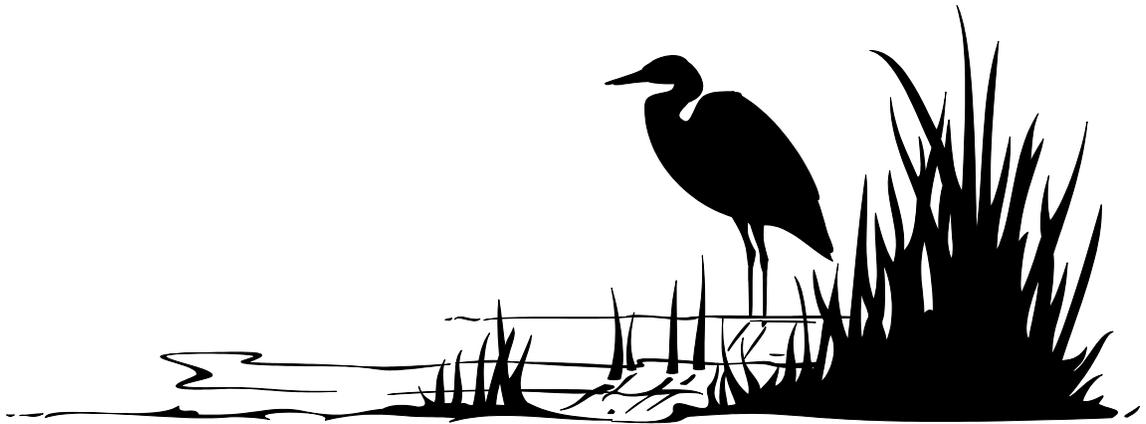


**OFF-ROAD VEHICLE MANAGEMENT PLAN**  
**BIG CYPRESS NATIONAL PRESERVE**

**Review Draft**

**April 1998**



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**United States Department of the Interior**

**~~National Park Service~~**  
**Big Cypress National Preserve**



**OFF-ROAD VEHICLE MANAGEMENT PLAN**  
**BIG CYPRESS NATIONAL PRESERVE**

**April 1998**

**Final Report**

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In partial fulfillment of Cooperative Agreement CA 4000-3-2013, Supplement No. 7

Approved by: \_\_\_\_\_  
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# INTRODUCTION

The purpose of this Off-Road Vehicle Management Plan is to guide the management of off-road vehicle (ORV) use within Big Cypress National Preserve (BCNP). The plan will be the National Park Service's (NPS) statement of intent with regard to ORV management, as called for and directed by the Preserve's General Management Plan/Final Environmental Impact Statement (GMP) (NPS GMP 1991). While broad direction is provided in the GMP, this document provides more comprehensive treatment of ORV-related issues and concerns, legislative mandates, environmental and social effects, and management alternatives. This plan will guide the NPS in determining the best management actions that are available and in the future selection of management strategies and tactics that will eliminate or minimize the environmental and social consequences of ORV use.

ORV use is one of the major recreational uses within BCNP, and one which is both impacting and controversial. This plan is needed to address issues and management concerns at the Preserve related to ORV use, including its effects on Preserve resources and non-motorized visitation. This document fulfills requirements set forth under the National Environmental Policy Act (NEPA) and Department of Interior guidelines for development of plans for park units in the national park system. An accompanying Supplemental Environmental Impact Statement (SEIS) analyzes the environmental consequences of planning alternatives identified in this plan. Development of alternatives for resource protection, visitor use, and management of the Preserve related to ORV use and an assessment of their impacts are required for an SEIS. Public participation, the scoping of issues and concerns, data collection, and alternative development are also required.

The Preserve's General Management Plan identified and selected from four different alternatives for managing ORV use within the original Preserve boundaries. The action selected provides general guidance for this ORV Management Plan, restricting the scope of alternatives applicable to the original Preserve lands. Therefore, only two alternatives are identified in this plan, labeled the "No-Action (Status Quo) Alternative" and "Alternative A (Proposed Action) Alternative."

The Preserve's boundaries were expanded by 146,000 acres in 1988 by The Big Cypress National Preserve Addition Act (P.L. 100-301). The "Addition lands" as they are commonly referred to, were not administered by the NPS until December of 1996. For this reason, and because the GMP planning was initiated prior to the Addition Act, these lands were not included within the scope of the 1991 GMP. The Addition lands are therefore not subject to the guidance of the GMP and a broader set of alternatives for their management relative to ORV use are included in this plan. Specifically, three alternatives are identified: "Alternative A: Closure to ORVs", "Alternative B: Full Access to ORVs", and "Alternative C: Designated Trail Access for ORVs", which is the proposed alternative. All other general ORV management guidance provided in this plan is equally applicable to lands within the original Preserve boundaries and the Addition.

This plan also contains descriptions of the Preserve's legislative and agency policy guidance, natural and cultural resources, recreational visitation, planning issues and concerns, review of

ORV environmental and social effects, and ORV management strategies and tactics. An ORV Management Practices Manual (Appendix 2) is also included as a reference document for future ORV management decision making.

## **Objectives**

The Preserve's GMP recognizes ORV use as "a practical means of transportation and an appropriate recreational activity when regulated" (NPS GMP 1991). GMP objectives for ORV management include:

1. Reduce adverse impacts to soils and vegetation, particularly vegetation identified as important resource areas, and
2. Provide for diverse visitor experiences at levels compatible with the purposes of the Preserve.

## **Document Organization**

**Legislative Mandates:** Describes federal laws and executive orders, state of Florida statutes, NPS management policies, and park planning guidance.

**Brief Description of the Preserve:** Describes the natural and cultural resources potentially affected by ORV use and its management.

**Visitor Use of the Preserve:** Describes the history, characteristics, and management of ORV use and an overview of non-motorized recreational uses.

**Planning Issues and Concerns:** Describes public involvement efforts and issues and concerns that emerged from the ORV planning process.

**Review of Literature:** Reviews available research literature to describe some of the environmental and social effects of ORV use.

**ORV Management Strategies and Tactics:** Describes alternative ORV management strategies and tactics. Introduces the ORV Management Practices Manual included as Appendix 2 to the plan.

**Plan Alternatives (Original Preserve):** Describes ORV planning alternatives for the original Preserve, direction for which was provided by the Preserve's General Management Plan.

**Plan Alternatives (Addition Lands):** Describes ORV planning alternatives for the new Addition lands, direction for which was not provided by the Preserve's General Management Plan.

**Literature Cited:** Contains a list of all literature cited in the plan.

**Off-Road Vehicle Management Practices Manual:** Describes in greater detail ORV management strategies and tactics, including a tabular presentation of 42 specific tactics (actions) to inform future ORV management decision making.



# LEGISLATIVE MANDATES

The Big Cypress National Preserve is one of 375 units of the National Park Service within the U.S. Department of Interior. Management direction for these units is provided by the NPS enabling legislation, applicable federal laws and Executive Orders, NPS management policies, state laws, and unit-specific legislation, management plans, and goals and objectives.

## Federal Laws and Executive Orders

### National Park Service Organic Act

In 1916 Congress established the National Park Service, directing it to:

“promote and regulate the use of the Federal areas known as national parks, monuments, and reservations...by such means and measures as to conform to the fundamental purpose of said parks, monuments, and reservations, which purpose is to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.” (National Park Service Organic Act, 16 USC 1)

The act established ambiguities between the potentially conflicting mandates of preserving parks unimpaired and opening them up to public use. Sellars (1992) notes that while the Organic Act’s statement of purpose contains a strong preservation mandate, the founders and early NPS directors vigorously promoted park visitation and the developments necessary to support it. Congress has often supported NPS management traditions emphasizing tourism development and recreation provision, in part through the creation of a diversity of new types of parks intended for intensive public use (such as national parkways, national recreation areas, and urban parks)(Sellars 1992). However, in the 1960’s and ‘70s research in the natural sciences began to reveal the negative impacts of human activities on natural ecosystems and a more environmentally aware public began to demand changes. A spate of new environmental laws, combined with broad public and Congressional support, began to shift public land management toward resource protection and preservation. The Organic Act was amended by the General Authorities Act of 1970 to recognize the growing diversity of the park system and to reaffirm its management as a unified system:

“... that these areas, though distinct in character, are united through their inter-related purposes and resources into one national park system as cumulative expressions of a single national heritage; that, individually and collectively, these areas derive increased national dignity and recognition of their superb environmental national quality through their inclusion jointly with each other in one national park system preserved and managed for the benefit and inspiration of all the people of the United States...” (16 USC 1a-1)

The Redwoods Act, as amended 1978, reasserted the system-wide standard of protection prescribed by Congress in the original Organic Act. This Act requires parks to be protected and managed “in light of the high public value and integrity of the National Park System” and that no activities should be undertaken “in derogation of the values and purposes for which these various areas have been established.” These amendments further enhanced the resource protection mandate, stipulating that recreational visitation is acceptable only to the extent that it does not impair the preservation of natural and cultural resources.

### **Big Cypress National Preserve Enabling Act**

Big Cypress National Preserve was established in 1974 to protect the Big Cypress Watershed from development and agricultural conversion pressures and other purposes as stated in the Act:

“... to assure the preservation, conservation, and protection of the natural, scenic, hydrologic, floral and faunal, and recreational values of the Big Cypress Watershed in the State of Florida and to provide for the enhancement and public enjoyment thereof ... Such lands will be administered by the Secretary as a unit of the National Park System in a manner which will assure their natural and ecological integrity in perpetuity in accordance with the provisions of this Act and with the provisions of the Act of August 25, 1916 (39 Stat. 535; 16 U.S.C. 1-4), as amended and supplemented.” (P.L. 93-440)

These statements recognize the values for which the area is being protected and cites the NPS Organic Act and its amendments as providing direction to the management of this new unit. Off-road vehicle use is not mentioned specifically in the Act though there are some additional statements that guide its management:

“In administering the Preserve, the Secretary shall develop and publish in the Federal Register such rules and regulations as he deems necessary and appropriate to limit or control the use of Federal lands and waters with respect to: (1) motorized vehicles, ... (6) hunting, fishing, and trapping ... The Secretary shall permit hunting, fishing, and trapping on lands and water under his jurisdiction within the Preserve in accordance with the applicable laws of the United States and the State of Florida, except that he may designate zones where and periods when no hunting, fishing, trapping, or entry may be permitted for reasons of public safety, administration, floral and faunal protection and management, or public use and enjoyment.” (P.L. 93-440)

This legislation provides a much clearer view of Congressional intent than the Organic Act. Specifically, the NPS is to “assure their natural and ecological integrity in perpetuity” and develop “rules and regulations as he deems necessary and appropriate to limit or control” various consumptive uses, including use of motorized vehicles. Thus, ORV use must be compatible with the resource protection mandate, regulated where necessary to assure the long term preservation of Preserve resources.

In 1988, Congress passed The Big Cypress National Preserve Addition Act to add lands north of the Preserve. Only one statement appears to have relevance to ORV management:

“The Secretary and other involved Federal agencies shall cooperate with the State of Florida to establish recreational access points and roads, rest and recreation areas, wildlife protection, hunting, fishing, frogging and other traditional opportunities in conjunction with the creation of the Addition and in the construction of Interstate Highway 74.” (P.L. 100-301)

This law also does not specifically mention ORVs, though it does call on the Secretary to provide for hunting and other “traditional opportunities”. The Addition lands north of I-75 are more upland than the original Preserve lands and include many miles of above-grade unsurfaced roads. Subsequently, the Addition lands north of I-75 have suitability for both non-motorized and motorized recreational activities.

Legislative ambiguities are so common that many individuals, including public land managers, often examine legislative histories to clarify Congressional intent. Such documents carry no legal standing, but they do provide additional detail to help explain sections of legislation that lack the specificity necessary to guide management decision making. The legislative history for the Preserve provides additional explanations of both its name and the management of ORVs:

“The description of the Big Cypress area as a national preserve will establish a new category which can serve as a feasible and desirable vehicle for the consideration of other nationally significant natural areas which differ from the qualities attributed to national parks and recreation areas. The committee chose to call the area a preserve rather than a reserve, feeling that such distinction may be important. Reserve refers to stock - a commodity held for future use. Preserve refers more definitively to the keeping or safeguarding of something basically protected and perpetuated for an intended or stated purpose, as with the specific objectives for Big Cypress provided by this legislation.

In general, national preserves will be areas of land and/or water which may vary in size, but which possess within their boundaries exceptional values or qualities illustrating the natural heritage of the Nation. Such areas would often be characterized by significant scientific values, including, but not limited to, ecological communities illustrating the process of succession, natural phenomena, or climax communities. In addition they could be characterized by a habitat supporting a vanishing, rare or restricted species; a relic flora or fauna persisting from an earlier period; or large concentrations of wildlife species. Other scientific, geologic, geomorphic or topographic values might also contribute to the purposes for which an area might be recognized.

The principal thrust of these areas should be the preservation of the natural values which they contain. They might differ, in some respects, from national parks and monuments insofar as administrative policies are concerned. Hunting, for example, subject to reasonable regulation by the Secretary, could be permitted to the extent compatible with the purposes for which the area is established...

All management activities within these areas should be directed toward maintaining the natural and scientific values of the area, including the preservation of the flora and fauna and the reestablishment of the indigenous plant and animal life, if possible...

National preserves may accommodate significant recreational uses without impairing the natural values, but such public use and enjoyment would be limited to activities

where, or periods when, such human visitation would not interfere with or disrupt the values which the area is created to preserve.” (Senate Report No. 93-1128)

In summary, Preserves are nationally significant natural areas which possess exceptional values or qualities illustrating the natural heritage of the Nation. They are areas having characteristics associated with national parks, but in which Congress has permitted continued uses such as public hunting, trapping, oil/gas exploration and extraction. Many existing national preserves, without sport hunting, would qualify for national park designation (cited from the NPS Website).

Regarding ORV management:

“Since the area included in the Preserve is largely undeveloped at the present time and because it will be managed in a manner which will assure its return to the true wilderness character which once prevailed, it will offer many outdoor recreation opportunities to the visiting public. During significant portions of the year, primitive camping, hiking, and sightseeing will be popular activities. Naturalists and wildlife observers will come to see the flora and fauna in their natural setting and hunters and fishermen will continue to find the area popular. While the use of all terrain vehicles must be carefully regulated by the Secretary to protect the natural, wildlife and wilderness values of the Preserve, the bill does not prohibit their use along designated roads and trails.” (Senate Report No. 93-1128)

Results from court cases have reaffirmed the Secretary of Interior’s responsibility in protecting park resources. Of particular relevance is the decision from the case *National Rifle Association v. Potter* which sustained NPS regulations prohibiting hunting and trapping in parks, except in parks where these activities were specifically authorized by Congress (*NRA v. Potter* 1985). Similarly, off-road vehicle use at Big Thicket National Preserve was not specifically authorized by Congress and the NPS prohibited ORVs immediately following its designation.

This legislative history reaffirms resource preservation as the primary focus for the Preserve and approves of hunting and ORV use to the extent that they are compatible with the values and purposes for which the area was established. It also acknowledges the area’s prior disturbance by asserting that management should “assure its return to the true wilderness character which once prevailed.” Finally, it suggests that the area will be managed for a diversity of recreational activities, including ORV use “along designated roads and trails.”

### **Federal Water Pollution Control Act (Clean Water Act)**

The Clean Water Act was established in 1972 to “restore and maintain the chemical, physical, and biological integrity of the nation’s waters” (33 U.S.C. § 1251). States are active participants in efforts to manage and regulate water quality and federal agencies must comply with the water quality management requirements of state laws. Section 404 of the Act, Administered by the U.S. Army Corps of Engineers, requires that a permit be issued for discharge of dredged or fill materials in all waters of the United States, including wetlands.

The 1995 lawsuit brought by the Florida Biodiversity Project (FBP) against the National Park Service was based largely on Section 404 of the Clean Water Act, specifically the discharge of dredged materials defined as:

“any addition, including any redeposit, of dredged material, including excavated material, into waters of the United States which is incidental to any activity...” (33 CFR § 232.2(1)(iii)).

In 1993 the Army Corps of Engineers (Corps) and the U.S. Environmental Protection Agency (EPA) issued the “Tulloch rule” to clarify the definition of discharge of dredged materials to close regulatory loopholes that had enabled some projects to avoid the required Section 404 review. The Tulloch rule modified the definition to:

“any addition, including any redeposit, of dredged material, including excavated material, into waters of the United States which is incidental to any activity, including mechanized landclearing, ditching, channelization, or other excavation.” (40 CFR Section 232.2 and 33 CFR Section 323.2(d)(1)(iii))

The FBP lawsuit charged that ORVs operating in the Preserve’s wetlands inevitably result in the displacement and redeposition of dredged soils and substrate and should be subject to the jurisdiction of Section 404. Furthermore, the lawsuit states that “amendments to EPA and Corps regulations create an effects-based de minimus threshold. Activities which do not, in any way, degrade a jurisdictional water are excluded from the requirement of permit review. This threshold of adverse effects is extremely low. As the final rule points out, “an adverse effect on any one aquatic function, even if it is temporary, would be sufficient to trigger the Section 404 permit requirement.” (58 FR 45020)” (Florida Biodiversity Project Petition, 1995). The FBP maintains that ORV use within the Preserve far exceeds this de minimus threshold.

In a 1995 Corps/EPA Memorandum to the Field these agencies further clarify their interpretation on applying Section 404 to vehicle use in wetlands:

“The Corps and EPA wish to clarify that, as a general matter, the driving of a vehicle or vehicles through wetlands does not require authorization pursuant to Section 404 under the Tulloch rule. Specifically, driving a vehicle such as a car, off-road vehicle (ORV), or farm tractor through a wetland in a manner in which such a vehicle is designed to be used is not subject to regulation under Section 404, except as discussed below.” (Corps/EPA 1995)

The exceptions include situations where vehicles are used in such a way that the activity creates an effect that is specifically identified in the Tulloch rule. For example, purposefully spinning the wheels on a vehicle to excavate ditches in order to alter a wetland. The Memorandum specifically exempts ORV use in BCNP: “Based on the agencies’ understanding that such ORVs will be driven in the manner in which the vehicles are normally used, the Corps and EPA wish to clarify that such vehicle use is not the type of activity that the Tulloch rule was intended to regulate” (Corps/EPA 1995).

## **Legislative Mandates**

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The FBP lawsuit was settled in October 1996. The agreement called on the NPS to proceed with development of the ORV Management Plan originally called for in the Preserve's GMP. Consistent with the National Environmental Policy Act (NEPA), the ORV Plan would include a Supplemental Environmental Impact Statement (SEIS) and extensive public involvement. The SEIS is to analyze the cumulative environmental effects of implementing an ORV Management Plan, including those associated with a "no action" alternative. "The overall objective of the ORV Management Plan will be to establish a comprehensive system for management of ORV use in BCNP with the goal of assuring the natural and ecological integrity of BCNP resources in accordance with the BCNP Establishment Act" (U.S. Department of Justice 1995). Many other details regarding the plan and SEIS components are also enumerated in the settlement agreement.

### **National Environmental Policy Act**

The National Environmental Policy Act (NEPA), passed in 1969, directs federal agencies to improve and coordinate Federal plans, functions, programs, and resources to:

"... attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences ..." (42 USC 4321 *et seq*)

Most significantly, NEPA requires federal agencies to identify and evaluate the environmental impacts of proposed actions and appropriate alternatives and to involve the public in their planning and decision making process. An Environmental Impact Statement (EIS) is the tool used to standardize evaluations of proposed actions and facilitate public review. An SEIS is being developed for this ORV Management Plan.

### **Endangered Species Act**

Congress passed the Endangered Species Act in 1973 to protect plants and animals that have been formally listed as endangered (species in danger of extinction throughout all or a significant portion of their range) or threatened (species likely to become endangered in the foreseeable future). The act requires federal agencies to "insure that any action authorized, funded, or carried out by [it] is not likely to jeopardize the continued existence of any" listed species "or result in the destruction or adverse modification of" its critical habitat (16 U.S.C. § 1536(a)(2)). Federal agencies planning actions that may affect a listed species must consult with the U.S. Fish and Wildlife Service for a "biological opinion" of the consequences of the proposed action. The courts generally give considerable deference to these biological opinions so they can serve as an effective brake on proposals to intensify use or otherwise manage parks in a manner detrimental to the survival of endangered species (Bean 1988). The Act also provides the authority to impose stringent restrictions or regulations on recreational use in sensitive park areas, such as in the crocodile sanctuaries of Everglades National Park.

### **National Trail System Act**

This 1968 Act (P.L. 95-625) established a National System of scenic hiking trails, including the Florida National Scenic Trail designated in 1983. This trail is planned to extend some 1,300 miles from Big Cypress National Preserve to the Gulf Islands National Seashore in Florida's western panhandle. The Act provides for the acquisition and protection of the scenic trail corridors.

### **Coastal Zone Management Act**

This Act created a national policy to protect the nation's coastal zone, and to encourage and assist States in implementing programs to achieve wise land and water use in coastal zones. Federal agencies are directed to comply to the maximum extent possible with the State's management programs. The Act is administered by the Florida Department of Community Affairs in Florida and Big Cypress is within the coastal zone.

### **Executive Order 11644 (Use of Off-Road Vehicles on the Public Lands)**

Federal agency policies and actions must also follow guidance provided by the Executive branch of the government, typically in the form of Executive Orders. President Richard Nixon signed Executive Order 11644 in 1972, directing the federal agencies to develop regulations for the designation of the specific areas and trails on public lands on which the use of off-road vehicles may be permitted:

“Designation of such areas is to be in accordance with the following: (1) Areas and trails shall be located to minimize damage to soil, watershed, vegetation, or other resources of the public lands. (2) Areas and trails shall be located to minimize harassment of wildlife or significant disruption of wildlife habitats. (3) Areas and trails shall be located to minimize conflicts between off-road vehicle use and other existing or proposed recreational uses of the same or neighboring public lands, and to ensure the compatibility of such uses with existing conditions in populated areas, taking into account noise and other factors. (4) Areas and trails shall not be located in officially designated Wilderness Areas or Primitive Areas. Areas and trails shall be located in areas of the National Park System, Natural Areas, or National Wildlife Refuges and Game Ranges only if the respective agency head determines that off-road vehicle use in such locations will not adversely affect their natural, aesthetic, or scenic values.”

