to reduce the potential for adverse effects to archeological and historic resources. In addition to monitoring that would occur as described under alternative B, the potential for active restoration of sites that contain archeological or historic resources would further enhance the preservation of these resources as they would be protected from the environment as well as from human activities. Monitoring of restoration methods would provide information about which approach is most effective to provide protection to archeological and historic resources.

TABLE 23: ANALYSIS OF HOW ALTERNATIVES MEET OBJECTIVES (CONTINUED)

	Objectives	Alternative A — Continue Current Management	Alternative B — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation	Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants (Preferred Alternative)
Cultural Resources (continued)				
8	Conduct the exotic plant management plan so it is continually monitored and improved; environmentally safe; incorporates best management practices; and supports, and is supported by, science and research	Partially meets the objective. Individual parks are responsible for their own data collection, with no consistency across parks regarding what is observed or how information is used. Some parks rely on opportunistic observation by staff and visitors; others use a more systematic approach. The parks would continue to follow guidelines for storage, transportation, application, and disposal of herbicides; employ certified contractors; and use only EPA approved herbicides according to label requirements (USDA) approved biological controls to minimize environmental risks. The NPS would continue to employ best management practices when choosing treatment strategies and methods. NPS staff refer to available scientific studies and publications, and some have published articles based on their research and experiences.	Fully meets objective. This alternative would implement a standard mitigation plan for the treatment of exotic plants to be used by the nine parks. This alternative would employ a standard monitoring and data collection program that would provide information on the effectiveness of treatments, the effects on other park resources, and the return of native species. Monitoring would provide data for scientific analysis, helping parks more effectively adapt to changing conditions. Use of a decision framework to define appropriate treatment methods given various environmental parameters further reduces risk to non-target resources. Park personnel would also provide access to other agencies and entities of the findings that result from management actions and could also submit their findings to peer-review publications, expanding the pool of knowledge available to researchers and managers in the field.	Fully meets objective. In addition to the activities under alternative B, monitoring of active restoration efforts would provide additional information that would allow parks to continually improve exotic plant management and share their findings with others in the discipline.
9	Minimize unintended impacts of control measures on park resources, visitors, employees, and the public.	Meets the objective to a large degree. Park staff employ mitigation measures to protect health and safety and park resources. Park personnel and contractors working on exotic plant control must have proper training and licensing to handle herbicides. Training involves identifying and establishing methods for protecting non-target plant species through proper herbicide application methods. The EPMT handbook provides additional safeguards for personnel performing treatments. Parks use signage or brochures to inform the public about treated areas. EVER employs mitigation measures to reduce impacts on wilderness and species of special concern.	Fully meets the objective. In addition to mitigations employed under alternative A, a standard set of mitigation measures would be implemented that includes guidance about types of measures required for various treatments to protect resources, visitors, employees, and the public. Use of a decision framework that identified appropriate treatment methods given consideration of various environmental parameters further minimizes the potential for unintended impacts. Monitoring would include the effectiveness of mitigation measures. Through adaptive management, management actions and mitigation measures would be adjusted if monitoring results show unintended impacts were occurring.	Fully meets the objective. In addition to the measures under alternative B, parks would ensure that seed stock or plants for replanting are consistent with native plant varieties and monitoring would reduce the potential for establishment of new exotic plants.

TABLE 23: ANALYSIS OF HOW ALTERNATIVES MEET OBJECTIVES (CONTINUED)

	Objectives	Alternative A — Continue Current Management	Alternative B — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation	Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants (Preferred Alternative)
Operations to Control Exotic Plants				
10	Use federal resources with increased efficiency.	Meets the objective to some degree. At present, parks rely primarily on NPS funds and Florida matching funds, giving attention to projects that seem likely to gain funds from other sources as well. Contract laborers trained in identification and treatment of exotic plants perform most field operations also increases efficiency.	Meets the objective to a large degree. Monitoring would enable managers to determine the most cost-effective approaches using available funds. Re-treatment on an optimal schedule would reduce future costs increasing efficiency.	Meets the objective to a large degree. Comparison of active vs. passive restoration would show the most cost-effective techniques for the return of native vegetation under given conditions. With active restoration of sites there would also be a slight decline in amount of labor and materials needed over time compared to alternative B.
11	Ensure that control measures are consistent with the *Wilderness Act* and *NPS Wilderness Policy*.	Meets the objective to some degree. Treatment in wilderness or proposed wilderness areas is conducted after completion of a minimum tool requirement analysis to determine the least intrusive method. In addition, the park botanist monitors treated areas and receives feedback from park staff to confirm compliance with wilderness policy. New projects proposed in wilderness areas consider information gained through such monitoring. However, without implementation of an optimal re-treatment program, exotic plants would continue to infest wilderness areas, degrading wilderness values and resources, and would require over the long-term, the use of intensive and intrusive methods within wilderness.	Fully meets the objective. Management actions would be conducted after completion of a minimum tool requirement analysis. Data would be collected to monitor the effects of treatment methods on wilderness resources and values, and methods would be adjusted to minimize any unintended impacts. The reduction of exotic plant infestation to a maintenance level of control and the reduction in need of mechanized equipment over the long-term would be consistent with the *Wilderness Act* and the *NPS Wilderness Policy.*	Fully meets the objective as described under alternative B, however, the benefits to wilderness as a result of active restoration of sits would occur more rapidly under this alternative.