The Executive Order also states that agencies shall ensure adequate opportunity for public participation in the development of areas, trails, and regulations that govern ORV use. Designated areas and trails are to be well-marked, publicized, and compliance enforced with appropriate penalties. The agencies are also to monitor the effects of the ORV use and from time to time amend or rescind designations of areas or other actions as necessary to further the policy of the order.

### **Executive Order 11989 (Off-Road Vehicles on Public Lands)**

In 1977 President Jimmy Carter also issued an Executive Order (11989), amending Executive Order 11644 to exclude emergency, law enforcement, and military vehicles and to close areas where adverse impacts are occurring:

“... the respective agency head shall, whenever he determines that the use of off-road vehicles will cause or is causing considerable adverse effects on the soil, vegetation, wildlife, wildlife habitat or cultural or historic resources of particular areas or trails of the public lands, immediately close such areas or trails to the type of off-road vehicle causing such effects, until such time as he determines that such adverse effects have been eliminated and that measures have been implemented to prevent future recurrence ... Each respective agency head is authorized to adopt the policy that portions of the public lands within his jurisdiction shall be closed to use by off-road vehicles except those areas or trails which are suitable and specifically designated as open to such use pursuant to Section 3 of this Order.”

### **Executive Order 11990 (Protection of Wetlands)**

Also in 1977, President Carter issued an Executive Order (11990) to “minimize the destruction, loss or degradation of wetlands, and preserve and enhance the natural and beneficial values of wetlands in carrying out the agency’s responsibilities ...” Further NPS guidance for compliance with this Executive Order is found in the Floodplain Management and Wetland Protection Guidelines, published in the Federal Register 45 FR 35916, Section 9.

## **National Park Service Management Policies**

Authority for implementing congressional laws is delegated to agencies, which identify and interpret relevant laws and formulate management policies to guide their implementation. For the National Park Service, these policies are set forth in the Management Policies (1988). These policies provide direction for management decisions. Selected statements from Management Policies with relevance to ORV management include the following:

“The use of motor vehicles will be limited to park roads and parking areas and to routes and areas designated for off-road motor vehicle use. ...Within the national park system, routes and areas may be designated for off-road motor vehicle use only by special regulation and only in national preserves, national seashores, national lakeshores, and national recreation areas. Routes and areas may be designated only in locations where there will be no significant adverse impacts on the area’s natural, cultural, and scenic resources and values and in consideration of other visitor uses.”

“Backcountry use will be managed to avoid unacceptable impacts on park resources or adverse effects on visitor enjoyment of appropriate recreational experiences. The National Park Service will identify acceptable limits of impacts, monitor backcountry use levels and resource conditions, and take prompt corrective action when unacceptable impacts occur.”

“Any restrictions on recreational use will be limited to the minimum necessary to protect park resources and values and to promote visitor safety and enjoyment. To the extent practicable, public use limits established by the National Park Service will be based on the results of scientific research and other available support data.”

## **State of Florida Statutes**

A number of Florida legislative statutes are also applicable to the use and management of ORVs within the Preserve. For example, lands within Preserve are designated in the Big Cypress Area of Critical State Concern under the Florida Environmental Land and Water Management Act. The waters of BCNP are also classified by the state as Outstanding Florida Waters, to be preserved in a non-degraded state and protected in perpetuity for the benefit of the public. A number of other Florida statutes also apply, reviewed in greater detail in Preserve’s Water Resources Management Plan (Schneider and others 1996)

## **Big Cypress National Preserve Plans**

Management guidance is also provided in park-specific planning documents which provide strategies for addressing issues and achieving management objectives. The Preserve’s General Management Plan (GMP) (NPS GMP 1991) is the principal planning document, guiding park development and management of visitation and natural and cultural resources. The GMP presented several alternative scenarios for future park management, including actions for managing ORV use. Subsequent ORV management actions, such as the promulgation of rules and regulations, have been guided by the GMP, though it does not provide an exclusive basis for such decisions.

The GMP recognizes ORV use as “a practical means of transportation and an appropriate recreational activity when regulated.” Plan objectives for ORV management include: (1) “Reduce adverse impacts to soils and vegetation, particularly vegetation identified as important resource areas,” and (2) “Provide for diverse visitor experiences at levels compatible with the purposes of the Preserve” (NPS GMP 1991). Under its adopted proposed action, the GMP describes how ORV use will be managed through (1) a vehicle permit system, (2) general regulations governing the operation of vehicles, and (3) a system of designated access points, areas, or trails for each management unit with ORV use. The GMP established a limit of 2,500 ORV permits, with a random drawing to be used if permit requests exceeded the quota. The GMP also specifically called for development of this plan:

“More detailed actions concerning ORV management would be included in an ORV management plan, which would be developed once the general management plan has been approved. Sportsmen and others knowledgeable about Big Cypress would be asked to participate in the development of the action plan.”

The GMP proposed two strategies for managing ORV use: (1) designated trails, currently applied in one management unit to contain potential disturbance to the endangered Florida panther and other important resource areas, and (2) dispersed use, currently applied in three

other units with more existing trails and larger areas being designated open to ORV use. Criteria for trail or area closures in these units include: (a) vehicle use causes or would cause extensive ponding or erosion, (b) soils, vegetation, wildlife, or wildlife habitat are or would be adversely impacted, (c) multiple trails cut through sloughs, strands, or other important resource areas, and (d) cultural resource sites might be threatened by vandalism or erosion. Two other management units are closed to ORV use. The GMP also proposed development of 15 ORV access points (NPS GMP 1991, Table 2 and ORV Management Map, p. 46), five frontcountry campgrounds, and 50 backcountry shelters for hunters, ORV users, and other recreationists. Finally, the GMP includes an Environmental Impact Statement which includes brief discussion of the environmental effects of ORV recreational use.

Other Preserve planning documents also address the issue of ORV use. For example, the Water Resources Plan identifies ORV use as a water resources management issue (Schneider and others 1996). Concerns identified in this plan include increasing ORV disturbance to vegetation and soils, particularly soil displacement from wheeled vehicles and airboats. This soil disturbance could result in elevated surface water turbidity, and changes in surface water flow direction, velocity, and hydroperiod. Additional research on the potential of ORVs to affect natural sheet flow patterns within the Preserve is identified as a need. Specifically, Resources Management Plan (NPS 1994) Project Statement BICY-N-211 described in the Water Resources Plan calls for an inventory of the ORV areas of influence which potentially impact water resources and site-specific studies to assess water quality and quantity impacts.

Management guidance is also provided by Preserve management objectives. In October of 1993 the Preserve invited a diverse group of NPS and State, local and organizational officials to participate in a nominal group process in developing management objectives for the Preserve (NPS 1993). The following excerpts from this process are relevant to this planning effort:

**Preserve Purpose** - The purpose of Big Cypress National Preserve is to assure the preservation, conservation, and protection of the natural, scenic, hydrologic, floral and faunal, and recreational values of the Big Cypress Watershed and to provide for the enhancement and public enjoyment thereof.

**Management Objectives** (selected) - To preserve and restore a sustainable ecosystem to allow native natural processes, functions, cycles, and species to continue or be reestablished. To provide visitors with the opportunity to experience the unique subtropical resources of the Preserve and enjoy its varied and traditional recreational activities. To ensure that the quality, timing, duration, and amounts of water entering and leaving the Preserve is characteristic of that which existed prior to upstream development.

**Issues** (selected) - Resource impacts on Preserve values by ORVs. Adequacy of recreational access to Preserve. Recreation carrying capacity of Big Cypress National Preserve. Inadequate monitoring of natural and cultural resources. Regulation of commercial use, i.e. airboats. Ability to enforce regulations (all kinds). Human alteration of hydrology within and outside the Preserve. Conflicts between various types of users.

# NATURAL AND CULTURAL RESOURCES

Big Cypress National Preserve protects 728,865 acres of natural wetland communities in southwestern Florida (**Figure 1**). The Preserve was established in 1974 by Public Law 93-440 for the purpose of ensuring “the preservation, conservation and protection of the natural, scenic, hydrologic, floral and faunal, and recreational values of the Big Cypress Watershed in the State of Florida and to provide for the enhancement and public enjoyment thereof”.

## Natural Resources

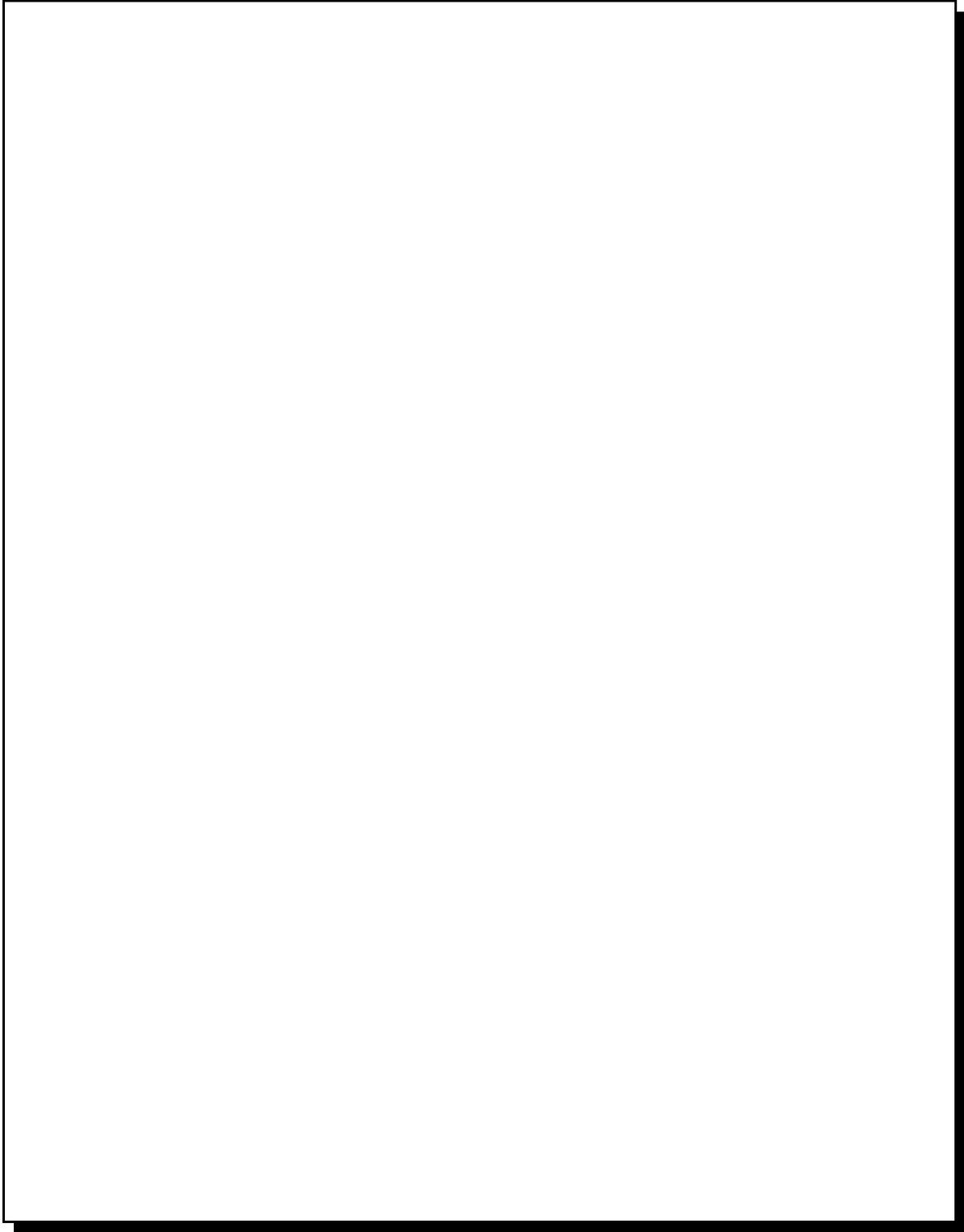
### Climate

The Preserve’s climate is characterized by hot, humid summers and mild dry winters (Duever and others 1986a). Precipitation is highly variable from year to year and across months of a year. Extended droughts and floods are common. Generally summers are wet with precipitation tapering off through the fall months. Winters are very dry and precipitation remains low until about May. Thunderstorms are quite common during the summer months with June through November considered the hurricane season.

### Geology and Soils

Geologic features and processes influence the Preserve’s general land forms and soils, which in turn influence the surface and groundwater runoff patterns that regulate hydroperiod. Hydroperiod, the duration of soil saturation, is the most significant factor controlling the species composition of plant communities and the frequency of fires (Duever and others 1986a). Various types of limestone bedrock underlie most the Preserve, generally only 10 to 40 inches below the ground surface. The area’s topography is flat but dips slightly to the south and west. Subtle differences in bedrock topography control hydroperiods and vegetation types. For example, bedrock lows form the broad channels occupied by strands and sloughs (Duever and others 1986a).

There are four general substrate types within the Preserve: rock, marls, sands, and organics. These are not soils in the true sense as they lack layers of mixed mineral and organic materials with characteristic profiles (Duever and others 1986a). Carbonate marls are the most widespread, formed by periphytic algae growing as mats or covering vegetation. Sands and peats are commonly mixed into these marls. Sands are also common throughout the Preserve, derived primarily from old shoreline deposits and the weathering of rocks. Organic soils are more rare but are environmentally significant. Peats and organic muck have the greatest capacity for storing water and nutrients, making them an important soil component. Peats are derived from organic litter that accumulates in inundated areas where the oxygen necessary for decay is lacking (Duever and others 1986a). Exposure of these soils to the air results in their rapid decay and oxidation, or “muck fires” may consume them leaving only ash.



**Figure 1.** Big Cypress National Preserve.

## Hydrology

The Preserve's hydrology is governed by subtle differences in its topography. Topographic features determine the course of surface waters while rock formations determine the paths groundwater follows (Duever and others 1986a). During the summer rainy season the shallow aquifer fills and the water table rises above the ground surface. Initially surface flows occur only in the deeper sloughs and strands. As water levels rise further water moves into the marshes. Water then moves down gradient across the land surface as sheet flow. The rate of water movement is remarkably slow because the terrain slopes an average of less than one foot per mile. Water flows range from zero when water levels are low, to about 65 feet per hour during high water (Duever and others 1986a). Water levels normally fluctuate three to five feet annually, with surface water levels typically rising from one to two feet above the ground surface in lower areas.

Canals, roads, and other human disturbances that affect topography both outside and inside the Preserve can significantly alter the flow of surface waters and alter hydroperiods. Raised obstructions parallel to the direction of water flow have minimal effects, but those perpendicular to flow act as levees, causing longer and deeper inundation on the upstream side and reduced inundation downstream (Duever and others 1986a). Canals and other depressions such as deep ORV rutting may also alter hydroperiods by hastening the drainage of some localized areas or extending inundation in areas where water is channeled.

## Plant Communities

The characteristics and composition of the Preserve's plant communities are directly influenced by hydroperiods and soils. The cypress and mixed swamp forests are the dominant vegetation type within the Preserve (Duever and others 1986a). These wetland forests include cypress domes and strands, shrub thickets, dwarf or scrub cypress, and due to the logging of overstory bald cypress, mixed swamp forests often dominated by a variety of hardwood species. The once dominant bald cypress grew to 130 feet and diameters of 7-10 feet, relatively few of these large trees remain today. Other prevalent plant communities are prairies, marshes, sloughs, and ponds. These communities are dominated by herbaceous vegetation and range from dry prairies with low saw palmettos, to wet marsh communities with forbs, sedges, and grasses, to ponds with submerged and floating aquatic plants. Pine forests are another common vegetation type in upland areas. The slash pine is the dominant overstory tree with understories comprised of saw palmetto, mixed grasses, and cabbage palms (Duever and others 1986a). Hardwood hammocks also occur in upland areas and are dominated by oaks growing to form a closed dome canopy.

Fire is also a critical determinant of the composition and succession of plant communities. The Preserve's plant communities have evolved for thousands of years under the influence of fire and many plant species have adaptations that allow them to coexist with or even depend upon frequent fires for their survival.

Big Cypress is noted for its substantial diversity of plant species, caused by its diverse environmental conditions and an overlapping distribution of temperate and tropical plants. Upwards of 1600 species have been identified and 70 species are under review for federal

protection, are protected by the Florida Department of Agriculture, or are listed by the Convention on International Trade in Endangered Species (NPS GMP 1991, see Tables 23 and 24, pp. 169, 170). Additional listings of plant species that are endangered, threatened, rare, or are species of special concern are listed in Duever and others (1986a, see Table 5.2, pp. 105-107).

Thousands of non-native plant species have been introduced to South Florida and some 250 species may be considered naturalized in the region (exotic species capable of reproducing without human care)(Duever and others 1986a, see Table 5.6, pp. 119-125). Most of these species are dependent upon disturbed vegetation and soils and are not able to invade or successfully reproduce in undisturbed wetland settings. Less than 10 species likely pose a significant long-term threat to native plant communities, including melaleuca, Brazilian pepper, Australian pine, water hyacinth, and hydrilla. These exotic plants are already widespread within the Preserve and several are subject to active NPS control programs.

### **Wildlife**

The Preserve supports a wide diversity of aquatic and terrestrial wildlife, however, many species have not yet been studied and even fewer have been observed for their responses to ORVs. Both wet and dry areas within the Preserve are required to support wildlife. Pine forests and inland marshes, ponds and sloughs are considered the most critical and heavily used habitats for the largest number of species within the Preserve because these habitats offer a diversity of wet and dry areas (Duever and others 1986a). The wetter areas support aquatic and amphibious species, and the dry areas accommodate mammals. Prairies and coastal marshes are the most important feeding areas, particularly for wading birds, because prey is highly visible and mobility is easier. Pinelands are important breeding and shelter areas for mammals and vertebrates. Hammocks are used for refuge and offer high ground during the rainy season when much of the Preserve is inundated with water.

There is no single habitat type that is less valuable than another because the Preserve protects habitats that are readily diminishing in South Florida. For example, wading birds such as Little blue herons, ibis, wood storks, and great egrets are increasingly depending on the Preserve for feeding grounds. Because they are highly susceptible to human disturbance their populations are being reduced in many other areas of the state. Fish species within the Preserve account for a large percentage of the aquatic animal biomass and are a critical link in the South Florida food chain. Although invertebrates are not well known (beyond crayfish, mosquitoes, and apple snails), it is known that their species composition and population numbers are quite sensitive to changes in hydroperiod (Duever and others 1986a).

A total of 34 species in the Preserve receive some level of protection or are recognized as rare species by the state of Florida, the federal government or the Convention on International Trade in Endangered Species (NPS GMP 1991, see Tables 25 and 26, pp. 176-178). Endangered species include the Florida panther, wood stork, West Indian manatee, bald eagle, Cape Sable seaside sparrow, snail kite, and the red-cockaded woodpecker. The Preserve's GMP contains additional discussions regarding endangered species and the factors that affect them.

At least 22 exotic animals have been found within the Preserve, 18 of which are known to be from breeding populations (NPS GMP 1991, see Table 28, pp. 190). Notable among these are European feral hogs and armadillos, both of which are widespread and create significant disturbance within the Preserve. Additional listings of exotic animals of South Florida may be found in Duever and others (1986a, Tables 6.10-6.13, pp. 178-179).

## **Cultural Resources**

The early Calusa Indians and the more recent Seminoles and Miccosukees lived and hunted throughout the area, though their use has diminished since the late 1920s when they moved to reservations bordering the Preserve (Duever and others 1986a). The Preserve also has a lengthy history of logging, grazing, farming, and oil extraction. The area was extensively logged in the 1930s through the mid 1950s (Duever and others 1986a). Slash pine and cypress were the primary timber species. Trains were used to extract the logs and most track was laid at ground level though some elevated tramways were constructed. Cattle grazing has also been conducted in the area of the Preserve since the early 1900s. However, the range is considered to be very poor quality and cattle grazing within the Preserve is being phased out (down to four leases of which one is active). Fire was used commonly by cattlemen to recycle nutrients and increase the quality of forage. Farming operations were also common as early as 1930 and continuing through the early 1950s (Duever and others 1986a). Approximately 10,000 acres were farmed, primarily for tomatoes. The remnants of these old fields are still visible from the air. Oil and gas exploration and extraction date from the late 1930s and is still active in the Bear Island and Raccoon Point areas of the Preserve today. Commercial interests in these activities throughout the Preserve continue.

Archeological surveys within the original Preserve boundaries have located 395 sites, including black earth middens, sand mounds, transient camps, and rock accumulations (GMP 1991). The majority of sites were considered to be in good condition but adverse effects could result from vandalism, animal burrowings, and activities at inholdings. Additional treatment of this topic may be found in the GMP (NPS GMP 1991).

Recreational activities with ORVs was not common until the 1940s, though various types of motorized vehicles were used for logging, farming, and oil exploration dating back to the 1920s (Duever and others 1986a). Many of the current ORV trails follow routes established by these former land use practices. Physical evidence of some of these historic land uses remain visible today in the form of dikes, canals, and the remains of structures.



# ORV USE AND MANAGEMENT

## Off-Road Vehicle Visitor Use

Off-road vehicle riding is a traditional and popular recreational activity within BCNP, originating in the 1920s. A variety of off-road vehicle types have been used to navigate the swampy terrain permitting access to the Preserve's vast backcountry. These include street legal four-wheel drive vehicles (4x4s) or trucks, all terrain vehicles or cycles (ATVs/ATCs), swamp buggies, airboats, and tracked vehicles. ORVs are an integral part of many recreation activities within the Preserve, particularly hunting. ORV use is regulated to maintain the ecological integrity of the Preserve, as directed by Preserve's legislation. Topics discussed in this section include ORV use within the Preserve, characteristics of ORVs and their riders, ORV management, and non-motorized visitor uses.

Hunting and ORV riding have been the primary recreational uses of the Preserve. Hunting increased substantially in the 1950s and 1960s due to population increases, more leisure time, and the development of ORVs that made travel across the swamp easier. Deer, turkey, and hogs (feral) are the principal species hunted. Hunting is managed jointly by the Florida Game and Fresh Water Fish Commission and the National Park Service. Hunting seasons currently run from September 7 through April 6. The principal weapons are rifles, shotguns, bows, and muzzleloading guns; bird dogs and waterfowl retrievers are the only dogs permitted for hunting. Hunting from ORVs is prohibited, with the exception of airboats when not under power and stopped.

## ORV Use Data

ORVs have become an established, and many would say indispensable, means of transportation for hunting, fishing, frogging, bird watching, and riding. ORVs are also used by grazing management and oil exploration lease holders. The NPS uses ORVs for administrative purposes that include patrolling, prescribed burning and fire fighting, research and monitoring, and conducting searches and rescues.

No data on ORV numbers could be located for years prior to 1980, when the NPS implemented a mandatory registration for all ORVs operated in the Preserve. NPS ORV permit data since 1980 are presented in **Table 1**. Tracked vehicles were never commonly used in the Preserve and were banned in 1988 due to research findings that showed they were more impacting than other ORV types (Duever and others 1981). ORV numbers have ranged from 871 in the first year of permitting to 2255 in 1992. Fluctuations in the number of ORVs permitted each year primarily reflect water levels within the Preserve, with fewer registered vehicles in the wetter years (e.g. 1995) when portions of the Preserve are closed to hunting. Overall, ORV numbers have remained fairly stable at around 2000 vehicles.

**Table 1.** Number and type of ORVs operating within the Preserve based on NPS permit data.

<b>Year</b>	<b>ATV/ATC</b>	<b>Buggy</b>	<b>Street Legal</b>	<b>Airboat</b>	<b>Half Track</b>	<b>Full Track</b>	<b>Totals</b>
<b>1980</b>	361	180	176	130	10	14	871
<b>1981</b>	1154	508	347	195	22	26	2252
<b>1982</b>	1042	162	464	166	5	14	1853
<b>1983</b>	1012	174	404	133	10	4	1737
<b>1984</b>	1020	155	410	115	4	2	1706
<b>1985</b>	300	143	345	96	2	5	891
<b>1986</b>	300	586	165	238	14	21	1324
<b>1987</b>	456	794	348	328	17	37	1980
<b>1988</b>	507	810	393	371		1	2082
<b>1989</b>	512	756	398	323			1989
<b>1990</b>	580	733	334	261			1908
<b>1991</b>	812	773	315	274			2174
<b>1992</b>	872	773	314	296			2255
<b>1993</b>	842	735	270	331			2178
<b>1994</b>	584	559	193	250			1586
<b>1995</b>	303	135	108	87			633
<b>1996</b>	682	586	205	234			1707
<b>1997<sup>1</sup></b>	899	620	195	274			1992

1 - 1997 data as of 3/98

Because of its strong association with hunting, ORV use is heaviest during the fall, winter and spring hunting seasons. Opening weekends of hunting seasons and holidays receive the greatest usage. Accurate data on ORV-related visitation is unavailable, though several efforts have been made to gather such information. Duever and others (1986a) attribute the substantial increase in ORV trails visible in aerial photographs from 1953 to 1973 to increased recreational ORV use, primarily associated with hunting. A 1970 study estimated 40,000 man-days of use per year in the entire Big Cypress region (Everglades Jetport Advisory Board). Duever and others (1986a) estimated that roughly 2,500-4,000 ORV-related hunters may be present in the Preserve at peak use times (weekends) during the hunting season. Jansen (1986) reported results of a ground-based vehicle survey within the Preserve. The mean number of hunting related vehicles counted on Saturday surveys was 178 and on weekday surveys was 27. No visitor estimates were derived from these vehicle counts. Bozzo and Schortemeyer (1995) reported 15,910 man-days of use for the Preserve in 1993-94, slightly less than the five year average of 17,105.

The NPS also estimates Preserve visitation annually in several categories (data are number of overnight stays): NPS frontcountry campgrounds, tent camping = 3,529, recreational vehicles (RVs, not ORVs) = 10,886; backcountry camping = 12,959 (NPS 1996). As part of this planning effort a survey was prepared and distributed for five of an originally planned 12 month period to document the current amount and distribution of ORV use. However, the response rate

on these monthly use surveys was too low to ensure validity (generally < 35%). The survey was therefore terminated early and data are not reported.

### **Characteristics of ORVs**

**Street Legal 4x4s:** Street legal four-wheel drive off-road vehicles and trucks which are commercially manufactured and sold are very restricted in the extent of their access within the Preserve. These vehicles require the driest driving conditions and rarely venture very far into the Preserve's backcountry. As a group this ORV type is the heaviest with a mean weight of 4,431 pounds (based on 1996/97 NPS permit data). On average, they comprise approximately 18% of the ORV permits registered with the NPS, though this varies from year to year.

**All-Terrain Vehicles:** Smaller three- or most commonly four-wheeled cycles, called all-terrain vehicles (ATVs) are also commercially manufactured and sold. These vehicles are also fairly restricted to drier terrain as they lack the clearance required for deeper water and mud. They also lack the ability to carry camping gear and supplies on extended overnight backcountry trips. However, they are less expensive to purchase and maintain, easier to transport, and can penetrate wooded areas more easily than other ORV types. These vehicles are the smallest and lightest ORV; current four-wheel drive models range in weight from 400 to 600 pounds with engine displacements from 300 to 600 cc's. On average, ATVs comprise approximately 39% of the NPS ORV permits.

**Swamp Buggies:** Swamp buggies include a very wide variety of custom designed and built vehicles. Often built and maintained by their owners, these vehicles have a wide range of configurations based on the frames, engines, number of axles, and wheel sizes used. Their weights range up to 7160 pounds with an average of 3,629 pounds (based on 1996/97 NPS permit data). These vehicles are less restricted in their access and can carry several individuals and supplies deep into the backcountry on extended trips. However, they are more expensive to build and maintain, less reliable, and require substantially larger trailers to transport to and from the area. On average, swamp buggies comprise approximately 30% of the NPS ORV permits.

**Airboats:** Airboats are also custom designed and built, comprised of a shallow rectangular aluminum hull and powered by aircraft or automobile engines that drive a large aircraft propeller. This ORV type is generally restricted to areas covered by deeper water as their hulls are easily damaged by rock outcrops or obstructed by trees. An advantage is their speed of transport, while wheeled ORVs travel very slowly, airboats are operated at 40 to 60 mph and can exceed 100 mph. They are also expensive and somewhat difficult to transport. On average, airboats comprise about 13% of the NPS ORV permits.

Use patterns within the management zones are directly influenced by terrain characteristics. Airboats can most easily negotiate the marshes and open prairies south of U.S. 41 and the Loop Road. Wheeled vehicles are used more frequently in shallow marl soils, sandy soils, and the drier upland areas north of U.S. 41. Swamp buggies are less restricted by open prairies and savannas. In more forested areas such as the Bear Island unit, swamp buggies are limited only

by the size of the vehicle and tires. ATVs are less confined to trails and can move faster but cannot traverse the marl or mucky soils as well as the swamp buggies. Street legal four wheel drive vehicles require mostly dry conditions and infrequently travel very far into the Preserve (NPS GMP 1991).

### Characteristics of ORV Riders and Visits

In a 1984 Florida Game and Fresh Water Fish Commission hunter survey reported in Jansen (1986), approximately 82% of Big Cypress quota hunters owned and used ORVs for hunting, 9% used someone else's ORV, and 9% didn't own or use an ORV. The vehicle with the highest ownership was the ATC but the vehicle of highest use was the swamp buggy, which was also the preferred vehicle for 39% of the respondents. In this survey the typical hunter had been going to the Preserve for 14 years and used the area 29 days per year of which 19 were spent hunting. The typical hunter hunted with a group of five family and friends and stayed at an established camp for three days. Hunters used a vehicle for hunting more in 1984 than in the past and supported vehicle use during muzzleloading, general gun, and small game seasons, but were undecided about their use during archery or spring gobbler seasons.

More current information about ORV riders was obtained from a survey conducted as part of this planning effort. A sample of 800 of the 1660 ORV NPS permit holders registered by spring of 1997 were sent a mail-back questionnaire in April of 1997. A stratified random sampling approach was used to obtain representative subsamples for permit holders for the four vehicle types. The survey had a response rate of 71% (Farrell and others Draft).

Nearly all of the respondents are male (98%) and white (80%); other significant ethnicities are Native American (11%) and Hispanic (11%). Eighteen percent of the respondents reported that they owned land within the Preserve, 7% live within the Preserve. The respondent's ORV vehicle types are: swamp buggy (48%), ATC (25%), airboat (14%) and street legal 4x4 (13%).

ORVs are used predominantly for hunting-related activities, though the survey revealed participation in a wide variety of non-hunting activities (**Table 2**). Most respondents visit the Preserve frequently, 67% estimated they have made more than 100 trips to the area. Over the previous 12 months 61% of the respondents reported they had visited the Preserve ten or more times, 16% visited 30 or more times. Most respondents spend two or three days per trip.

Hunters stay at frontcountry campgrounds and at backcountry camps in structures that range from primitive to elaborate. Approximately 500-600 backcountry camps existed when the Preserve was created. However, only 125 of these camps met criteria for exemption from federal acquisition and structures are being removed from properties as they are acquired. While most hunters access hunting camps by ORV, some walk in, and a few fly into one of the Preserve's four active backcountry airstrips.

ORV riding is a social activity. Most of the respondents visit the Preserve with family and friends (61%), 21% visit most frequently with just friends, 11% with just family, and only 5% visit the area alone. Respondents were asked about the role and importance of the ORV to their enjoyment of the Preserve. Seeing wildlife, the ability to reach a favorite destination, sharing activities with friends and family, and reaching a favorite hunting spot were the most highly rated items (**Table 3**). “Testing the ORVs durability” and “personal driving skills” were the two lowest rated items, suggesting that the “man and machine vs. nature” theme depicted in many 4x4 vehicle advertisements holds little or no attraction to Preserve ORV riders.

Respondents were also asked to indicate their extent of agreement with statements describing the importance of specific places, vehicle types, and routes used within the Preserve (**Table 4**). Results reveal a remarkably clear delineation and substantial agreement among ORV riders. Strong agreement was voiced for the statements “I like to explore new places in Big Cypress” and “I am very attached to a special place in Big Cypress.” Such statements indicate that ORV visitors are deeply attached to certain places such as hunting camps or favored hunting spots yet they also assign considerable importance to the opportunity provided by their ORVs to roam and explore the Preserve’s backcountry. The most strongly rated statement was “I am very attached to the ORV I use in Big Cypress,” likely reflecting the substantial work involved with constructing and maintaining ORVs such as swamp buggies and airboats.

**Benefits of ORV Recreation**

Past research has shown that many recreation outings produce long lasting benefits and valued experiences. As part of the planning effort selected Preserve ORV visitors were asked to describe and explain the experiences and benefits they received from their recreation. These individuals provided rich, detailed, and passionate descriptions of numerous ways in which recreational use of the Preserve improved their lives (Hull 1998). Preliminary analysis of information from these focus group discussions suggest that Preserve ORV users are similar in some respects to ORV riders in other parts of the country: they travel in groups; they prefer little managerial intervention; they see themselves as skilled risk takers and identify with others like

**Table 2.** Activities participated in by 1996 ORV permit holders in the last 12 months.

<i>Activity</i>	<i>Percent (N=542)</i>
Camping	81
General gun hunting (deer or hog)	81
Pleasure of driving an ORV	77
Pre-hunting season scouting	69
Fishing	68
Sightseeing	64
Muzzleloader hunting	62
Animal/birdwatching	54
Archery hunting	52
Spring turkey hunting	52
Visiting with members of my group	52
Photography	51
Visiting others (residents/campers)	50
Picnicking	48
Small game hunting	38
Frogging	34
Hiking	31
Swimming	20
Migratory game bird hunting	14
Other	10

**Table 3.** Role and importance of the ORV in recreational experiences.

Role of ORV	Mean Scale Rating <sup>1</sup>
See wildlife	3.8
Reach a favorite destination	3.7
Share an activity with friends or family	3.6
Reach my favorite hunting spot	3.4
Explore places where few others go	3.4
Scout new hunting places	3.2
Experience the simple joy of riding	3.2
Travel off the beaten path	3.2
Bring in equipment and supplies	3.0
Visit friends in other camps	2.6
Test the ORVs durability or power	1.7
Test my driving skills	1.6

1 - Scale: 1=Not at all important to 4=Extremely important

**Table 4.** Agreement with statements describing the importance of specific places, vehicle types, and routes used within the Preserve.

Statements	Mean Scale Rating	Percent Agree <sup>1</sup>	Percent Disagree <sup>1</sup>
I am very attached to the ORV I use in Big Cypress	4.5	89	4
I like to explore new places in Big Cypress	4.3	87	2
I am very attached to a special place in Big Cypress	4.1	73	5
I couldn't do what I do in Big Cypress with any other type of ORV	3.9	67	18
I keep going back again and again to the same place	3.7	63	20
I generally take the same travel route through Big Cypress	3.1	44	37
If amount of time needed to reach my destination in Big Cypress stays about the same, one travel route is as good as another	2.4	25	58
One management unit is as good as another for what I like to do	2.1	15	65
One type of ORV is as good as another for what I do in Big Cypress	2.0	15	75

1 - Scale: 1=Strongly disagree to 5=Strongly agree

themselves; they say the ORV experience is a way to release stress, revitalize spirits, and to gain a sense of purpose; they want to protect the natural environment; they enjoy opportunities for social bonding; and they value the ORV as a means to achieve solitude and immersion in nature.

However, preliminary analysis also suggest that Preserve ORVers are special in that they experience a high intensity of benefits and attachment to ORV riding in the Preserve. Importantly, many of the most significant benefits seem dependent upon their specific activities and/or upon specific places, as supported by information from the larger survey of ORV permit holders. The type and intensity of place and activity dependent benefits create connections between users, activities, and places that must be taken into consideration when selecting ORV management actions. Several of the benefits are introduced below using the words of people interviewed. These comments are not meant to be exhaustive nor representative but rather to give a glimpse into the benefits of ORV riding within the Preserve:

***Identity:*** The vehicles, activities and places are so significant to ORV riders that they provide a primary source of self-identity.

“When my parents were alive that was our recreation, we would go out there. We would eat wild pumpkins and turkey that we killed. When I go out there I remember those experiences growing up, and my daddy saying 'I want to kill one more deer before I die, son'... and he did... and I was with him--just him and I. It is part of my culture. I love it. When I die, that is where my remains will be, out there too. That is how important it is to me, and to a lot of my friends.”

“The vehicle is something you put the hours and the time into, and literally the blood, sweat, and tears. It is something that you respect and have some type of love for. You are a team, going through the woods. It makes you proud.”

***Spirituality:*** Nature provides recreationists everywhere a spiritual experience. Some ORV riders develop a deep spiritual connection to the land.

“We go out and we see nature and God on a one to one basis. When you're sitting on a buggy watching the sun drop into the western sky and its highlighting the plants, and the colors all change... you are seeing nature and God on a one-to-one basis. It is not something that is being interpreted by another human being, telling you what God should be. You don't need to go to church after you've been to the woods. You see it all.”

***Freedom:*** One of the most basic definitions of recreation is that it involves activities undertaken of one's free will. Typically, backcountry recreation is associated with opportunities for "unconstrained" experiences. Regulation of use can degrade this sense of freedom.

“I knew [the Preserve] when there was almost total freedom out there...you could go for miles,... nobody told you what you could do, you were on your own, you had to be self-correcting. It was just a wild, free experience...so I have a little difficulty these days being regulated, watched over, told what to do. That sense of freedom is harder to find.”

“There are signs all over the highway coming down here, ... when you put the signs out into the woods it takes what is on the road, what you are trying to get away from and puts it right on top of you... you could never get away from it.”

**Formative experiences for children:** Social science research demonstrates that recreation provides children with important opportunities for development. Participants described how ORV trips in the Preserve not only kept kids off the street and allowed parents to provide "quality time" with their children, but also provided opportunities for culture and nature study and promoted responsibility, integrity, self-confidence, and restraint.

“These experiences with friends and family build character, integrity ... a lot of the qualities you like to find in people. You take those lessons learned out here and apply them back in normal life, in your life in town, as a parent, everywhere.”

“It shows them to be self sufficient.... to be innovative. If a part does break down when they are back there you make do with what you can until you get back to the road. It is a good experience for younger people who are use to running down to McDonalds for a hamburger... you just don't do that in the swamp.”

**Other Benefits:** Past research suggest, and participants confirmed, that there exist numerous benefits associated with ORV recreation in the Preserve. Other benefits not described above include but are not limited to the following: sense of community, stress relief, escape from civilization, thrill and excitement, mental alertness, bonding with friends and family, environmental awareness and environmental ethic.

### Management of ORV Recreation

A variety of management actions have been implemented by the NPS to provide appropriate ORV recreational opportunities yet limit the resource degradation and social issues associated with ORV use. ORV owners must obtain a \$35 annual permit for each ORV operated within the Preserve. To receive a permit owners must bring their vehicles to the Preserve's Oasis Visitor Center for inspection and every five years for reinspection. During inspections Preserve staff check to ensure compliance with various ORV specifications such as safety features and tire width (see Off-Road Vehicle Guide, 1997-1998). Requirements related to minimizing impacts include the following:

- C ATVs - Tires must provide a minimum of 7 inches on the ground for front tires and a minimum of 9 inches on the ground for rear tires. This is measured as the flat or rounded surface of the tire contacting the ground during normal use of the ATV.
- C Swamp Buggy - Tires with a minimum of 9 inches on the ground front and rear.
- C Street Legal 4x4 - Tires same as for swamp buggies.
- C Airboats - None.

A current certified weight slip is also required for all swamp buggy and street legal registrations. While no specifications regarding ORV weights exist, this information has been collected to inform managers and planners in reviewing vehicle weights and evaluating the need for weight

restrictions. The mandatory vehicle registration and minimum tire width requirements were implemented in 1980.

Tracked vehicles were banned in 1988. Tracked vehicles were found to be causing substantially greater impact than the other ORV types (Duever and others 1981), primarily because they were commonly operated year-round in the most easily impacted habitats. ATVs were also temporarily banned for hunting use by the Florida Game and Freshwater Commission from 1985-90.

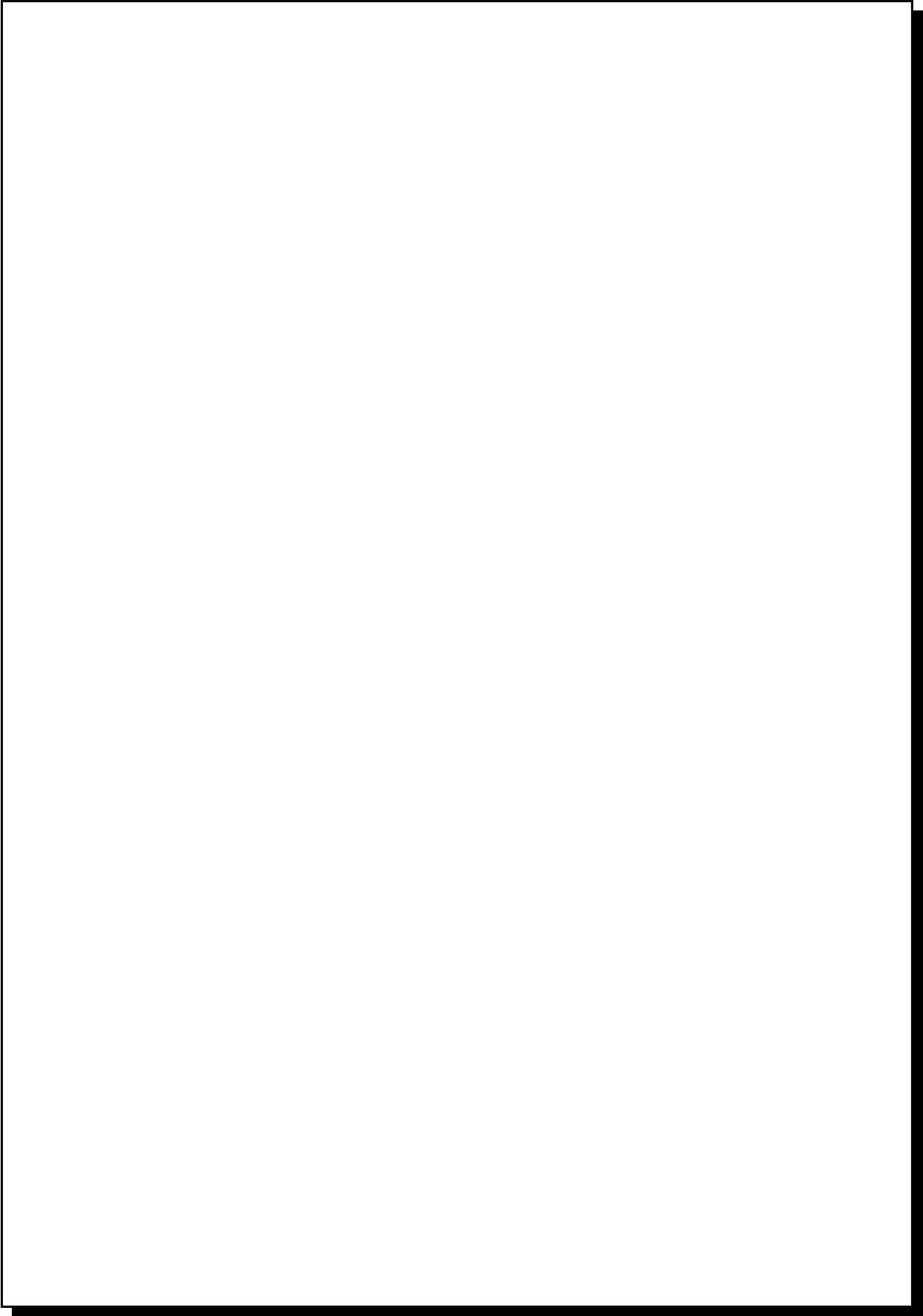
Vehicles may only be operated within designated areas or trails, as required by Executive Orders 11644 and 11989. Three general strategies are currently used to control ORV access within the Preserve. Area closures, permanent or temporary, are used to protect important or sensitive natural and cultural resource areas. Temporary closures may be justified for resource protection or visitor safety reasons, such as during extremely high or low water or when ORV activity might disturb the denning or nesting sites of protected species. Temporary closures might also apply only to a single type of ORV, such as closure of an area to airboats to limit impact during low water. Use of designated trails comprises the second strategy, for places where ORV use is appropriate but where important or sensitive resources areas require added protection from unlimited ORV access. Designated trails may also be identified in areas where unacceptable levels of ORV disturbance occur (NPS GMP 1991). The third strategy is dispersed use, with more existing trails and larger areas being designated open to ORVs. All three strategies have been applied in the management of ORV use at the Preserve, as shown in the unit-specific management descriptions that follow:

The Turner River and Corndance management units are currently designated as open to dispersed traffic for all types of ORVs, with the exception of the Florida National Scenic Trail and the Eleven mile road (with designated crossings) (see map **Figure 2**). However, the GMP allows for designation of trails and area closures within these units (NPS GMP 1991). Special management zones and restrictions were defined for the Stairsteps unit in 1990 to allow area-specific ORV management. This unit is the wettest and is often referred to as airboat country. Currently there are four special management zones (Figure 2). Zone 1 includes the Ochopee Prairie and has been closed to airboats since 1994 but is open to dispersed traffic for other ORVs. Airboats are prohibited from this zone because they have been shown to cause considerably greater vegetation and substrate disturbance when operated in shallow water (Duever and others 1981). Zones 2 and 3 are open to all ORVs but are differentiated to allow selective closures during exceptionally low or high water levels. Zone 4 is restricted to airboats, except in the Lostmans Pines area, part of which is open to all ORVs and part of which is open only to ATVs and airboats (see Figure 2). The Lostmans Pines area south of Gum Slough contains drier upland areas that permit wheeled vehicle use.