TABLE 23: ANALYSIS OF HOW ALTERNATIVES MEET OBJECTIVES (CONTINUED)

	Objectives	Alternative A — Continue Current Management	Alternative B — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation	Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants (Preferred Alternative)
Visitors and the Public				
12	Increase visitor and public awareness of the impacts exotic plants have on native habitat and species and on cultural resources, building support for NPS management efforts.	Meets objective to some degree. Most parks use one or more measures to inform the public and to encourage public involvement. Interpretive programs and displays in visitor centers include information about the threat posed by exotic plant species. Outreach also involves distributing brochures, submitting news releases and articles, presenting lectures to organizations, including information about exotic plants in annual reports and park newsletters, and hosting focus-group meetings. Cooperation with other government agencies, environmental organizations, and native plant societies provides information to a broader audience.	Fully meets objective. Educational materials and programs would be enhanced under this alternative. Information gained through monitoring could be added to the information distributed to the public using the methods described under alternative A, which would help increase public awareness of the issues and build additional support for NPS responses to those issues. Monitoring could also include surveys to gauge visitor reaction to exotic plant management efforts, and could help determine which outreach techniques are most effective.	Fully meets objective. In addition to the efforts under alternative B, public education would also include information about active restoration efforts and their effects.
Government Partners / Neighboring Communities				
13	Coordinate efforts with partners and neighbors (nationally and internationally) to establish compatible goals and provide assistance to achieve them.	Meets objective to some degree. The National Park Service collaborates with federal, state, and local agencies to establish common goals for treating exotic plants and to set priorities for funding exotic plant control efforts. EPMT and park staff member provides expertise and treatment assistance to neighboring agencies and landowners. EPMT staff share information about exotic plant control with representatives from other nations and territories.	Meets this objective to a large. Expanded monitoring of treatment and mitigation would provide information that would allow park staff to give more effective advice and assistance to neighboring agencies and landowners. Park personnel could share their findings with partners and neighbors directly and through peer-reviewed publications.	Fully meets this objective. Increased knowledge about the effectiveness of active vs. passive restoration efforts would permit improved cooperative goal setting and better enable the parks to achieve those goals with partners and neighbors.

TABLE 23: ANALYSIS OF HOW ALTERNATIVES MEET OBJECTIVES (CONTINUED)

	Objectives	Alternative A — Continue Current Management	Alternative B — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation	Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants (Preferred Alternative)
Restoration				
14	Restore and protect native vegetation categories in ways that allow natural processes, function, cycles, and biota to be re-established and maintained in perpetuity.	Meets objective to some degree. The parks' focus in the field is on treatment, relying on passive return of native plants to treated areas through natural reseeding or re-establishment from adjacent areas. Treatment however does not occur on a frequent enough basis to allow for success in treating all exotic plant species within the parks and therefore restoration of native vegetation in treated sites is not ensured.	Meets objective to a large degree. The integrated inventory and monitoring program would acquire information about the rate of return of native plant species as a function of the type of treatment and the mitigation measures used, allowing parks to determine actions that would best promote the return of native plant species. This, in turn, would help the parks modify exotic plant management methods to continuously improve responses and allow for the greatest recovery of native vegetation. Treatment under an optimal schedule of all treated sites would ensure recovery of native vegetation.	Fully meets this objective. This alternative would ensure recovery of native vegetation to treated sites more rapidly than other alternatives. In addition, park resource managers would have the ability to direct the type of native vegetation to be restored to enhance the restoration of native systems that could not occur through passive restoration. Monitoring would provide information to allow comparisons of the effectiveness of active vs. passive restoration, further improving re-establishment and maintenance of natural conditions.

TABLE 24: SUMMARY OF ENVIRONMENTAL CONSEQUENCES

Impact Topics	Alternative A — Continue Current Management	Alternative B — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation	Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants (Preferred Alternative)
Native Plants / Vegetation Categories	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 grasslands, 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.	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.	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.

Table 24: Summary of Environmental Consequences (continued)

Impact Topics	Alternative A — Continue Current Management	Alternative B — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation	Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants (Preferred Alternative)
Soils	In Big Cypress National Preserve and Everglades National Park, 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.	Accelerated treatment of exotic plant species and reduction of the total acreage of infestation in the parks would result in ***short-term adverse and beneficia***l effects and ***long-term benefits*** to park soil resources. Prescribed 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.	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.