Within the Bear Island unit wheeled ORVs are restricted to approximately 50 miles of designated trails, 22 miles of which are above-grade roads developed by the oil and gas industry



**Figure 2.** Big Cypress National Preserve maps showing ORV use access by management unit. Continued on facing page.



(which has active oil pads in the area) (see map, Figure 2). These restrictions were initiated in 1989 to minimize potential disturbance to Florida panthers, to control hunting pressure on panther prey, and to protect important resource areas. This unit, along with the Addition lands, contain the highest densities of panther. In 1991 designated trails in this unit were marked by white fiberglass posts and travel off designated trails was prohibited. Most of the area is within one mile of an ORV trail, with no area farther than two miles.

ORVs are prohibited within the Loop and Deep Lake units and within the Addition lands. The Loop unit has been closed to ORVs since 1977 in order to provide a primitive area for recreation (including hunting) and a control area for determining the effects of ORV use (NPS GMP 1991, p.49). The Deep Lake unit was closed to ORVs in 1989 because of the unit's important resource areas and documented panther habitat, and concern for illegal and unchecked hunting which are difficult to enforce because of the unit's accessibility from surrounding roads (NPS GMP 1991, p.48). This closure was also expected to reduce hunting pressure on panther prey species as well as potential disturbance from ORV use of panther habitat. The Addition lands have been closed to ORVs since their acquisition by the NPS in 1996. This closure was implemented to provide time to study panther use of the area without ORVs present and to allow considerations of ORV use and management options included in this plan. Private property owners within the Addition lands are permitted to use ORVs to access their properties but must obtain NPS permits to cross federal lands.

ORV management regulations are published in the Code of Federal Regulations (36 CFR 1.5 and 7.86) and modified as necessary to address management issues and concerns as they arise:

These regulations now prohibit the operation of ORVs in a manner that could adversely affect the preserve's resources. Damaging and irresponsible practices, such as "mudding," racing, and tug-of-war contests with ORVs, would continue to be prohibited. Cutting vegetation, ditching, filling, or other activities to build new trails or improve existing trails would also continue to be prohibited. As provided by 36 CFR 7.86, the superintendent has authority to close portions of the Preserve to ORV use if the use represents a threat to resources. Executive Order 11989 requires immediate closure of areas or trails, or the discontinuation of certain vehicle types, whenever it is determined that ORV use "will cause or is causing considerable adverse effects on the soil, vegetation, wildlife, wildlife habitat or cultural or historic resources of particular areas or trails" of the Preserve. The public would be notified before any area or trail was closed, or a vehicle type was discontinued, under such conditions." (NPS GMP 1991)

ORVs are prohibited on the Florida National Scenic Trail, except for required and designated crossings. ORV use will also not be permitted on any new mineral access roads, which could increase and concentrate recreational use in previously remote areas and consequently cause unacceptable resource impacts (NPS GMP 1991).

### ORV Management Decision Process

The following criteria, specified in the GMP (NPS GMP 1991), are applied by the NPS to determine which trail segments or areas should be closed to ORVs:

- C Vehicle use causes or would cause extensive ponding or erosion.
- C Soils, vegetation, wildlife, or wildlife habitat are or would be adversely impacted.
- C Multiple trails cut through sloughs, strands, or other important resource areas.
- C Cultural resource sites might be threatened by vandalism or erosion.

The NPS applies these criteria as part of an ongoing management process. Issues and concerns related to ORV use arise from a variety of sources, including Preserve staff, research and monitoring programs, Preserve visitors, staff of other Federal and State agencies, stakeholder organizations, inholders, and others. Generally, these issues and concerns are brought up and discussed at weekly meetings of senior Preserve staff. Such evaluations consider Preserve mandates as defined by legislation, agency management policies, and planning guidance in making determinations of whether specific issues exist that require management attention or action. When problems are identified, Preserve staff conduct more intensive background fact-finding to describe the problem and develop a broader understanding of the problem and its underlying causes. Such efforts frequently involve background investigations of published literature, agency records, and letters from the public, and may also involve phone calls to agencies, organizations, and individuals, and public announcements.

Where management actions are deemed necessary and appropriate, Preserve staff identify alternative actions, evaluate the pros, cons, and management constraints associated with each alternative, and select a preferred alternative. The public is generally notified prior to implementation of management actions, particularly those that directly affect Preserve visitors. Following implementation, Preserve staff continue to evaluate the effectiveness of the applied action to determine if further action is needed. This management decision making and review process is a continuous process applied to ORV management and other recreation management and resource protection issues.

Management of the Bear Island designated trail system provides an example illustrating the application of this process. The designated trail system was established in 1988 and fully implemented in 1989, in accordance with direction provided by Executive Order 11644 and the GMP. The original trail system sought to use existing above-grade roads and at-grade routes and to avoid sensitive sites. Since then Preserve managers have made several adjustments in the extent and location of the trails to minimize resource degradation. In 1992 there were 63 miles of designated trail. A post-season evaluation revealed that some trails required rerouting to avoid unacceptable levels of resource impact. In 1993 seven miles were therefore omitted from the system and other trails were rerouted through more upland areas to improve tread resistance. In 1994 two additional miles of trail were eliminated.

### **Resource Monitoring of ORV Effects**

Resource monitoring involves the systematic collection and comparison of standardized resource measurements from different times to predict or detect natural and human-induced changes. The National Park Service's Management Policies (NPS 1988) require the use of monitoring programs to support management decision making:

“The National Park Service will assemble baseline inventory data describing the natural resources under its stewardship and will monitor those resources at regular intervals to detect or predict changes. The resulting information will be analyzed to detect changes that may require intervention and to provide reference points for comparison with other, more human-altered environments.” (Chapter 4:4)

“Backcountry use will be managed to avoid unacceptable impacts on park resources or adverse effects on visitor enjoyment of appropriate recreational experiences. The National Park Service will identify acceptable limits of impacts, monitor backcountry use levels and resource conditions, and take prompt corrective action when unacceptable impacts occur.” (Chapter 8:3)

“Potential impacts on soil resources will be routinely monitored.” (Chapter 4:20)

“Any restrictions on recreational use will be limited to the minimum necessary to protect park resources and values and to promote visitor safety and enjoyment. To the extent practicable, public use limits established by the National Park Service will be based on the results of scientific research and other available support data.” (Chapter 8:2)

Managers require scientifically valid research and monitoring data. As with other prominent and critical resource issues, managers can no longer afford a wait-and-see attitude or rely upon subjective impressions of deteriorating resource conditions. When establishing policy for managing ORV visitation, such data could describe the condition of ORV trails, relationships between trail condition and visitor use or environmental attributes, and the likely effects that visitor activities have on biophysical, social, and managerial environments. These relationships are complex and not always intuitive. A reliable information base, therefore, is essential for managers who seek to develop and implement effective visitor and resource management policy.

Monitoring programs can be of significant value when providing managers with reliable information necessary for establishing and evaluating resource protection policies, strategies, and actions. When implemented properly and with periodic reassessments, these programs produce a data base with significant benefits. Monitoring programs provide an objective record of resource conditions, even though individual managers may come and go. A monitoring program may help detect and evaluate trends when data is compared between present and past resource assessments. It may detect deteriorating conditions before severe or irreversible changes occur, allowing time to implement corrective actions. Analysis of monitoring data may assist in the selection of appropriate management actions and reveal their effectiveness over time.

Limited resource monitoring programs to evaluate ORV effects have been conducted at the Preserve. Pernas (1991) developed a comprehensive ORV designated trail and area monitoring proposal that has not been implemented due to insufficient funding. The proposal called for monitoring at 15 permanent sites within the Preserve to evaluate physical conditions on ORV trails, including trail width, depth, and vegetation cover loss. Some monitoring of the designated trail system within the Bear Island unit has been conducted to assess the effectiveness of management actions. Monitoring of airboat impacts within the Ochopee Prairie has also been conducted beginning in 1993-94. Resource impairment caused by heavy commercial airboat use prompted this monitoring work which measured changes in soil topography, vegetation, and wildlife. The area was closed to airboats and monitoring is currently documenting natural recovery in the area. Monitoring of water turbidity associated with commercial airboat use in Halfway Creek was also conducted in 1988-89. This effort included the collection of monthly turbidity samples from four sites and the use of aerial photographs to examine turbidity plumes.

Current monitoring efforts have used permanent line transects established perpendicular to the ORV trails at selected sample points. Along these transects trail depth, ridge height, and trail width data are collected to characterize the ORV trail at that location. Cross-sectional area measures are calculated from the trail depth measurements in order to track overall rutting and soil displacement over time. The width of trail devoid of vegetation cover and vegetative composition and cover data collected within sampling plots located within and adjacent to the trail are used to document changing vegetation conditions. Wildlife monitoring at Ochopee Prairie was limited to frogging activities. Considerable research and monitoring of the endangered Florida panther has also been conducted within the Preserve.

Aerial photography offers another efficient opportunity for monitoring the distribution, overall length, and condition of ORV trails within the Preserve. Color infrared photographs taken in 1994/95 at 1/10,000 scale are currently being examined to map all ORV trails within the Preserve. This work is being conducted by The University of Georgia's Center for Remote Sensing and Mapping Sciences and is scheduled for completion by March, 1998. The ORV trails will be available for analysis in both database and Geographic Information System (GIS) data layers. This work provides a comprehensive baseline which can facilitate efficient and accurate monitoring of ORV impacts in the future. Some potential indicators that can be assessed using photographs include total length of trails, total area of disturbance, trail density, and trail width.

ORV impact monitoring programs conducted in other areas may also be consulted for additional guidance. The most developed program has been implemented at the Turkey Bay off-road vehicle area at the Land Between the Lakes area in western Kentucky and Tennessee (Chilman and others 1991, McKnelly 1980). A monitoring program was initiated in 1972 and has evolved over time to include assessments of vegetative, soil, and wildlife effects. Some monitoring has also been conducted to evaluate ORV effects in California's extensive network of ORV use areas (Smith 1980).

## Non-Motorized Visitor Uses

A variety of non-motorized recreational activities are also enjoyed by visitors to the Preserve. These activities include camping, hunting, hiking, canoeing, wildlife observation, photography, fishing, sightseeing, off-road bicycling (limited to Bear Island unit), swimming, and picnicking. The Preserve has limited facilities and programs that support these recreational activities. The Preserve has one small visitor center, two picnic areas, eight small primitive campgrounds, and two interpretive trails. A section of the Florida National Scenic Trail also provides opportunities for backcountry hiking and camping.

The most popular non-motorized recreational activities are camping, hunting, sightseeing and wildlife observation while driving or stopping along roads, fishing, picnicking, and canoeing. Walk-in hunting, particularly to the Loop and Deep Lake units, is a popular activity during hunting seasons. Driving the Turner River and Loop Roads to view birds, alligators, and other wildlife in the roadside canals are particularly popular. Fishermen also commonly fish in roadside canals. Mountain biking is gaining in popularity, though it is limited to above-grade roads such as those found in the Bear Island unit. Canoeing is also popular in season along Turner River and Halfway Creek.

Many pass-through visitors do not see and are likely not affected by the Preserve's ORV use. Commercial businesses offering airboat or buggy rides are more evident to visitors. Frontcountry visitors do likely witness ORV use or its environmental effects at ORV access points along Preserve roads. However, few non-motorized visitors venture off roads or other prepared surfaces or engage in backcountry recreation. Exceptions include walk-in hunters, Florida Trail hikers, mountain bikers, canoeists, and campground visitors. These visitors are much more aware of and affected by the Preserve's heavy ORV visitation. Interactions between these visitors and ORV use are discussed further in later sections.

Due to its national status, additional information is presented on the Florida National Scenic Trail. The Florida Trail received national designation in 1983 and is one of only eight Scenic Trails in the country. The trail is incomplete presently but is planned to extend some 1,300 miles from Big Cypress National Preserve to the Gulf Islands National Seashore in Florida's western panhandle. The trail provides backcountry hiking experiences to Preserve visitors and is the only designated hiking trail within the Preserve. Section I (the Oasis Section) of this trail was established by the Florida Trail Association in the early 1970s. Beginning at a Loop Road trailhead, the trail extends north eight miles to the Oasis Visitor Center and another 30-35 miles to a new rest area along I-75. Several informal campsites are located along the trail. Section II (the Seminole Section) of the trail will begin at I-75 and run north through the Addition lands to Clewiston, a distance of approximately 65 miles. Approval for the siting of this section of the trail has not yet been granted by the NPS.

Some disagreements between hikers and ORV users have occurred regarding the siting (location) of the Florida Trail. However, foot traffic is more limited by high water levels than ORV use so the siting of the hiking trail on the highest available ground should generally take precedence. Designated crossings and a no-ORV use trail corridor are also needed but have yet to be established.

# PLANNING ISSUES AND CONCERNS

## Assessment and Description of Issues and Concerns

This ORV management planning process sought to use a participatory and collaborative planning process to identify and incorporate the ideas and concerns of many people and organizations throughout south Florida and elsewhere. Toward this end the project team conducted extensive public outreach efforts including meetings, visitor surveys, newsletters, a World Wide Web Website, and extensive E-mail correspondence. These efforts provided a forum to encourage interested individuals and organizations to learn of and participate in the planning process.

Information gathering related to the scoping of ORV planning issues and concerns began with meetings with Preserve staff and interviews with individual employees. These meetings sought to identify ORV management issues and concerns from the perspective of the managing agency. The names of potential stakeholders, organizations and individuals with an interest in or affected by ORV management decisions, and various subject matter experts were also solicited. Stakeholders and experts were then contacted and meetings were arranged to gather their perspectives on issues and concerns, and to request the names of additional individuals and organizations with whom the project team should meet.

Meetings with people outside the Preserve occurred at their request and had the purpose of providing or gathering information about the ORV planning effort. Many contacts with people from the general public precipitated from several newspaper articles printed on either Atlantic and Gulf coasts of Florida and/or from press releases issued by the Preserve announcing the planning effort. Organizations included ORV and hunting groups, hiking clubs, traditional environmental groups, employees or friends of Miccosukee or Seminole Tribes, state agencies, and other Federal agencies. Project staff members also contacted several people because of their special expertise with ORVs, ORV effects, or ORV management.

At each meeting, regardless of whether with NPS employees or others, Project staff members conversationally asked several broad questions: Why is the backcountry of Big Cypress National Preserve important? What makes it important? Why do they care about it? What are their concerns about the Preserve, ORV riding, or its management? Which of these concerns are most important to them and why? What do they see as getting in the way of resolving those concerns? How could those things that get in the way be removed? How might they, their organization, or their division (for NPS employees) help remove these barriers? What actions would they like to see taken to improve the Preserve or to improve ORV riding? What actions would they like to see taken to manage ORV riding in the Preserve? What would they like to see done to resolve their concerns about the Preserve, ORV riding, or its management? How do those actions protect or conserve what they consider most important about the Preserve or ORV riding there?

Responses to these questions supplied important information about the issues and concerns that guided our planning efforts. Information gathered from these meetings was summarized and returned to participants for verification. Points raised in the discussions dramatically broadened the planning team's understanding of ORV use within the Preserve, especially because many divergent perspectives were represented. The participatory planning efforts and development of the social science survey, ORV Management Practices Manual, and this plan benefitted from the insights provided by those who participated in these meetings.

Preliminary issues and concerns from these meetings were highlighted in the first ORV planning newsletter with a request for additional input. This newsletter was distributed to an estimated 1600 people, including ORV permit holders, Preserve private property owners, hunters, stakeholder organizations, and interested individuals. Newsletter responses from 165 individuals were also incorporated into the issues list. Finally, additional issues and concerns gathered from subsequent meetings and correspondence were incorporated into the list.

A content analysis was used to identify and describe repetitious or dominant issues and concerns based on planning oriented categories. In general, these were issues mentioned by at least 10% of the respondents. An effort was made to include both specific and general categories of issues to reflect both the breadth and depth of the issues and concerns. The final listing was divided into two broad categories, 15 topical categories, and 106 issues (**Table 5**). Many ORV issues and concerns are linked to broader issues of Preserve policy and management. Examples include the NPS management philosophy, previous management actions, public participation in planning and management, relationships with other agencies, and perceived public rights. These issues were included in the first broad category titled "General Management or Policy Issues and Concerns". Other ORV issues and concerns are more directly linked to the ORV planning effort, including topics like planning needs, effects of ORV use on the environment and other Preserve visitors, ORV management actions, and plan implementation. Finally, issues and concerns related to non-ORV management topics like hunting and fire management were identified but are omitted here as they lie outside the scope of this plan.

These issues and concerns provided an early basis for guiding the planning effort though they did not constrain it. For example, additional concerns arising from Congressional legislative mandates and from agency policy and planning documents, scientific literature, the visitor survey, and correspondence were also considered.

Selected issues were also rated by Preserve ORV permit holders in the ORV permit holder survey conducted for this planning effort (see earlier survey description in the Visitor Use of the Preserve section). Results relative to these issues are presented in **Tables 6 and 7**. Only a subset of the preliminary issues were included in this survey.

**KEY to outline:**

- I. Broad category
  - A. Topical category
    - 1. Issue or concern

**Table 5.** ORV planning issues and concerns.

<b>1) General Management or Policy Issues and Concerns</b>
<b>1.1 Management Actions: Perceptions of ORVers/Hunters.</b>
<ol style="list-style-type: none"> <li>1. NPS “attitude”: management philosophy (very dominant concern with differing perspectives on the intentions of the attitude).</li> <li>2. Too much (management) control: hunters controlled, water controlled, ORVers controlled.</li> <li>3. Consistency in the rules from one year to the next (mentioned often).</li> <li>4. Too many rules.</li> <li>5. Fees: too expensive.</li> <li>6. Adequate and timely notification of ORV rules/regulations.</li> <li>7. Management actions justified according to “resource” concerns appeal less to ORVers than justification that also refers to “visitor” concerns.</li> <li>8. Loss of access to Preserve.</li> <li>9. ORV restrictions: least amount needed to prevent permanent detrimental effects.</li> <li>10. Ad hoc decisions: little consistency.</li> <li>11. Unclear justifications (e.g. criteria) for closures or other management actions.</li> <li>12. Perception of arbitrary closures.</li> <li>13. Access to private lands within the Preserve.</li> <li>14. “Band-aids” instead of progress.</li> <li>15. Fear that any action is just the beginning.</li> <li>16. Permit money: where does it go?</li> <li>17. Mismanagement of water levels so that the Preserve is flooded due to human interference, not rainfall. (Some people think water management occurs at the Preserve’s management unit level).</li> <li>18. Conspiracy theory: NPS and environmental extremists are working to eliminate ORVs and hunting, possibly with this project as a front, perhaps with the blessings of the United Nations. (A minority view).</li> </ol>
<b>1.2 Public Participation</b>
<ol style="list-style-type: none"> <li>1. Lack of communication (big concern).</li> <li>2. Rejection of ORVers concerns by NPS, EPA, courts, etc. (No sense of political standing).</li> <li>3. Access to management and planning processes (openness sought).</li> <li>4. Desire for a participatory role in management processes.</li> <li>5. The Preserve caters to the ORV constituency: participation by others is futile.</li> <li>6. Participation by individuals is overshadowed by organizations: improve opportunities for individuals to participate</li> </ol>
<b>1.3 Internal Management Decisions and Participation</b>
<ol style="list-style-type: none"> <li>1. Differences in management philosophy within Preserve staff.</li> <li>2. Preserve has an identity crisis: lack of widespread recognition.</li> </ol>

<b>1.4 Relationships between NPS or ORV Planning Effort with other Federal Agencies</b>
1. Role and influence of other agencies: U.S. Fish and Wildlife Service, Environmental Protection Agency, Army Corps of Engineers, and others.
<b>1.5 Relationships with State Agencies</b>
1. Disagreements between NPS and Florida Game and Fresh Water Fish Commission (GFC): this concern was heard from individuals, groups, organizations, GFC staff, and NPS staff (a very big concern).
<b>1.6 Rights vs. Responsibilities</b>
1. Many hunters and ORVers believe they have a right to ORV riding in the Preserve. 2. Many others, including ORVers, believe they have a responsibility to act in a responsible manner. 3. Still others see a need to clarify what is a right and what is not, regarding ORVs in the Preserve.
<b>1.7 Information and Education</b>
1. Need better dissemination of information 2. What does the NPS know, anyway? Suggests a need to design a participative educational program. 3. Expanded education materials and programs are needed to address ORVs and hunting.
<b>1.8 “Meddlesome” Influences</b>
1. NPS biologists (i.e., their reports cause the problem). 2. Lawyers (i.e., their lawsuits cause the problem). 3. Cultural animosity/tension: perceived as a problem by some. 4. Researchers and planners who don’t know the area or who don’t spend any time in the Preserve. 5. Emotionalism: much rhetoric with little constructive open-mindedness.
<b>2) ORV Management or Policy Issues and Concerns</b>
<b>2.1 ORV Planning Effort: Guidance and Integration with other Efforts.</b>
1. Integration of ORV planning effort with efforts of State or other Federal agencies. 2. What are the limits or boundaries of this planning effort? What restrictions have been placed upon it? 3. Legislation: what are the mandates (both for ORV and Preserve management)? 4. Backcountry experience: how does this fit with the purpose of the Preserve? How doesn’t it? 5. ORV Management Plan must apply a scientifically (biologically) based approach. 6. The plan must be fairly simple and straightforward, not a cumbersome monster. 7. The plan must be objective: sources of information must not be biased but balanced. How are conclusion going to be reached? 8. Openness with all materials: participants are expecting to review project materials as those materials are produced. 9. The planning team lacks familiarity with the Preserve and has not spent enough meaningful time there. 10. An advisory panel consisting of local residents and Preserve visitors is needed to assist the planning team. 11. Failure of NPS to recognize that the American people own the Preserve and that the NPS is only a caretaker who works for the people, not the owner in the traditional sense. (A frequent comment). 12. The Planning effort must ensure that the area is protected or conserved for children, grandchildren, and future generations (A frequent comment)
<b>2.2 ORV Plan Needs</b>

1. Definitive set of long-range goals for ORV management.
2. Address non-ORV activities and interests in conjunction with ORV planning effort.
3. Think long-term.
4. Recognize that the Preserve is just part of a far larger ecosystem under great stress.
5. Simple, effective decisions, not impractical or overly-burdensome ones. Effects or Consequences of ORV Use
6. Apply the best science possible in an open, participatory manner. Effects or Consequences of ORV Use

**2.3 Effects or Consequences of ORV Use**

1. Unclear what damage/effects are caused by ORVs: direct, indirect, and cumulative effects to physical, biological, and social components of the Preserve.
2. Effects of ORVs on vegetation: composition, cover, life history, phenology.
3. Exotic vegetation: substrate disturbance and creation of ruts and berms by ORVs might increase an area's susceptibility to exotic invasion.
4. Effects on sensitive species of plants or animals: snail kite, Florida panther, etc.
5. Effects on microhabitat.
6. Effects on biodiversity.
7. Effects on animals and their habitat.
8. Conflicts with non-motorized Preserve visitors: several comments from individuals and groups support the concern that ORV-related activities lead some people to avoid the area altogether or during certain times.
9. Real or perceived benefits of ORV use: some changes to vegetation and substrates appear to be beneficial to wildlife.
10. Some effects of ORVs lead to conditions that substitute for conditions lost by human development in south Florida.
11. ORVs as a means of access for elderly, children, handicapped, etc.
12. Effects on water quality, quantity, and flow: significance of effects?
13. Speed: noise, greater effects on soil and vegetation.

**2.4 ORV Specifications**

1. Size of ORVs: need limits.
2. ORV sizes and tire: suggest carefully considered restrictions.
3. Vehicle design: width, weight; tire size and type, engine power, clearance, and ground pressure (psi), limited slip differential transmissions, etc. Banning ORVs / No regulation of ORVs.
4. Need a clear, concise definition of what vehicle characteristics are acceptable. The definition should not constrain future innovations that may reduce effects.

**2.5 Banning ORVs / No regulation of ORVs**

1. ORVs should be banned
2. There should be no regulations and ORVers should be left alone.

**2.6 ORV Management Actions**

1. Lack of information: does revegetation work? What are the effects of ORVs on water flow? What is the distribution of use?
2. Incorporate existing, regularly used trails.
3. There is too much concentration of vehicles in confined areas.
4. Designated trails: don't like them based upon Bear Island experience.

**Planning Issues and Concerns**

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<ol style="list-style-type: none"> <li>5. What areas should be open, closed, reopened, etc.?</li> <li>6. Water: when to open/close an area to hunting or ORVing?</li> <li>7. How to mitigate the effects?</li> <li>8. What might be the effects of management actions?</li> <li>9. What are realistic maintenance options?</li> <li>10. Insufficient crossings of Turner River.</li> <li>11. Need buffer on either side of Florida Trail: buffer from sound and disturbances.</li> <li>12. Should consider a daily limit on vehicles.</li> <li>13. There should be a well designed and publicized way for people to anonymously report problems they see.</li> <li>14. Must incorporate the need for landowners to access property with in the Preserve.</li> <li>15. Access to Deep Lake and The Loop units should be greater (easier): many ORVers feel it is only equitable that reopening these units should be on the table, just as closing other units or areas is on the table.</li> <li>16. Deep Lake and The Loop should remain closed: many ORVers, walk-in hunters, and non-ORVers feel strongly about this.</li> <li>17. Required vehicle weighing is harassment when there are no vehicle restrictions based on weight.</li> <li>18. Who's going to enforce any regulations or limits that come from this effort? How?</li> <li>19. Greater law enforcement presence is needed to deal with criminal activities: illegal hunting, head crashing (intentional vegetation disturbance to scare out hunted animals), theft, etc.</li> </ol>
<p><b>2.7 Implementation: Management Aspects.</b></p>
<ol style="list-style-type: none"> <li>1. Change: don't want it. Some people fear any change and want things to remain as they are, despite fairly common agreement that "as they are" is not great.</li> <li>2. Want the Preserve to remain open for the next generation.</li> <li>3. Lack of money: government's lack of funds; Congress cutting NPS budget.</li> <li>4. Will NPS abide by same rules?</li> <li>5. Involvement of ORVers in monitoring and implementation is needed.</li> <li>6. Native Americans: rights, privileges, preferences, resources, etc.</li> <li>7. Process: what happens when and why (referring to this project and to future management decisions).</li> <li>8. Fear of a "one-size-fits-all" approach to management: the Preserve is too big and complex for simplistic approaches.</li> <li>9. Implementation responsibility: who's in charge?</li> </ol>

**Table 6.** ORV permit holder's perceptions about selected issues with respect to the management unit they most frequently use.

<i>The Number of:</i>	<i>N</i>	<i>Too few</i>	<i>About right</i>	<i>Too many</i>	<i>Don't know</i>
		----- Percent -----			
Rules and regulations	543	1	44	54	1
Preserve Rangers on patrol	541	22	61	14	3
ORV recreationists seen per day	535	16	73	8	3
Non-ORV recreationists seen per day	528	19	59	10	12
Hunters seen per day during hunting seasons	537	10	72	12	5
Groups camped within sight or sound of your camp	537	13	62	14	11
<i>The Level of:</i>	<i>N</i>	<i>Too low</i>	<i>About right</i>	<i>Too high</i>	<i>Don't know</i>
Water level when you prefer to visit the area	531	12	55	30	3
Cost of annual ORV permit	546	3	50	48	<1
Level of law enforcement in the unit	545	21	63	13	3

**Table 7.** ORV permit holder's perceptions about selected problems with respect to the management unit they most frequently use.

<i>Problems</i>	<i>N</i>	<i>Not a Problem</i>	<i>Minor Problem</i>	<i>Moderate Problem</i>	<i>Serious Problem</i>
		----- Percent -----			
ORV impacts to vegetation	542	20	20	26	30
ORV impacts to soils	540	21	19	25	32
ORV impacts to wildlife	531	66	25	7	2
ORV impacts to water flow through Preserve	531	80	14	5	1
Noise from ORVs	542	72	18	6	3
Litter	542	83	9	4	2
Current rules and regulations	540	37	21	26	16
Frequent changes of rules and regulations	524	21	21	27	31
Poor communication of rules and regulations	526	24	19	25	32
Temporary closure of mgmt. unit due to high water levels	534	72	22	5	1
ORV "play" activities like "mudding"	535	35	41	18	6
ORV traveling too fast	522	23	20	26	33
Lack of suitable campsites	522	85	9	4	2
Inadequate facilities at campsites	545	56	17	10	10
Availability of parking spaces at access points	540	80	17	3	1

ORV permit holders were asked to provide their opinions on selected issues and problems with respect to the management unit they most frequently use. ORVers tend to feel satisfied with the current social conditions related to Preserve visitation (Table 6). Slightly more than one-half of the respondents feel that there are too many rules and regulations, but about one-fifth feel that

the number of Preserve patrol rangers are too few and the level of law enforcement is too low. Respondents are more evenly split on the issue of permit costs: 48% feel that the cost of a permit (\$35) is too high and 50% feel that they are about right (Table 6).

ORV permit holders have stronger opinions regarding the environmental impacts of ORV use, rules and regulations, riding behaviors, and facilities. Perceptions of environmental effects vary with the type of impact. For example, 80% of respondents feel that ORVs do not impact water flow through the Preserve and another 66% feel that ORVs do not impact wildlife. Noise and litter are also not considered to be problems at BCNP. Conversely, over one-half of respondents feel that ORV impacts to vegetation and soils are moderate or serious problems (Table 7).

In addition to being numerous (Table 6), current rules and regulations are also considered to be a moderate or serious problem for 42% of the respondents, while 58% believe that frequent changes in these rules are a moderate or serious problem (Table 7). Driving behaviors, such as driving too fast, is rated a moderate or serious problem by 59% of the respondents while activities like “mudding” are not generally viewed as a problem. Finally, the majority of respondents think that there are suitable campsites and parking facilities (Table 7).

## **Significant Issues**

A subset of the most significant issues was identified from the initial issues and concerns listing, with additional information from the ORV survey, correspondence, literature review, review of legislative mandates, and input from members of the planning team. Factors considered in this selection process included whether the issue fell within the scope of the planning process, whether the issue overlapped with other related issues, the overall importance of the issue, and the degree to which the issue might influence management actions and planning alternatives. Issues were grouped based on similarities and related issues were combined. The importance of the issue was evaluated based on the Preserve’s legal and administrative mandates, salient issues identified by the public, the scientific literature, and the judgement of planning project staff. In summary, issues identified as “significant” are those that reflect the most critical ORV use and management issues (ecological, social, and administrative) currently facing the Preserve.

## **Environmental Effects**

ORV use has been shown to cause disturbance to vegetation and soils and may also have negative consequences for wildlife, water quality and flow, and rare and endangered flora and fauna. These environmental effects are a significant issue because of the Preserve’s strong resource protection mandates and because the effects are spatially extensive, intensive in many areas, and are slow to recover. The cumulative impact of ORV use to significant Preserve features, such as water resources and rare and endangered species, are also unknown but potentially significant.

## **Conflicts with Non-Motorized Visitors**

ORV use can alter the Preserve's physical and social environments in ways that could conflict with non-motorized visitors. While there is generally no conflict in the physical or confrontational sense, there can be conflict with respect to visitor's expectations for certain desired experiences. For example, a non-motorized visitor may choose to avoid areas where vegetation damage and rutting are apparent or times (days or seasons) when ORVs are present. ORVers may not witness this form of conflict but park managers and planning staff have heard about it in letters and through meetings and personal contacts with non-motorized visitors. Throughout the balance of this plan the term conflict is used to refer to these more subtle, non-confrontational forms of interference.

### **Rules and Regulations**

The number of rules, intrusiveness of management control, frequent changes in rules, and fear of more restrictive rules is another central issue. These interrelated concerns are a significant and frequently mentioned issue among ORVers. Coincident with this issue was concern over the charging of ORV permit fees, including related concerns such as how fee money is used and why non-motorized visitors are not charged a comparable fee.

### **Management Rapport with the Public**

Lack of communication and lack of access to planning and management decision making comprise the final significant issue. Numerous individuals and organizations mentioned this issue and cited it as an important element of the controversy that has developed around ORV use and its management. For example, the rationale for management decisions related to regulations is not always fully explained or communicated and some non-motorized visitors and organizations feel that the Preserve caters to the ORV constituency.



## REVIEW OF LITERATURE

ORV research in terrestrial and wetland areas reveals the occurrence of vegetation, soil, water, wildlife and other natural resource effects. These effects are reviewed in Appendix 1 to provide a basis for ORV use planning and management within the Preserve. This review complements, updates, and expands the coverage of material previously included in the BCNP GMP and SEIS. Additional discussion of ORV environmental and social effects are included in the ORV Management Plan SEIS. Activities related to ORV use, such as hunting and camping, also contribute certain effects but are omitted from this review.

The environmental effects of ORV use are often referred to in the literature as impacts. However, many planning participants maintain that some effects have positive consequences for wildlife. For example, fish densities are often higher in the ORV ruts, a benefit to wading birds searching for food, a disadvantage to the fish who are more vulnerable to predation. In establishing the Preserve, Congress directed the NPS to assure the area's "natural and ecological integrity in perpetuity." Human effects on the Preserve's natural resources and processes should therefore be minimized or avoided where possible. Exceptions include instances where deliberate management actions, such as prescribed fires, seek to replace or mitigate the negative consequences of other, often unavoidable, human effects.

Congress also directed the NPS to assure the "recreational values of the Big Cypress Watershed in the State of Florida and to provide for the enhancement and public enjoyment thereof." Given that even limited ORV use will result in some degree of resource degradation it becomes the responsibility of Preserve managers to determine what level of degradation is acceptable, i.e., what are the acceptable limits of change. Thus, some environmental impact is unavoidable (acceptable) if recreational use is to occur. An additional objective of the literature review is to help identify the relative ecological significance of the various types of environmental impacts to aid managers and other decision makers in determining the relative acceptability of different types of environmental effects.



# ORV MANAGEMENT STRATEGIES AND TACTICS

This section introduces and describes ORV management strategies and tactics presented in an off-road vehicle management practices manual included as Appendix 2 to this plan. This manual is designed to serve as a comprehensive reference guide of ORV management practices. The ORV management strategies and tactics described within it are provided as a resource to planners, managers, and others involved in ORV management and decision making. The manual contains brief descriptions of a wide range of potential ORV management tactics, organized within 12 general strategies. Strategies are broad approaches that address underlying causes of problems (Manning 1979). Tactics are the specific means or actions used to implement a strategy (Cole and others 1987). These strategies and tactics have been compiled into a single document to facilitate their review both now and in the future. **These potential actions are not proposed, nor are they currently under consideration by the NPS either as part of or separate from this plan.**

As previously reviewed, laws passed by the U.S. Congress compel NPS managers to protect park resources and natural processes *and* to provide for appropriate recreational activities and experiences. Such management is inherently difficult. Numerous research studies have shown that even limited amounts of recreational activities, including hiking, camping, or ORV riding, can quickly cause changes to resource conditions. To some degree, these changes, or impacts, are unavoidable and must be accepted if recreation is to be provided. The critical and often controversial challenge for public land managers is to interpret congressional laws in judging when these impacts reach unacceptable levels and what corrective actions should be applied when they do.

Numerous strategies and tactics may be potentially applicable or effective in resolving any given management problem. This manual cannot identify the “best” strategies and tactics that are universally applicable in addressing various types of issues in diverse environmental or recreational use settings. Nor does it advocate one practice over another. Rather, selection of preferred strategies and tactics requires the careful consideration of many factors. Questions that need to be addressed in such a process include, but are not limited to, the following:

- C Has the problem been described in sufficient detail to gain a thorough understanding of its underlying causes and relationships to other contributing or affected factors?
- C Has the full range of alternative strategies and tactics been identified?
- C Have the pros and cons of alternative strategies and tactics been thoroughly described?
- C Have potential main- and secondary-effects of alternative strategies and tactics to all affected stakeholder groups been thoroughly described?
- C Have the administrative, staffing, and fiscal costs of implementing alternative strategies and tactics been identified and considered?
- C Have affected stakeholders been informed and involved in commenting on or participating in the decision process?

The U.S. Congress has delegated responsibility for managing Big Cypress National Preserve and its recreational uses to the National Park Service. Final decisions on management actions remain the responsibility of Preserve managers. However, decision making for selecting the most

appropriate and effective ORV management practices should consider, and where appropriate involve, representatives of the public and affected stakeholders. Selection of a preferred set of tactics requires consideration of many factors and is most optimal when stakeholders are involved in an open participatory process. Public participation may greatly increase the understanding and support of corrective efforts and may reduce the need for more restrictive tactics and/or long-term costs.

## **Presentation and Discussion of Strategies and Tactics**

This discussion provides additional guidance in selecting from among different strategies and tactics. Specifically, twelve strategies, organized under six topical categories, are described. The relative advantages and disadvantages are also discussed.

### **No Action**

No management actions are needed when existing environmental and social conditions are acceptable.

### **Modify Visitor Use Practices**

#### **Strategy 1: Educate Visitors to Adopt Low Impact Practices**

This strategy provides information that encourages the adoption of ORV use practices that prevent or minimize resource or social impacts. Education is the common theme for this strategy. Educational approaches seek to instill in visitors a greater understanding of how their recreational activity affects both the environment and the experiences of other visitors. Some impacts are avoidable. For example, use of a resistant trail results in less vegetation damage and rutting. Concentrating traffic on one or two resistant trails avoids the creation of many parallel or alternate trails. Similarly, avoiding travel close to areas used by non-motorized recreationists, such as campgrounds and hiking or canoe trails, reduces ORV and non-ORV conflicts.

A wide variety of ORV low-impact use practices specific to each vehicle type and to the Preserve's diverse habitat types and varying water levels need to be identified, compiled, and described. Such information could be communicated to visitors through a printed booklet, a short seminar, or a weekend workshop. Such efforts could be developed jointly between NPS staff and ORV riders. Tread Lightly!, a national non-profit organization devoted to the responsible use of ORVs on public lands, might also be contacted for assistance. Tread Lightly! has extensive experience working with agencies and ORV recreationists in developing educational materials and programs. This organization has already developed a national "Tread Lightly Guide to Responsible Four-Wheeling" booklet, though it would require substantial modification for application to the Preserve's unique environments and vehicle types. Additional information on effective techniques to convey such information to visitors may be found in Doucette and Cole (1993) and Martin and Taylor (1981).

Educational approaches are the most sensible and appropriate “first step” because they are light-handed and can reduce or eliminate avoidable impacts. Information and educational approaches foster ethical changes, with visitors willingly adopting low impact practices for the greater benefit of the resource and recreational environments. Such a strategy is generally preferred by both managers and visitors over more regulatory and heavy-handed strategies. If informed visitors voluntarily apply practices that minimize problems, then regulations can be less pervasive.

### **Strategy 2: Regulate Visitor Use Practices**

This strategy regulates ORV use by prohibiting particularly damaging practices or by requiring practices that prevent or reduce resource or social impacts. Some ORV riding practices are particularly damaging and must be prohibited. Such practices are avoidable and are not essential components of appropriate recreational experiences. As stated in the GMP: “regulations now prohibit the operation of ORVs in a manner that could adversely affect the preserve’s resources. Damaging and irresponsible practices, such as “mudding,” racing, and tug-of-war contests with ORVs, would continue to be prohibited. Cutting vegetation, ditching, filling, or other activities to build new trails or improve existing trails would also continue to be prohibited” (NPS GMP 1991). Regulations to resolve conflict between recreation groups include prohibitions from driving on or near hiking trails or in the vicinity of canoe trails and campgrounds.

Regulations may also be used to reduce the impact of standard ORV practices that are not necessarily avoidable. For example, regulations on swamp buggy or street vehicle weight, ground pressure, or tire type might produce vehicles that can be operated with less impact.

## **Modify Location of ORV Use**

### **Strategy 3: Encourage Dispersal of Traffic in Remote Areas**

This strategy seeks to prevent or reduce resource impact by distributing ORV traffic over a large number of trails so that individual trails are lightly used and able to recover on an annual basis. This strategy will generally be effective only in remote or infrequently visited areas. Duever’s research provides only limited support for this strategy (Duever and others 1981, 1986b). Vegetation, soil types, and water conditions in many areas of the Preserve naturally constrain vehicle traffic to a limited set of trails, preventing dispersal of traffic. Research also suggests that traffic would have to be dispersed to exceptionally low levels on an annual basis to prevent the formation of visible trails that do not fully recover in a one year period. For example, heavy buggies with tractor tires cut through vegetation cover and produced ruts after only a few passes in some habitat types. A dispersal strategy is somewhat more effective during drier seasons and for less impacting vehicle types such as airboats and ATVs.

Implementation of a dispersal strategy that is ineffective in reducing the number of passes to levels that preclude permanent effects can substantially increase the total area of disturbance or cumulative impact. Ineffective dispersal creates many more permanent trails

than are needed. For example, the common practice of “moving over” to a parallel but less rutted trail is appropriate in remote areas but inappropriate in popular areas, particularly in marl prairies. In moderate to high use areas this practice has created deep rutting over large areas and is therefore ineffective in reducing cumulative impact and should be discontinued.

Generally, dispersal will be effective only when travel options are numerous, habitat types are resistant, vehicle types are low-impacting on a per-pass basis, and amount of traffic in the area is low.

**Strategy 4: Encourage Concentration of Traffic in Popular Areas**

The areal extent or total area of disturbance of resource impact is reduced with this strategy by promoting the repeated use of a common set of resistant and/or maintained trails. Generally, greater concentration of traffic will result in greater reductions in the areal extent of resource impact because fewer trails are needed. However, the severity of impact will increase on the trails receiving concentrated use, often requiring maintenance to sustain traffic and limit trail widening and the development of multiple trails.

Implementation of this strategy by designating ORV trails in the Bear Island unit provides an illustration of the concentration strategy. Within this unit most of the ORV trails not selected for designations have already recovered. Preserve management has concluded that the increase in disturbance on the designated trails is more than offset by the recovery that has occurred on the extensive mileage of former ORV trails.

The provision of designated access points can aid in concentrating vehicle use in more resistant areas of the Preserve. The GMP proposed the development of 15 access points (NPS GMP 1991, Table 2, p. 47) though few of these have been formally constructed or developed.

A concentration strategy also has several requirements essential to a successful implementation. Resistant trails able to sustain heavy traffic must be available. If naturally-occurring or human-constructed resistant trails are unavailable then they must be created by the addition of fill material and/or geotextiles. Geotextiles are synthetic materials frequently used in road construction to reinforce soil stability, separate soils from fill material, and promote soil drainage. Trails may be constructed “at-grade” such that the trail’s surface extends no higher than surrounding substrates, or “above-grade” in which case frequent culverts or swales are needed to minimize interference with water movement. Fill materials and geotextiles may be used in maintenance efforts to correct problem areas that develop on all types of trails.