TABLE 24: SUMMARY OF ENVIRONMENTAL CONSEQUENCES (CONTINUED)

Impact Topics	Alternative A — Continue Current Management	Alternative B — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation	Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants (Preferred Alternative)
Water Quality and Hydrology	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 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 effects of accelerated exotic plant treatment and scheduled, routine re-treatment, and monitoring would be similar to those outlined for alternative B.
Water Quality and Hydrology (continued)	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.	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.	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. ***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 C.
Special Status Species	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***	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	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).

TABLE 24: SUMMARY OF ENVIRONMENTAL CONSEQUENCES (CONTINUED)

Impact Topics	Alternative A — Continue Current Management	Alternative B — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation	Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants (Preferred Alternative)
	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 in vegetation categories 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.	treatments and would result in ***short-term, adverse impacts that range from negligible to minor in intensity***.	
Special Status Species (continued)	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.	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.	The active restoration of the native vegetation categories 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 l***ong-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.

TABLE 24: SUMMARY OF ENVIRONMENTAL CONSEQUENCES (CONTINUED)

Impact Topics	Alternative A — Continue Current Management	Alternative B — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation	Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants (Preferred Alternative)
Wildlife and Wildlife Habitats	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 categories 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 categories in which they occur. Under alternative A, exotic plants would be controlled, but habitats and native vegetation categories 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.	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 categories 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.	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 categories 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.

TABLE 24: SUMMARY OF ENVIRONMENTAL CONSEQUENCES (CONTINUED)

Impact Topics	Alternative A — Continue Current Management	Alternative B — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation	Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants (Preferred Alternative)
Air Quality	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.	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.	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			
Archeological Resources	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.)	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***.	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.

TABLE 24: SUMMARY OF ENVIRONMENTAL CONSEQUENCES (CONTINUED)

Impact Topics	Alternative A — Continue Current Management	Alternative B — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation	Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants (Preferred Alternative)
Archeological Resources (continued)	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 prescribed fires 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.	***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.	***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.

TABLE 24: SUMMARY OF ENVIRONMENTAL CONSEQUENCES (CONTINUED)

Impact Topics	Alternative A — Continue Current Management	Alternative B — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation	Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants (Preferred Alternative)
Archeological Resources (continued)	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.		
Historic Structures, Buildings, and Districts	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.	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.	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.

TABLE 24: SUMMARY OF ENVIRONMENTAL CONSEQUENCES (CONTINUED)

Impact Topics	Alternative A — Continue Current Management	Alternative B — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation	Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants (Preferred Alternative)
Historic Structures, Buildings, and Districts (continued)	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)***. Prescribed fires 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.		
Ethnographic Resources	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.	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.	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.

TABLE 24: SUMMARY OF ENVIRONMENTAL CONSEQUENCES (CONTINUED)

Impact Topics	Alternative A — Continue Current Management	Alternative B — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation	Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants (Preferred Alternative)
Ethnographic Resources (continued)	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. Prescribed fires 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.		

TABLE 24: SUMMARY OF ENVIRONMENTAL CONSEQUENCES (CONTINUED)

Impact Topics	Alternative A — Continue Current Management	Alternative B — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation	Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants (Preferred Alternative)
Cultural Landscapes	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.	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.	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.
Visitor Use and Experience	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***.	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.	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	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.	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. ***Cumulative impacts*** would be the same as alternative A.	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

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Impact Topics	Alternative A — Continue Current Management	Alternative B — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation	Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants (Preferred Alternative)
Soundscapes (continued)	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 would not result in impairment of the soundscapes in any of the parks analyzed.	***benefit*** to soundscapes in the parks. ***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	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.	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 to 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.	***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.

TABLE 24: SUMMARY OF ENVIRONMENTAL CONSEQUENCES (CONTINUED)

Impact Topics	Alternative A — Continue Current Management	Alternative B — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation	Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants (Preferred Alternative)
Public Health and Safety	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***.	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***.	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 l***ong-term impacts declining to negligible to minor*** as parks reduce infestations. Any cumulative adverse impacts would be ***negligible***.
Essential Fish Habitat	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	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	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.

TABLE 24: SUMMARY OF ENVIRONMENTAL CONSEQUENCES (CONTINUED)

Impact Topics	Alternative A — Continue Current Management	Alternative B — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation	Alternative C — New Framework for Exotic Plant Management: Increased Planning, Monitoring, and Mitigation, with an Emphasis on Active Restoration of Native Plants (Preferred Alternative)
Essential Fish Habitat (continued)	fish habitats in the parks would also be ***negligible to minor***. ***Short- and long-term localized adverse*** effects from motor or airboat 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.	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***. ***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.	
Management and Operations	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.	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 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.