Options available for implementing a concentration strategy range from indirect (educational) to direct (regulatory). ORV riders could simply be encouraged to follow well-used resistant trails wherever possible and avoid the creation of new trails or use of lightly-used trails (which could recover). Alternately, managers could mark resistant trails and encourage their use by producing maps of their locations. Maintenance of such marked trails would further encourage their use, allowing less-used trails to recover. Another option is to require use of marked trails in heavily trafficked primary access areas but not in other areas. For example, several one to three mile access trails radiating from the Monument Lake

access area might be designated to reduce the extensive ORV trailing in this heavy use area. ORV riders would retain the freedom to select different trails beyond the ends of these access trails. Finally, ORV use within specified areas or management units could be restricted entirely to designated trails, the most restrictive application of this strategy.

### **Strategy 5: Reduce Use in Problem Areas**

Significant problems are often common in only a few popular areas. Such areas may be access areas, travel corridors, or popular destination areas. Intensive traffic in such areas frequently leads to resource or social problems. One option to address such issues is to reduce the use of these popular areas.

A range of options exists for achieving the reduction of use within popular problem areas. An indirect method is to simply describe the problems that are occurring within the area and requesting riders to avoid the area. Alternately, trail-related actions such as eliminating trail maintenance, removal of above-grade trails, or trail closures can be used to reduce use of such areas. Nearby ORV accesses could also be reduced in size or closed. Designation of ORV trailheads, as prescribed in the GMP, can also be used to redistribute or restrict use in selected problem areas. Quotas restricting entry into the area are a final option.

An important note of caution for this strategy is that actions to resolve problems in one area may merely shift use to other areas where those same or different problems may occur. Shifting use and problems is a short-term and unproductive solution. Generally use should not be shifted to other areas unless the areas receiving the additional use are in some way more resistant to the effects of use.

### **Strategy 6: Reduce or Prohibit Traffic in Sensitive Areas**

This strategy is similar to Strategy 5 with the exception that the problems occurring within an area are due to its sensitivity to environmental or social disturbance or fragility. Such areas may have rare or endangered species of plants and animals, cultural sites, a high density of wildlife nesting or denning sites, important resource values, easily disturbed vegetation and soils (such as marl prairies, flag lily ponds, or areas with needle grass), or support non-motorized recreational activities that are disturbed by ORV use.

Any of the methods described for Strategy 5 are also applicable to reducing use within sensitive resource areas. An additional option is closure of the sensitive area as, for example, closing an area around a cultural site or endangered plant population. Wheeled vehicle use within fragile marl prairies might also be discouraged or prohibited. Conflicts with other visitor groups are commonly resolved by establishing area or zone closures, such as around campgrounds or hiking trails.

## **Modify the Resource**

### **Strategy 7: Maintain Marked Trails**

Trails receiving concentrated traffic must be constructed and maintained to sustain traffic. As discussed under Strategy 4, whenever ORV traffic is concentrated onto fewer trails those trails must have the ability to sustain heavy traffic. Some trails have natural resistance due to their soils and drainage. Human-created at-grade or above-grade trails are also generally resistant. However, all trails will require at least some maintenance to avoid common problems of trail widening, excessive rutting, or the formation of multiple parallel trails.

Maintenance options include shifting locally-available fill material into the problem areas, importing fill material for placement in problem areas, or using geotextile materials. A combination of geotextile and fill materials are often the most cost-effective option. Little work or experience in South Florida environments with these materials exists, particularly with respect to their use in “at-grade” trails or roads. Additional research and management experience is likely needed to generate further guidance.

Ideally, trails should be no wider than necessary, sufficient to allow two vehicles to pass each other on high use routes and single vehicle width for lower use routes. The type and amount of vehicular access provided by a trail is also an important issue. The objective is to sustain passage of the type and number of vehicles that are appropriate or were historically common within a given area. Generally it would be inappropriate to improve trail standards so that additional traffic is permitted or that more limited vehicle types could access an area previously unavailable to them. Improvement of trail standards could dramatically change the character of visitor use within an area, for example, opening a previously remote and rarely visited area to substantial traffic and use.

Vehicles not equipped to travel in a given area could be prohibited by the construction of “slough gates” at backcountry accesses or at places along maintained ORV trails. Such gates would be placed at locations where travel around them would be difficult or impossible and would consist of a mud and water dip that must be traversed to gain entry to a particular area. If a vehicle could not traverse the slough gate then it is not appropriately matched for travel into that area.

Other important considerations relevant to any resource manipulation action include formal permitting to do such work and funding. Appropriate review and clearance by state and federal permitting agencies must be obtained for most types of trail maintenance work. Representatives of these agencies have suggested that some form of blanket approval may be possible for specified types of work. Trail maintenance work is expected to be expensive due to the large number and remoteness of ORV trails that require such work. Furthermore, maintenance work requires moving and placing fill material, which will likely limit work to the driest seasons and require specialized machinery.

### **Strategy 8: Rehabilitate Closed ORV Trails**

Recovery of soils and/or vegetation on ORV trails closed to use can be accelerated through resource rehabilitation efforts. This strategy seeks only to assist natural recovery of areas that have been closed to ORV use. Actions include reconfiguration of substrates to their pre-disturbance conditions and/or the planting of native vegetation of appropriate composition within disturbed areas. Duever’s research reveals that there are few natural processes that

act to restore displaced substrates but that vegetative recovery often proceeds quickly. Areas where substrates are not restored commonly develop vegetation of different composition than would normally occur due to altered water levels and hydroperiods. Subsequently, rehabilitation of substrates should generally be a higher priority than rehabilitation of vegetation.

On a cautionary note, rehabilitation and recovery work does not address the underlying causes of problems. This strategy should not be viewed as an effective option to permanently reduce ORV effects except in areas closed to use. Even in these areas limited trespass use can easily prevent recovery from proceeding. Areas reopened to ORV use will likely become impacted again, negating whatever recovery work was done.

## **Modify ORVs**

### **Strategy 9: Modify ORVs to Reduce Impacts**

Modifications to ORVs are made to reduce their potential for contributing to resource or social impacts. Research has shown that resource impacts vary considerably among ORV types (Duever 1981). For example, airboats operated in deeper water cause little impact, ATVs require far more passes to create a given level of impact than street legal 4x4s or swamp buggies. Measurable but less sizable differences were also apparent among the different types of swamp buggies tested in the Duever studies. It is clear that various ORV characteristics can be modified to make them less impacting:

Heavier vehicles create deeper ruts with fewer passes than those from lighter vehicles. Vehicle pressure on the ground surface can be measured as pounds/square inch (psi) or displacement of water. Both qualities can be manipulated by reducing vehicle weight and tire pressure and by increasing the number of tires or tire size. Vehicles with high psi or low displacement create deeper ruts with fewer passes than vehicles with contrasting attributes.

Vehicle clearance is primarily a function of wheel and tire sizes. Vehicles with six foot diameter tires can have a clearance of up to two feet. Such tires are typically narrow and the vehicle relies on trenching to solid substrates for traction. The exceptionally deep ruts created by such vehicles essentially ruin the trail for other vehicles with less clearance. Therefore restrictions on vehicle clearance could be used to limit depth of soil rutting and increase the ability of trails to sustain traffic.

More powerful engines permit greater speed which allow operators to engage in high impact practices such as “surfing” - running vehicles fast through deep water and driving vehicles through upland vegetation to drive out prey. More powerful engines are also heavier and more frequently spin tires, both of which cause a vehicle to create deeper ruts. Tire sizes and treads are also important. Smooth airplane tires flatten but do not chop up or tear vegetation and root mats or create ruts the way more aggressive tractor treads or tires with chains do. Lower air pressure can also improve traction while reducing the potential for impact.

Different engine types and mufflers can also reduce noise levels for all ORV types, an important factor given its potential negative effects to wildlife and known negative effects to non-motorized human recreation. Quieter vehicles can be developed and specifications on noise are an additional regulatory option.

Vehicle types other than those currently permitted within the Preserve should be periodically reviewed and considered. The goal is to create a low impact method of transportation - management regulations should foster rather than restrict innovation. Newer lighter-weight and extremely low psi tracked vehicles operated outside of airboat country may be far less impacting than travel with swamp buggies. Improved half-track designs and rubber tracks show promise for reducing vegetation damage and soil rutting. Specifications to reduce their size, weight, and potential speed would likely be necessary. Go-devils, boats with extended angled power shafts, appear to create less impact than airboats, even more so if noise is taken into consideration. While propellers do cut submergent vegetation the trails from these boats are far closer in appearance to muskrat trails than airboat trails and submergent vegetation recovers exceptionally fast. More importantly, go-devils cannot be operated in low water and therefore could never create the substrate displacement common to airboat trails. Research on this and other promising vehicle types is needed. Other vehicle types, even hovercraft, have been suggested as potentially lower impact alternatives.

Additional discussions between ORV riders and agency staff can likely yield an array of vehicle types and modifications with strong potential to reduce impacts associated with each vehicle type. Additional research may also be needed to evaluate the effectiveness of different vehicle types or modifications. Involvement by Tread Lightly! and sponsorship by vehicle manufacturers could also be helpful. For example, periodic competitions to create the least impacting vehicle, in various classes and types, could be sponsored to stimulate innovations.

Vehicle specifications imposed as regulations would have to be phased in over time to allow owners to modify their vehicles or purchase new ones. Alternately, ORV impact could be reduced by a program whereby ORV entry to areas of the Preserve are based on ORV specifications. Existing vehicles could be rated as high, intermediate, or low impacting using formulas based on various vehicle specifications. Vehicles with low ratings might then be allowed into more areas of the Preserve than vehicles with intermediate or high ratings.

### **Strategy 10: Restrict Particularly Damaging Types of ORVs**

This strategy seeks to reduce social or resource impacts by restricting or prohibiting particularly damaging types of ORVs. Restricted or prohibited vehicle types may refer to a class of vehicles, such as tracked vehicles, or to a sub-class within a particular vehicle type, such as tall tractor tire buggies. Restrictions may be area-specific, management unit-specific, or Preserve-wide. For example, certain vehicle types may be restricted from entering a specific zone of a management unit where its use would cause substantially greater impact than other vehicle types. More lengthy discussion on this topic is provided in Duever and others (1986b, pp. 42-45). Depending upon what criteria are employed, various types of vehicles would be prohibited from various habitat types in order to avoid

unacceptable impacts. Due to the significant burden that vehicle restrictions pose for ORV owners, any restrictions would have to be phased in over a period of years to allow owners to modify or replace existing vehicles.

## **Modify Timing and Amount of ORV Use**

### **Strategy 11: Modify Timing of ORV Use**

This strategy is based on the recognition that the sensitivity of soil, vegetation, and wildlife to ORV impacts vary by season. Impacts are reduced by limiting or prohibiting use during times of high resource sensitivity. Wildlife examples include closing an area around a bald eagle nest site, a panther denning site, or a bird rookery. Vegetation and soil protection can be enhanced by discouraging or prohibiting wheeled vehicle use during times when water levels are closest to substrate surfaces (when substrates are most prone to severe rutting). Substrate disturbance by airboats can be minimized by restricting or prohibiting airboat use during times when water levels are low. Even social issues, such as crowding and conflicts, may be addressed by shifting use away from peak use periods.

The timing of ORV use is largely dictated by the timing of hunting seasons. Any opportunities to shift use from the heavy use fall hunting season to the winter time period could substantially reduce ORV impact. Research by Duever and others (1981) has shown water levels to be a major determinant of vegetative and soil impact, with lower impact occurring during the driest time periods. However, movement of the deer hunting season is constrained by the fact that most bucks shed their antlers by January.

### **Strategy 12: Reduce ORV Use in General**

This more restrictive strategy seeks to resolve resource or social issues by limiting visitation. This strategy is often viewed as the most stringent, applied only when other strategies prove ineffective. However, in some instances visitors may prefer use restrictions over other strategies. For example, ORV impacts in an area such as the Turner River unit could be controlled by establishing a quota to regulate amount of impact. Those visitors permitted to enter could travel anywhere they please with few or no controls. Alternately, a designated trail system could be implemented to limit ORV impacts or vehicle specifications could be imposed. Given a choice, visitors may prefer quotas to designated trails or vehicle specifications. From a management perspective quotas are more easily and cheaply applied than a designated trails system with its high maintenance costs. In fact, funding limitations may dictate selection of this strategy over other more costly strategies.

Numerous methods for reducing ORV use exist, including advanced reservations, first-come/first-served, lotteries, changes in access, and fees. As established by the GMP, a limit of 2,500 ORV permits was set for the entire Preserve, with a lottery system to determine who receives permits if this level is exceeded. This limit has never been reached, the highest permit issuance was 2253 in 1992 (Table 1). The NPS does have the authority to close or limit use within specific areas or management units.

## **Conclusion**

These strategies and tactics, though designed to be comprehensive, should not restrict the scope of potential management actions. Ideas from ORV riders, NPS managers, staff of other agencies and organizations, and other interested individuals should be sought and incorporated into the ORV Management Practices Manual over time. This document should be modified and updated periodically to reflect changing vehicle types, management policies and approaches, and ORV management issues and concerns. Actions that may appear unrelated to ORV management may also be effective in reducing ORV impact. For example, hunters who do not operate from backcountry camps frequently stay at frontcountry campgrounds and commute to the backcountry each day to hunt. Provision of backcountry campsites might reduce some of this traffic and associated impact.

## **PLAN ALTERNATIVES: ORIGINAL PRESERVE**

The development of the proposed action and the alternatives was guided by the Preserve's establishing legislation, other Federal and State legislation and applicable documents, the General Management Plan, the issues and concerns identified in this planning process, and the involvement and participation of the public and agency staff. This plan is tiered to the GMP and relies upon planning work done for that document for general guidance. Highlights of this specific direction, including objectives and management strategies related to ORV use, were described in a previous section titled "Big Cypress National Preserve Plans."

The Preserve's General Management Plan identified and selected from four different alternatives for managing ORV use within the original Preserve boundaries. The selected alternative provides general guidance for this ORV Management Plan, which is therefore restricted in scope to two alternatives for the original Preserve lands. These alternatives are labeled the "No-Action (Status Quo) Alternative" and "Alternative A (Proposed Action) Alternative".

### **No-Action (Status Quo) Alternative**

The no-action alternative would continue existing National Park Service management programs as of 1995-96 within Big Cypress National Preserve. The NPS would continue to respond to future needs and problems as they arose, but no major change in management direction would be initiated.

Existing ORV management and decision making has been described in a previous section titled "Management of ORV Recreation" and in a subsection titled "ORV Management Decision Process." Existing regulations governing ORV use would continue under the no-action alternative.

### **Alternative A (Proposed Action)**

Alternative A constitutes the National Park Service's proposed action. This alternative would adopt a process for ORV management decision-making that would consider material presented in the "Planning Issues and Concerns" and "Review of Literature" sections of this plan, and be guided by discussion in the "ORV Management Strategies and Tactics" section and supporting information in the "ORV Management Practices Manual" included as Appendix 2 of this plan. Several additional recommended actions are also described and considered part of this alternative, subject to the availability of funding.

### **Recommended Actions**

Several additional recommended research, monitoring, and management actions are also proposed.

### **Research**

Research on four general topics is recommended:

(1) Research to evaluate differences in vegetative and soil impacts associated with differing vehicle specifications is needed to support development of lower impact vehicle types and to support management decision making. Different vehicle types and different vehicle specifications within vehicle types need to be evaluated. Reliable and efficient methods of rating vehicles according to their potential for creating vegetation and soil impact are needed.

(2) Research to evaluate the differing resistance and sensitivity to the effects of ORV traffic for Preserve vegetation and soil types is needed to guide the selection of resistant ORV routes. A dataset being developed at the University of Georgia provides comprehensive data on existing ORV trails and vegetation types that can be analyzed for this work. Such work should also collect, assemble, and integrate information on resistant route selection from experienced ORV riders. Recommendations for selecting resistant ORV routes in various vegetation and soil types and under various water level conditions should be summarized.

(3) Research on ORV trail construction and maintenance options and their relative effectiveness and cost are needed to support efficient and effective ORV trail maintenance efforts. A variety of construction and maintenance approaches should be investigated, including “at-grade” trails, and maintenance options such as existing fill, imported fill, and various geotextile/fill combinations.

(4) Research on the effects of different types and amounts of ORV traffic on the Preserve’s vegetation, soils, hydrology, wildlife, and visitors is also needed. The majority of existing ORV research is not applicable to the environmental conditions and ORV types found within the Preserve. Those few studies from within the South Florida region are limited in scope, dated, and have not been subjected to scientific peer review. Improved research designs for conducting such studies are now available. This research is critical to an improved understanding of ORV resource and social effects, knowledge which provides an essential foundation for management decision making.

### **Monitoring**

A comprehensive long-term ORV effects monitoring program is recommended to support ORV management decision making. ORV trail conditions should be monitored both on the ground, to document changes in vegetation and soil conditions at specific sample sites, and from aerial photography, to document changes in the overall distribution and number of ORV trails and their area of disturbance. The monitoring design and sampling locations and intensity should be sufficient to document and analyze differences in ORV effects across vegetation/soil types and across ORV types. Monitoring of wildlife effects and of ORV disturbance to Preserve recreational visitors should also be considered.

## Management

Several management actions are recommended in direct response to significant issues identified by individuals and organizations who participated in the ORV planning process.

***Environmental Effects:*** An enhanced program of education and information was a highly supported strategy to reduce or eliminate “avoidable” ORV impacts. Planning participants stated that current efforts could be strengthened and many indicated a strong willingness to volunteer and participate in such efforts. There are three components to this work: (1) documenting effective and appropriate low impact ORV riding practices, (2) determining which communication approaches will be most effective, and (3) developing and implementing preferred communication approaches. Educational approaches were viewed as the most sensible and appropriate “first step” because they address avoidable impacts and reduce the potential need for more regulatory actions. An increased presence by NPS Rangers in the backcountry (on the ground *not* in the air) to enhance both visitor contact and law enforcement was also a frequently recommended action.

Information contained in this plan, the proposed decision process, and the additional recommended research and monitoring actions, also directly address the important issue of environmental effects.

***Conflicts with Non-Motorized Visitors:*** Non-motorized visitors voiced concerns about both noise and vegetation and soil disturbance in frequently visited areas such as along hiking and canoeing trails and near campgrounds. Establishment of buffer zones around these areas where ORVs are prohibited, except for designated crossings, are recommended. Separation of these visitor groups within or between campgrounds and/or the establishment of quiet hours during evening and night time hours might also be investigated.

***Rules and Regulations:*** Existing ORV management is viewed as highly regulatory and many planning participants fear additional controls arising from this planning effort. Managers need to be sensitive to this issue when addressing future ORV management issues. While such regulations may be unavoidable, improved communications with ORV recreationists can help by describing ORV management issues and problems, alternative solutions, and the rationale for any actions that are selected.

***Management Rapport with the Public:*** Poor rapport with Preserve staff was another commonly voiced issue that can be addressed by improving communications to both organizations and individuals and providing greater access to the management decision process. While the authority to determine non-compliant conditions and select appropriate management actions resides with the NPS, frequent communication and involvement of stakeholders can improve decision making, public rapport, and compliance with management actions.



## **PLAN ALTERNATIVES: ADDITION LANDS**

The Preserve's boundaries were expanded by 146,000 acres in 1988 by The Big Cypress National Preserve Addition Act (P.L. 100-301). The "Addition lands" as they are commonly referred to, were not administered by the NPS until December of 1996. For this reason, and because the GMP planning was initiated prior to the Addition Act, these lands were not included within the scope of the 1991 GMP. The Addition lands are therefore not subject to the guidance of the GMP and a broader set of alternatives for their management relative to ORV use are included in this plan. Specifically, three alternatives are identified: "Alternative A: Closure to ORVs", "Alternative B: Full Access to ORVs", and "Alternative C: Designated Trail Access for ORVs", which is the proposed action. All other general ORV management guidance provided in this plan is equally applicable to lands within the original Preserve boundaries and the Addition.

### **Alternative A: Closure to ORVs**

Alternative A would prohibit ORV use in the Addition lands. This alternative provides maximum protection to the endangered Florida panther and maximizes opportunities for non-motorized recreational uses. The Addition lands contain higher ground than much of the original Preserve, providing good habitat for the Florida panther. Preliminary research investigating the effects of hunting and ORV use on the panther in the Addition lands suggest that there are no pronounced negative effects from these activities (Janis and Clark 1996). However, these scientists stress that additional data has been collected and that a final report is forthcoming. They also urge "a conservative management approach" given the tenuous nature of the panther.

Existing roads within the Addition lands north of I-75 also lend themselves to non-motorized recreational uses, including walk-in hunting, hiking, mountain biking, and nature observation. Separation of these recreational activities from ORV use areas avoids the potential for social conflicts.

### **Alternative B: Full Access to ORVs**

Alternative B would allow full ORV access to all areas of the Addition lands by designating them "open" to ORV use. The alternative provides maximum ORV access but limits protection of the Florida panther and increases the potential for conflict with non-motorized recreational activities.

### **Alternative C: Designated Trail Access for ORVs (Proposed Action)**

Alternative C would allow for ORV access on specifically designated trails and constitutes the National Park Service's proposed action. An assessment would be conducted to evaluate the resistance of existing roads capable of sustaining ORV traffic. Selection of routes designated for ORV use would also include consideration of important or sensitive resource areas and routes needed to accommodate non-motorized uses. This alternative balances resource protection needs to preserve undisturbed habitat for the Florida panther and other flora and fauna while providing limited ORV and non-motorized recreational uses.

## LITERATURE CITED

Aust, M.W. 1994. Timber harvesting considerations for site protection in southeastern forested wetlands. In: Proceedings of a Workshop on Water Management in Forested Wetlands. U.S. Environmental Protection Agency and USDA Forest Service, Southern Region. USDA Forest Service. Atlanta, GA. Technical Publication R8-TP 20, pp. 5-12.

Baldwin, M.F., Stoddard, D.H. Jr. 1973. The off-road vehicle and environmental quality. Washington, D.C. The Conservation Foundation.

Bean, M.J. 1988. The Endangered Species Act: Protecting the living resources of the parks. In: Our Common Lands, pp. 253-260, Island Press, Washington, D.C. 567p.

Berry, K. 1973. The effects of off road vehicles on the fauna at Dove Springs Canyon. In: Preliminary Studies of Off-Road Vehicles on the Northwestern Mojave Desert: A Collection of Papers, pp. 78-91. Kirsten H. Berry, (Editor). Privately published: California.

Berry, K.H. 1980. The effects of four wheel vehicles on biological resources. Edited by: Off-Road Vehicle Use: A Management Challenge. Richard N.L. Andrews and Paul F. Nowak (University of Michigan Extension Service) Michigan League. University of Michigan. School of Natural Resources. USDA, The Office of Environmental Quality.

Black, B.B., M.W. Collopy, H.F. Percival, A.A. Tiller, and P.G. Bohall. 1984. Effects of low level military training flights on wading bird colonies in Florida. Florida Coop. Fish and Wildlife Research Unit, School of Forest Resources and Conservation, University of Florida, Gainesville, FL. Technical Report No. 7.

Bozzo, J.A. and J.L. Schortemeyer. 1995. Big Cypress National Preserve deer and hog annual report. Florida Game and Fresh Water Fish Commission, Tallahassee, FL. 75 pp.

Brandt, K. and M.T. Brown. 1988. Noise impacts on wildlife and recreation: literature review and management recommendations. Florida Department of Environmental Regulation. Center for Wetlands, University of Florida, Gainesville Florida. Southwest Florida Water Management District, Tallahassee, FL, 25 pp.

Bury, B.R. 1980. What we know and do not know about off-road vehicle impacts on wildlife. In: Off-Road Vehicle use: A Management Challenge. Richard N.L. Andrews and Paul F. Nowak (University of Michigan Extension Service) Michigan League. The University of Michigan. School of Natural Resources. USDA, The Office of Environmental Quality.

Bury, R. L. , R. L. Wendling, and S. F. McCool. 1976. Off-road vehicles: A research summary, 1969-1975. Texas A & M University, Texas Agric. Exp. St.

## Literature Cited

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Byrne, S. 1973. The effects of off road vehicles in the Mojave Dessert on small mammal populations. In: Preliminary Studies of Off-Road Vehicles on the Northwestern Mojave Desert: A Collection of Papers, pp. 64-73. Kirsten H. Berry, (Editor). Privately published: California.

Chilman, K.C., J.J. Vogel and J.L. Conley. 1991. Turkey Bay off-road vehicle area at Land Between the Lakes. Tennessee Valley Authority. Southern Illinois University, Department of Forestry, 36 pp.

Cole, D.N., M.E. Petersen, and R.C. Lucas. 1987. Managing wilderness recreation use: Common problems and potential solutions. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Ogden, UT. General Technical Report INT-230. 60 p.

Doucette, J.E. and D.N. Cole. 1993. Wilderness visitor education: Information about alternative techniques. U.S. Department of Agriculture, Forest Service, Intermountain Forest Experiment Station. General Technical Report INT-295. Ogden, UT. 37 pp.

Duever, M.J., J.E. Carlson and L.A. Riopelle. 1981. Off road vehicles and their impacts in the Big Cypress National Preserve. USDI National Park Service, Big Cypress National Preserve. T-614. National Audubon Society, Ecosystem Research Unit, 214 pp.

Duever, M.J., J.E. Carlson, J.F. Meeder, L.C. Duever, L.H. Gunderson, L. Riopelle, T.R. Alexander, R.L. Myers and D.P. Spangler. 1986a. The Big Cypress National Preserve. USDI National Park Service, Big Cypress National Preserve. No. 8. National Audubon Society, 455 pp.

Duever, M.J., L.A. Riopelle and J.M. McCollom. 1986b. Long term recovery of experimental off-road vehicle impacts and abandoned old trails in the Big Cypress National Preserve. USDI National Park Service, Big Cypress National Preserve. SFRC-86/09. National Audubon Society, Ecosystem Research Unit.

Duever, M. 1995. Affidavit: Florida Biodiversity Project Lawsuit. United States District Court for the Middle District of Florida Fort Myers Division, 21 pp.

Geological Society of America. 1977. Impacts and management of off-road vehicles. Report of the Committee on Environmental and Public Policy.

Hall, R.B. and G.J. Walker. 1998. Scripting dynamic on-site recreation experiences: A case study of off-road vehicle use. USDI National Park Service, Big Cypress National Preserve. Final Research Report from Virginia Tech Department of Forestry. 66 pp.

Hinckley, B.S., R.M. Iverson and B. Hallet 1983. Accelerated water erosion in ORV-use areas. In: Environmental Effects of Off-Road Vehicles, pp. 81-96. Robert H. Webb and Howard G. Wilshire, (Editors). Springer Verlag New York Inc.: New York, NY.

Janis, M.W. and J.D. Clark. 1996. Interim report and recommendations: Effects of public use on Florida panthers at Big Cypress National Preserve. USDI National Park Service, Big Cypress National Preserve.

Jansen, D. 1986. Big Cypress public use study. Final Report for study E-1-10, part of the Florida Endangered Wildlife Panther Research and Recovery Plan. Florida Game and Fresh Water Fish Commission, Tallahassee, FL. 241 pp.

Jansen, D. 1994. Impacts of commercial use licenses airboat activities and frogging on the wildlife resources of Ochopee Prairie. USDI National Park Service, Big Cypress National Preserve. Ochopee, FL, 9 pp.

Knight, R.L. and D.N. Cole. 1995. Wildlife responses to recreationists. In: Wildlife and Recreationists: Coexistence through management and research. R.L. Knight and K.J. Gutzwiller (eds). Island Press, Washington, D.C. 372 pp.

Kockelman, W.J. 1983. Management concepts. In: Environmental Effects of Off-Road Vehicles, pp. 399-446. Robert H. Webb and Howard G. Wilshire, (Editors). Springer Verlag New York Inc.: New York, NY.

Manning, R.E. 1979. Strategies for managing recreational use of National Parks. Parks 4(1): 13-15.

McKnelly, P.K. 1980. Turkey Bay off-road vehicle area: its use and monitoring system. In: Off-Road Vehicle Use: A Management Challenge. Richard N.L. Andrews and Paul F. Nowak (University of Michigan Extension Service) Michigan League. University of Michigan. School of Natural Resources. USDA The Office of Environmental Quality.

National Rifle Association v. Potter. 1985. Court decision. 487 F. Supp. 443 (D.D.C. 1980), 628 F. Supp. 903 (D.D.C. 1985).

National Park Service. 1989. Turbidity investigation on Halfway Creek. USDI National Park Service, Big Cypress National Preserve, Natural Resource Management Ochopee Prairie Monitoring Program. Ochopee, FL, 8 pp.

National Park Service. 1992. General Management Plan & Final Environmental Impact Statement, Big Cypress National Preserve, Florida. U.S. Department of the Interior, National Park Service, Big Cypress National Preserve. 427 pp.

National Park Service. 1994. Resources Management, Big Cypress National Preserve. U.S. Department of the Interior, National Park Service, Big Cypress National Preserve.

National Park Service. 1993. Management Objectives Workshop: Big Cypress National Preserve. U.S. Department of the Interior, National Park Service, Big Cypress National Preserve. 19 pp.

National Park Service. 1996. Statistical Abstract, 1996. U.S. Department of the Interior, National Park Service, Public Use Statistics Program Center, Denver, CO. 64 pp.

## Literature Cited

---

Pernas, T. 1991. Big Cypress National Preserve ORV designated trail and area monitoring program proposal. USDI National Park Service, Big Cypress National Preserve. 9 pp.

Pernas, T., D. Weeks and C. Bates. 1995. Dye trace field study-Ochopee Prairie (unpublished data). USDI National Park Service, Big Cypress National Preserve. Ochopee Prairie Monitoring Program. Ochopee, FL, 4 pp.

Reisinger, T.W., and M. Aust. 1990. Specialized equipment and techniques for logging wetlands. In: Presentation at the 1990 International Winter Meeting Sponsored by the American Society of Agricultural Engineers. Chicago, Illinois. American Society of Agricultural Engineers. Hyatt Regency Chicago. ASAE Paper 90-7570.

Rennison, D. C. and A. Wallace. 1976. The extent of acoustic influence of off-road vehicles in wilderness areas. Department of Mechanical Engineering, University of Adelaide, Adelaide, Australia, 19 pp.

Rodgers, J.A. Jr. 1991. Minimum buffer zone requirements to protect nesting bird colonies from human disturbance. Florida Game and Fresh Water Fish Commission, Bureau of Wildlife Research. 7511, 8 pp

Sellers, R.W. 1992. The roots of National Park management: Evolving perceptions of the Park Service's mandate. *Journal of Forestry* 90(1):16-19.

Schneider, W.J., D.P. Weeks, and D.L. Sharrow. 1996. Water Resources Management Plan: Big Cypress National Preserve. U.S. Department of the Interior, National Park Service, Big Cypress National Preserve. 178 pp.

Sheridan, D. 1979. Off-Road vehicles on Public lands. Council on Environmental Quality, Washington, D.C.

Smith, T.C. 1980. ORVs and the California Department of Parks and Recreation resource management efforts. In: *Off-Road Vehicle Use: A Management Challenge*. Richard N.L. Andrews and Paul F. Nowak (University of Michigan Extension Service) Michigan League. University of Michigan. School of Natural Resources. USDA The Office of Environmental Quality.

Stebbins, R.C. 1974. Off road vehicles and the fragile desert. *The American Biology Teacher* 36:294-295.

Snyder, C., G. Frickel and R. F. Hadley 1976. Effects of off-road vehicle use on the hydrology and landscape of arid environments in Central and Southern California. United States Geological Survey. USGS Water Resources Investigation. Denver, Colorado.

Webb, R. H., H. C. Ragland and D. Jenkins. 1978. Environmental effects of soil property changes with off-road vehicle use. *Environmental Management* 2(3):219-233.

Webb, R.H. and H.G. Wilshire. 1983. Environmental effects of off-road vehicles. Robert S. DeSanto ed., Springer-Verlag: NY, NY.

Wellman, J. D., Buhyoff, G. J. 1978. Off-road vehicle use and social conflict at Cape Hatteras National Seashore. Virginia Polytechnic Institute and State University, Department of Forestry, Blacksburg, Virginia.

Yamataki, H. 1994. Agency position statement: condition of soils in ORV use areas at BICY. USDA Soil Conservation Service, 2 pp.



# **APPENDIX 1: Review of Literature**

## **Environmental Effects of ORV Use**

The following sections review the effects of ORV use on vegetation, soil, water resources, and wildlife. Though substantial literature on ORV effects in other areas was examined, the findings from this work are often not directly applicable to the Preserve due to differences in the environments and types of ORVs. Generally, literature from areas outside of south Florida is included only where necessary to address gaps in information. The principal South Florida studies include two reports by Duever and others (1981, 1986b) on the impacts and long-term recovery of ORVs within the Preserve and a report by Schemnitz and Schortemeyer (1972) in the Everglades Wildlife Management Area in Broward County. These studies are briefly described here as they are frequently cited in the following sections.

In the Duever studies, measurements of experimental effects in the various cypress habitats for all commonly used ORV types were taken in 1979, 1980, and again in 1985 (Duever and others 1981, 1986b). Recovery rates for soil and vegetation parameters, water flow speed in trails, temporal-spatial patterns of use and aesthetic effects were recorded. The effects of five types of swamp buggies, a three-wheeled ATV, an airboat, and a tracked vehicle were evaluated. Effects were evaluated in six vegetation types (small cypress, pine, marl marsh, peat marsh, and sand marsh) and for three levels of impact (one-pass, significant vegetation impact, and significant soil impact) (Duever and others 1981). The Schemnitz and Schortemeyer study evaluated the effects of airboats and tracked vehicles in a sawgrass vegetation type. Vegetative and soil effects were evaluated for one and five passes of airboats and for one (slow and fast), two, and five passes of halftracks.

The following literature review is limited in that so few studies have been conducted within South Florida on the environmental effects of ORV use. Furthermore, the three studies upon which much of this review is based are management reports which have not undergone scientific peer review. Material from these reports has also not been published in peer-reviewed journals so readers should consider their findings with some caution. Finally, a principal objective of the review is to present a comprehensive coverage of the most prevalent ORV use effects. Effects may be minor with respect to severity, geographical extent, or ecological significance. For example, Duever states this in his own words in his recent lawsuit affidavit:

“Based on my observations and studies of ORV activity in BCNP, it is my expert opinion that operation of ORVs in BCNP, while creating discernable effects on the Preserve, are not creating biologically or ecologically significant impacts on the overall BCNP ecosystem.” (Duever 1995)

## **Area of Disturbance**

ORVs are permitted within four of the six Preserve management units (493,898 acres, 85% of the Preserve). As prescribed in the GMP, ORVs are restricted to designated trails within one unit and have largely unlimited access within the remaining units. An extensive network of ORV routes have developed over the years, most of which is clearly visible from the air. ORV trailing is considerably less visible or evident on the ground due to the extremely flat terrain and the masking effect of taller vegetation. ORV trails crossing prairies and open areas frequently branch outwards in a braided pattern. Trails are more confined in number and width in more densely vegetated areas. The visual effects of ORVs were evaluated by the two Duever studies (Duever and others 1981, 1986b) as generally unsightly and demonstrated the slowest recovery rates of all parameters assessed.

Evaluations of the number, distribution, and total lineal length of ORV trails have been made from aerial photographs taken in 1940, 1953, 1973, 1985, and 1994. Estimates of the lineal lengths reveal their growth over time (**Table 8**). However, the photographs have been of varying scales and variable mapping procedures complicate the interpretation of these estimates. Generally, mapping for each year through 1985 have been based on only trails clearly visible without magnification [ORV trail maps occur in the following citations: 1940, 1953, 1973 (Duever 1986a, pp 301, 302, 305); 1985 (NPS GMP 1991, p 206); 1994 (not yet available)]. Mapping in 1994 was conducted from substantially larger scale maps with the aid of backlighting and stereoscopic instruments.

Many of the 1940 and 1953 trails were created primarily by logging, which ended in the 1950s (Duever and others 1986a). The greatly expanded trail system documented in 1973 is attributable primarily to recreational activities. The Preserve’s GMP conservatively estimated the existence of 1240 miles of ORV trails and 2,230 acres of related disturbance based on the 1985 aerial photography interpretations using an average trail width of 15 feet (NPS GMP 1991). The proposed action was to reduce this area of disturbance to 950 miles and 1,770 acres through closure of the Deep Lake unit and use of designated areas and trail systems in other units (cited only as an example, not intended to represent specific limits).

**Table 8.** Total mileage of ORV trails by year based on mapping from aerial photography.

<i>Photograph Year</i>	<i>Photograph Scale</i>	<i>ORV Trails (total miles)</i>
1940	1:63,000	93
1953	1:63,000	155
1973	1:75,000	1100
1985	1:63,000	1240
1994	1:10,000	Not Available

[Note: This section should be expanded to include some presentation of the additional ORV trail mapping work being done at the University of Georgia. Due to the larger scale maps being used and improved instrumentation these results will undoubtedly expand documentation of both the mileage and distribution of ORV trails. It will also provide an efficient and defensible method for monitoring ORV effects in the future.]

## Vegetation Effects

A number of direct and indirect vegetative effects have been documented in ORV impact studies. ORV use directly alters vegetation structure and reduces cover by breaking or crushing plants under vehicles or their tires. The most substantial vegetation impact found in the initial Duever study was reduced height of understory vegetation (Duever and others 1981). Duever's research reveals that understory vegetation is generally not particularly resistant to ORV disturbance. However, vegetative recovery is generally rapid unless vegetation is completely removed or the soil substrate is disturbed (Duever and others 1986b). Schemnitz and Schortemeyer (1972) and Johnson (1984) determined that sawgrass is particularly resilient, exhibiting high recovery rates in most plots. ORVs also indirectly affect vegetation by disturbing soils and plant roots and by altering water depths. For example, emergent vegetation may be prevented from growing in the deeper waters or disturbed substrates of ORV ruts. Vegetation disturbance and cover loss reduce vegetation biomass, the total weight or volume of all plant materials in an area. Vegetation disturbance also results in decreased protein content in plants, which is needed for foraging species (Schemnitz and Schortemeyer 1972)

The relative proportions of different plant species, or vegetation composition, are also altered by ORV activity (Duever and others 1981). The density of Golden Ragwort and cattails, for example, often increases in ORV ruts. In Duever's second study (1986b) a number of species occurred more frequently in undisturbed controls than in the test plots receiving ORV traffic. Conversely, some taxa, particularly submergent plants, were more common in the test plots. In general, however, there were fewer taxa within the test plots than in their undisturbed control plots. Localized reductions in the composition and number of plant species present diminishes biodiversity, defined as the variety and abundance of species in different habitats and communities.

ORV effects on the introduction or spread of exotic plant species or on rare plants have not been formally studied within the Preserve. Vegetation and soil disturbance caused by ORVs can increase the potential for invasion and spread of exotic or non-native plant species. The vehicles may also introduce and further distribute the seeds or vegetative materials of exotic species such as melaleuca. ORV traffic may also crush rare plants or alter their habitat to create unfavorable conditions.

ORVs cause considerable disturbance to periphyton, algal mats which are a major component of many Preserve vegetation types (Duever and others 1981, 1986b). The passage of wheeled vehicles greatly disturb these mats, chopping up and/or burying the algae under sediments. Airboats also break up periphyton and prevent the formation of such mats within heavily trafficked trails. The biological effects of this disturbance to food webs and nutrient cycling are unknown.

Vegetative effects are variable depending upon the influence of vegetation type and ORV type. Duever's research revealed that small cypress, peat marsh, and deeper water marl marshes are most sensitive to ORV impacts (Duever and others 1981). The shallower marl marshes where wheeled-vehicles operate are only slightly less sensitive. The more upland pine type was the least sensitive and the sand marsh only slightly more so. In general the wettest vegetation types are most sensitive and within any given type ORV impacts are greatest when water levels are

above or near the ground surface (Duever and others 1981, Schemnitz and Schortemeyer 1972). Recovery rates also vary by vegetation type with good recovery in the pine and marl marshes but poorer recovery elsewhere.

Vegetation damage in Duever's research was greatest for tracked vehicles, attributed to their use in the most sensitive areas and times (high water). The tracks on this vehicle type still crush vegetation but their low ground pressure results in little or no soil displacement and disturbance of plant roots. Among the swamp buggies, those with tractor tires were most damaging because their deep treads chop up understory vegetation and its root mat (Duever and others 1981). ATVs were considerably less impacting to vegetation due to their light weight and airboats had the least effect, generally just flattening vegetation cover. However, on permanent airboat trails emergent vegetation is generally absent.

Interference with natural fire cycles is also possible. ORV tracks in some plant communities can act as artificial barriers to the spread of ground fires. Given the natural dependencies of many plants and plant communities to a frequent fire cycle, such interference can have a pervasive negative influence. ORV trails are also a mixed blessing with respect to the Preserve's large prescriptive fire management program, which seeks to mimic the role of natural fire within the Preserve. ORV trails sometimes hamper efforts to conduct these burns but are also used as fire breaks to control which areas are burned.

ORVs may also be preventing tree regeneration along the margins of cypress domes and hardwood hammocks. The encirclement of smaller upland areas to look for or scare out prey is a common hunting practice. Evidence of such encirclement is clearly visible on aerial photographs and on the ground ORV trails can be seen to frequently cut through the outer margin of trees located on these upland areas. Evidence of ORV rutting adjacent to or directly over tree seedlings and saplings is common.

### **Soil Effects**

Soil disturbance may be more significant than vegetation loss or damage because it demonstrates cumulative and long term effects that are linked to secondary effects on other natural resource components. ORVs alter soil physical and biological properties. Reisinger and Aust (1990) summarize some applicable findings from research on the effects of logging vehicles on wetland soils:

“In moist soils rutting is a function of vehicular pressure and the lower strength of moist soil makes them subject to compaction. Compaction increases soil bulk density, which may result in decreased soil macroporosity. Soil macropores govern soil drainage and aeration, thus decreased macroporosity may create a less aerated and more poorly drained soil. Another situation exists on wet soils. Water fills the soil pores and resists compaction, yet the water reduces the soil strength and shear resistance, allowing traffic to “puddle” the soil. Puddled soils also have soil strengths that hamper root growth. Puddled soils, when wet, have exceedingly slow rates of soil aeration and drainage. Thus, site impacts can occur during moist (compaction) or wet (puddling) conditions, but both have the potential to reduce site productivity.”

Duever's research within the Preserve failed to document measurable soil compaction, perhaps because in saturated soils water fills the soil pore spaces and reduces their compressibility. However, soil rutting can also decrease the degree and duration of soil aeration due to diminished internal water flow (Aust 1994). The reduction in water and air flow may also result in decreased site productivity, inhibiting tree and plant growth. Soil erosion is also generally not a problem in wetlands as their flat terrain slows water movement so that sediments are not carried very far.

Soil rutting resulting from ORV traffic is caused by soil shearing stress which involves particles of soil sliding over each other, changing soil structure and composition. One consequence is that upper biologically productive soil layers are intermixed with and sometimes covered by subsurface soils. Wet soils easily deform under the weight of ORV tires. The material displaced from the ruts may be pushed out laterally, creating berms of deposited materials parallel to each rut. Exposure of organic soils to the air can result in their rapid oxidation at a rate that could reach one inch per annum (Yamataki 1994). Many of the Preserve's soils are extremely soft and repeated vehicle passage can create extensive rutting filled with a slurry of unconsolidated substrate material suspended in water. Soils in some of the Duever study plots were still a loose slurry one year after the experimental treatments (Duever and others 1981). This research documented soil rutting to be a common and widespread effect of ORV use within the Preserve, particularly in areas with soft soils and/or under conditions of moderate to heavy traffic.

As a result of soil rutting, Schemnitz and Schortemeyer (1972) found soil moisture in halftrack and airboat ruts to be consistently higher during a dry period when surface water was not present. They also documented a "greening" effect in vegetation within the ORV routes which they attributed to the increased soil moisture, higher soil temperatures, and curtailment of vegetative competition and shading. Rutting recovered fairly quickly following light to moderate levels of traffic in both the Schemnitz and Schortemeyer and Duever studies (Schemnitz and Schortemeyer 1972, Duever and others 1981). However, Duever cited soil disturbance, particularly rutting, as the most critical type of ORV impact. The initial recovery of ruts is relatively rapid, though recovery rates decrease markedly thereafter. For example, rutting within very few of the heavy impact lanes in Duever's experimental study had recovered after seven years and little recovery of rutting was noted within pre-existing ORV trails closed to use over that period. Duever concluded that "It appears that once soils are displaced, there are few natural mechanisms capable of restoring the ground contour, and the ruts remain indefinitely. Also, when soil disturbance occurs, the recovery rate of visual and vegetation impacts is appreciably slowed."

Similar to the vegetation effects, the type and extent of soil degradation depends on soil type, ORV type, and amount of traffic. Duever's research documented that soils in the small cypress, marl marsh, and peat marsh habitat types were most sensitive to ORV rutting, followed by the sand marsh and pine habitats (Duever and others 1981). ORV trails in these habitats become impassable more quickly and begin to widen or divide into braided patterns which are commonly observed in the Preserve. Sandy soils are least affected by ORV use. Some ORV trails have rutted down to rock, which while resistant, generally provides a rough ride due to unevenness associated with solution holes and pockets.

Buggies with tractor tires cut deeper ruts in fewer passes than the other buggy types in Duever's study, while ATVs created relatively little rutting and airboats none at all. Heavily used airboat trails are rutted, however, but soil displacement only occurs during low water levels when boat hulls come into direct contact with substrates. Stream or canal bank erosion from airboat generated wave action can also occur. Duever's results regarding amount of traffic indicate that the swamp buggies begin to create significant rutting after relatively few passes. Once root mats become torn the soils are easily displaced and rutting proceeds quickly. Unless bedrock is reached within the clearance limits of the vehicle the ORV is forced to move over to a new track.

Soil wetness in many instances is more important than soil or buggy type. According to Duever:

“Soil disturbance increases as a site gets wetter, either along a moisture gradient or at different times of the year. If water levels are at or above the soil surface, impacts are much greater than if they are well below ground. So habitats or portions of a habitat which are wet more of the time are more likely to be impacted and will take longer to recover. They also tend to have substrate and vegetative characteristics which make them more susceptible to impacts.”(Duever and others 1986b)

“Variations in swamp buggy characteristics (weight per unit area and tread type) had a minor effect on their ability to impact study sites compared to water levels...” (Duever and others 1991)

### **Water Resource Effects**

Wetland environments depend on the quality, abundance, and movement of water, all of which may be affected by ORV use. Localized effects of ORV use may contribute to hydroperiod, temperature, or turbidity changes. Negative effects to these water resource elements can lead to subsequent negative consequences for other environmental components, such as vegetation and wildlife. However, compared to vegetation and soil effects there is a substantially less research conducted in this area.

Some water resource effects have already been introduced in previous discussions regarding soil effects. Rutting can reduce soil macropores and create or rearrange fine sediments, which can lead to increased water runoff and decreased water infiltration, groundwater replenishment, and water movement through the soils (Kockelman 1983, Geological Society of America 1977, Webb and others 1978, Webb and Wilshire 1983). According to Kockelman (1983) increased runoff, linked to a diminished ability of the ground to absorb water, is frequently evident in ORV riding areas. Studies in ORV recreation areas have measured increased runoff and flooding has been associated with areas containing high densities of ORV trails (Hinckley and others 1983, Geological Society of America 1977, Snyder and others 1976).

Water quality is affected when ORV operation causes organic and soil particles to become suspended in water. The resulting water turbidity decrease sunlight penetration to rooted and floating vegetation (including periphyton) and reduces primary production. Water turbidity is caused by both wheeled vehicles and airboats. A study of turbidity associated with airboat use in the Preserve revealed higher turbidity during periods of increased airboat traffic and during

lower water levels (NPS 1989). Turbidity plumes and erosional effects were also observed in photographs. Down stream/gradient areas may experience chemical and biological contamination and siltation problems due to increased sediment loading from ORV use.

Wetland plants produce up to two times as much biomass as upland plants each growing season and normally absorb large amounts of nutrients from the water. According to Beardsley (1995) extensive vegetation damage from ORV use may inhibit nutrient uptake, causing greater levels of nutrients (primarily from agricultural areas north of the Preserve) to remain in the water. Beardsley also states that the loss of vegetation cover reduces water filtration and removes frictional forces that slow water movement, negatively affecting the dynamic water storage capacity of the Preserve. This ability refers to the capacity of the Preserve to store and slowly release water over a long period of time.

Water temperature within ORV ruts were measured by Schemnitz and Schortemeyer (1972) to be 6 to 10° F higher than in adjacent vegetated areas. These differences might influence biological activity in unnatural ways.

Big Cypress Preserve is exceptionally flat, with a typical gradient of only five to ten inches per mile and a water flow rate of approximately 860 feet per day. ORV rutting, which can extend up to two feet in depth, can act as drainage ditches, channeling water and potentially altering natural water flow patterns. The extent of occurrence and severity of such effects are largely unknown. However, two studies have documented consistently greater water flow rates within ORV ruts than in adjacent undisturbed areas. Duever's research showed that water flows over wet and dry seasons in trails and nearby areas were found to accelerate from two to four times in trails oriented parallel to the direction of water flow (Duever and others 1981). Flows in some trails continued after they had ceased in surrounding areas, possibly leading to a shortening of natural hydroperiods (duration of inundation) in localized areas. In a similar 1995 study using a fluorescent dye, surface water flow always followed the airboat trails regardless of the trail orientation (Pernas and others 1995). Flow rates were also accelerated, approximately five times faster within airboat trails than in adjacent undisturbed areas.

Further descriptions of these potential effects and their ecological significance are provided by Duever and others (1986a):

“Generally, ORV trails have little effect on surface water, although under certain circumstances, they can act as drainage channels and alter natural hydrologic patterns. In most parts of the BCNP the ground surface is sufficiently irregular to interrupt any channelizing effect. Since ORV drivers tend to try to stay on relatively high ground, most trails cross wetter areas then climb back onto higher ground. Thus, even if a shallow canal develops in the wetland, it usually does not result in drainage because it is bounded at both ends by uplands. A possible major exception to this might be the long north-south tracks through the extensive low flat habitats of the Everglades Unit [Stairsteps Unit]. Drainage is a concern where ORV use has removed the vegetation and rutted the soil, forming a channel that goes through a low and extremely flat habitat more or less surrounded by higher land which then connects with a canal or major slough. These conditions exist most often at access points, where vehicle use is most concentrated and trails branch out from a roadside canal. Although some drainage can

take place anywhere a trail leads into a slough or strand, it is unlikely that the average shallowly rutted trail has significant drainage impacts. Where deeply rutted roads do create drainage problems, rerouting them over higher ground or creating small rises in the roads at intervals could help to reduce the impact.”

### Wildlife Effects

The Preserve supports a wide diversity of aquatic and terrestrial wildlife, however, many species have not yet been studied and even fewer have been observed for their responses to ORVs. In particular, the potential harm from ORV use to endangered, threatened, or rare species living within the Preserve is largely unknown.

Literature from other places clearly demonstrates that wildlife can be negatively affected by ORV use. Direct contact may injure or kill animals or their eggs and young, particularly small animals such as fish and amphibians. ORVs may also disturb wildlife, leading to changes in their behavior. For example, wildlife may learn to avoid ORVs, becoming displaced from preferred habitats during times of ORV use or in places where ORV use is common (Knight and Cole 1995). These disruptions to normal behavior can cause reduced vigor and reproduction or lead to death. Significant disturbances can alter the abundance, distribution, or demographics of wildlife populations or alter the species composition and interaction of biotic communities (Knight and Cole 1995).

As an example, at Dove Springs Canyon in California, lower diversity and density of small mammals was observed in areas of ORV riding (Byrne 1973). Plant species present and variety were also altered. Ground cover and shrubs were reduced, possibly explaining the reduced numbers of mammals. Decreased populations of small mammals affect the rest of the food chain, disrupting the dynamics of the entire ecosystem. Similarly, in western California, ORV use areas had fewer species and numbers of vertebrates, and substantially lower reptile and mammal biomass (Stebbins 1974). Breeding birds in these same areas also showed decreased diversity, density and biomass (Berry 1973).

ORV soil and vegetation changes indirectly affect wildlife. For example, disturbance of soils and reduction of vegetation cover alters wildlife habitats and microclimates, which in turn can impact species dependent upon these habitats. Wildlife food and cover are reduced in quantity and quality by ORV soil and vegetation disturbance. Wildlife habitats, particularly for smaller species such as lizards, small mammals, or invertebrates, can be fragmented by ORV trails due to the lack of vegetative crossings over expanses of open water.

ORV noise is one of the most significant effects reported. Auditory disturbance has been linked to disruption of feeding, resting, reproduction, and caring for young (Bowles 1995). In a study by Rodgers (1991), colonial water birds nesting in eleven colonies in north and central Florida, were subjected to noise caused by approaches on foot, in canoes, outboard motor boats, and airboats. Airboats were found to cause the greatest disturbance. In another study a colony of wading birds showed the highest flushing and panic responses to approaching airboats, compared to low flying aircraft and bulldozer passings (Black and others 1984).

The approach of a vehicle is apparently more disturbing to waterfowl than is a source of constant noise (Rodgers 1991). According to biologists at the Loxahatchee National Wildlife Refuge, wading birds are disturbed by airboats and flush even if the vehicles are one hundred yards away. Another study comparing behavioral responses of animals to ORV operation concluded that birds are the most sensitive vertebrates (Bury and others 1980). Berry (1980) also reported that the number of birds and total biomass may experience a two- to fourfold increase in adjacent non-ORV use areas. Other species like the alligator in Loxahatchee, appear to have become habituated to airboat noise (Brandt and Brown 1988).

In an ORV study by Rennison and Wallace (1976) the vehicles produced noise that could be heard from two to four kilometers away with high decibel levels. Duever measured the decibel levels of several ORV types (**Table 9**) (Duever and others 1981). Airboats were consistently louder than other vehicle types and a maximum noise level of 120 dB was recorded during acceleration. Brandt and Brown (1988) report that automobile engines can turn airboat propellers twice as fast as airplane engines and therefore can run with smaller blades which make less noise.

**Table 9.** Noise levels measured for three types of ORVs.

<i>ORV Type</i>		<i>Sound (dB) (3 meters)</i>	<i>Sound (dB) (100 meters)</i>
Airboat	Slow	86	63-69
	Fast	91-92	74-75
Swamp Buggies		68-84	37-44
ATVs		78-81	53-56

ORVs may also endanger isolated species, remnant populations, and other rare, threatened or endangered species. For example, as stated in the GMP, the Florida panther may be potentially affected by ORVs due to decreased habitat quality and prey and greater human disturbance (NPS GMP 1991). Since ORV use and hunting seasons coincide, it is difficult to separate the effects of hunting from ORV riding on the Florida panther based on available information. Higher densities of panther prey, including feral hogs and deer, are found in the northern end of the Preserve. In the Bear Island Unit where hunting and ORV use are high, panthers are more abundant than in other units and in October 1993, a female panther built her den within fifty yards of an ORV trail.

Current research on the Florida Panther within the Preserve is aimed at identifying some of the relationships between hunting, ORV use, and panther disturbance and displacement. However, preliminary findings from this work have not provided any conclusive evidence that hunting (and its associated ORV use) significantly alter panther home range dynamics, movement rates, activity rates, or predation success (Janis and Clark 1996). However, additional data have been collected since that time and a more complete analysis will be available in the near future (Clark, 1998, Personal Communication).

Other rare or endangered species may also be affected by ORV use but few studies have been conducted and management decisions must often be based on the judgement of biologists. For example, the management decision to close Ochopee Prairie to commercial airboat use was based in part on a staff report prepared by Jansen (1994). Airboat activities in the proximity of

a bald eagle nest, the potential loss of food for snail kites due to vegetation damage from airboats, and the overlap between the tourist season and nesting season of wading birds, were factors considered in this decision.

## **Social Effects of ORV Use**

### **Recreational Conflict**

As described under the Significant Issues section, ORV use alters the Preserve's physical and social environment in ways that could displace non-motorized visitors. The presence of these large, often noisy vehicles in the Preserve, the visual degradation to soils and vegetation, and their close association with hunting and associated concerns for human safety, can lead to conflict between ORV visitors and non-motorized visitors. While such conflict is rarely confrontational, the use of ORVs nonetheless can deter use of the Preserve by non-motorized visitors. Other factors, such as limited facilities, developed trails, and interpretive activities also contribute to the Preserve's limited use by non-motorized recreationists.

Conflicts may have little or nothing to do with the actions or behavior of ORV riders. Non-motorized visitors may simply be seeking to escape the noise and confusion of everyday life by hiking in an undeveloped and protected environment. The presence of motorized vehicles and/or the visual reminders of their passage conflict with their expectations regarding desired conditions. The protection of scenic values is one of the reasons BCNP was created and there is a current effort to designate the Tamiami Trail as a Scenic Highway. Alternately, conflict may arise because of competition for space, discourtesy, litter, noise, trespass, or vandalism (Bury and others 1976).

One source of conflict is the noise created by ORVs. Baldwin and Stoddard (1973) suggest that the noise from ORVs can be highly annoying for visitors seeking privacy and natural quiet. In a study of ORV use at Cape Hatters National Seashore, Wellman and Buhyoff (1978) found that very few ORV riders considered noise as a problem, compared to one-third of non-motorized visitors. Similarly, whereas only ten percent of ORV users viewed tire tracks as a problem, fifty percent of non-ORV users thought that tire tracks were a problem. Baldwin and Stoddard (1973) suggested that the impact of ORVs on recreation involves its physical presence, as well as noise, its effect on fish, wildlife and vegetation. The net effect of these issues acts to spoil the pleasure of hiking and other activities and can lead to the displacement of non-motorized visitors to other areas. In general, noisier, more consumptive activities such as ORV use and hunting will preempt and eventually displace activities that are quieter, less consumptive, and more contemplative (Sheridan 1979). This phenomenon is referred to as the "ISD syndrome"- that is the progression from impairment of satisfaction, to suppression of use, to eventual displacement.

Conflicts between the Preserve's ORV use and non-motorized recreational visitors are illustrated by the following examples, provided by Preserve visitors to BCNP staff or members of the ORV planning team:

- C Conflicts at campgrounds routinely occur between ORV visitors and non-ORV campers. Complaints received by Preserve staff commonly cite ORV noise, particularly during the night, competition for limited camping spaces, and highly disturbed ORV trails that prevent or make hiking difficult. Daytime ORV activity and noise can also degrade solitude and serenity of campground activities.
- C Conflicts with mountain bike riders seeking places to ride where ORVs have not rutted the soils, preventing or hindering bike travel. ORV activity and noise can also degrade solitude and the potential for wildlife observation. Rutting and vegetation disturbance from ORV traffic also degrade the visual qualities of the setting.
- C Conflicts with hikers, particularly on the Florida Trail, where ORVs have traveled along the trail or crossed it. ORV rutting in these places prevents or hinders foot traffic and degrades the visual qualities of the setting. Noise from ORVs is another commonly cited issue.
- C Conflicts with canoeists occur along the Turner River, Halfway Creek, and Baron River canoe trail. The noise and presence of concentrated commercial use by airboat companies near Everglades City may also discourage or displace canoeists, anglers in motorized or non-motorized boats, and recreational crabbers. The noise and presence of ORVs, in addition to seeing ORV trails, can degrade the quality of these experiences.



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**APPENDIX 2:**

**OFF-ROAD VEHICLE  
MANAGEMENT PRACTICES MANUAL**

**BIG CYPRESS NATIONAL PRESERVE**

April 1998

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**United States Department of the Interior**

**National Park Service**  
**Big Cypress National Preserve**



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# Introduction

This manual describes a diverse array of potential strategies and tactics for managing off-road vehicle (ORV) use in Big Cypress National Preserve. Such management includes, but is not limited to, the provision of appropriate ORV recreational experiences at levels compatible with the purposes of the Preserve, identification of associated resource protection and recreation management problems, evaluation of the cause(s) of such problems and alternative management actions, selection and implementation of preferred actions, and evaluation of their effectiveness.

This manual serves as a comprehensive *reference guide* of potential management practices, intended to assist ORV planning and management decision making both now and in the future. It serves in a supporting role to the ORV Management Plan, which provides guidance and direction to ORV management decision making. ***This manual does not prescribe or advocate one management practice over another but rather compiles and describes an array of potential practices.*** The manual provides guidance in identifying and selecting effective and efficient practices with the goal of fostering high-quality ORV recreational experiences while managing that use to avoid or minimize associated environmental effects (e.g. vegetation and soil disturbance) or social effects (e.g. visitor crowding and conflict). Laws passed by the U.S. Congress requires National Park Service managers to both protect park resources and natural processes and to provide for appropriate recreational activities and experiences.

This manual is organized into three sections. The first section describes a decision making process recommended to guide the selection of ORV management strategies and tactics. The second section provides an overview of 12 general strategies available for managing ORV use. These strategies are more fully described in the final section which provides descriptions for each of 42 specific ORV management tactics. A standardized table format is used to present information for each tactic, including its purpose, description, costs to ORV visitors, costs to management, effectiveness, and comments. Ratings for the cost and effectiveness topics are often subjective and represent the opinions of the author, as modified through public review and comment of this manual. While the manual is focused on ORV management it is recognized that other Preserve visitors will be affected by many ORV management actions. For example, while a requirement to use only designated trails represents a “cost” to ORV visitors this action might be a “benefit” to non-ORV visitors who can more easily avoid areas where designated trails exist. Costs to the resource, reflected by listings under the “effectiveness” topic, must also be considered in light of agency mandates, policies, and objectives.

The comprehensive nature of this presentation of tactics also limits the inclusion of more detailed information and discussions within individual topics. As described in the following section, prior to the selection and implementation of tactics it is expected that managers and other decision-making participants will more thoroughly describe and discuss the issues or concerns that require action, the relative merits of alternative tactics, and how such tactics might be specifically implemented. This manual provides only a starting point and should be revised periodically to reflect new knowledge from research, management, and visitors.

## A Process for Selecting ORV Management Practices

Strategies are broad approaches that address underlying causes of problems (Manning 1979). Tactics are the specific means or actions used to implement a strategy (Cole and others 1987). Generally, a variety of strategies and tactics may be applicable in managing recreational visitation and resolving associated issues or concerns. Selection of preferred approaches must necessarily involve many considerations. Often a set of supporting strategies and tactics will prove most effective. For example, a tactic that promotes concentration of ORV traffic onto a common set of trails also requires communication of the policy to inform riders, selection and marking of resistant trails, and maintenance of the trails to sustain heavy traffic. Consideration of secondary effects (side effects) associated with an action is also essential. Relative to our example, tactics that promote concentration of ORV traffic may also require tread maintenance efforts to prevent deep rutting.

The U.S. Congress has delegated responsibility for managing Big Cypress National Preserve and its recreational uses to the National Park Service. However, decision making for selecting the most appropriate and effective ORV management practices should consider, and where appropriate involve, representatives of the public and affected stakeholders. A six-step process, as outlined below, is recommended. This document provides supporting information for step 2 of this process:

1. Review existing resource and social conditions and recreation management needs in light of legal mandates, agency administrative policies, and management objectives to identify issues and concerns requiring action. Clearly describe and communicate these issues to the public. Develop knowledge and understanding of the underlying causes by investigating research findings and/or consulting with scientists, ORV riders, and others with relevant knowledge.
2. Identify and describe all strategies and tactics that are potentially applicable to the issues or concerns. Discuss the pros, cons, and perceived effectiveness of alternative approaches, involving representatives of the public where possible or appropriate.
3. Select one or more preferred strategies and tactics that appears most appropriate. Choose strategies that attack the primary causes of issues and tactics that do not conflict with management objectives, that are realistic given the visitor use, environment, and management situation, and that minimize costs to visitors and avoid or reduce unwanted side effects (Cole, Petersen, and Lucas 1987). Describe the specifics of a proposed implementation process along with a supporting rationale. Communicate proposal to the public requesting their review and comment. Note: Funding and staff to implement preferred strategies and tactics may also constrain the selection process and may even preclude implementation of any action.
4. Revise proposal based on public comment and prepare action plans to implement specific tactic(s).
5. Implement action plans, working cooperatively with individuals, organized groups, and commercial interests where appropriate.

6. Monitor effectiveness of implemented tactics and modify them as necessary. If the target problem is not adequately resolved, return to step 3 and select a different set of proposed strategies and/or tactics.

This decision process and the format of this manual are adapted from a recreation use management publication by Cole, Petersen, and Lucas (1987).

It is important to emphasize several points associated with this recommended decision process. First, ORV management issues and concerns are defined by considering relevant congressional mandates, administrative policies, and management objectives in a careful review of recreation management needs and resource and social conditions. **The responsibility for interpreting laws and agency policies to evaluate non-compliant conditions lies with agency managers.** Secondly, numerous strategies and tactics may be potentially applicable or effective in resolving any given issue. Selection of a preferred set of tactics requires consideration of many factors and is most optimal when stakeholders are involved in an open participatory process. Public participation may greatly increase the effectiveness of corrective efforts and may reduce the need for more restrictive tactics and/or long-term costs. Finally, this decision process is cyclical. If the objective of an action is not achieved by the first set of tactics a different set may be implemented. Tactics that are judged to be potentially effective yet entail the least "cost" to visitors (for example, educational approaches) are often selected first. However, if these tactics fail to resolve the issues or concerns then more restrictive tactics (e.g., regulations or reduction of use) become both necessary and justifiable.

## Strategies and Tactics for Managing ORV Use

Twelve strategies, organized under six topical categories, are described:

### No Action

No management actions are needed when existing environmental and social conditions are acceptable.

### Modify Visitor Use Practices

#### Educate Visitors to Adopt Low Impact Practices

This strategy provides information that encourages the adoption of ORV use practices that prevent or minimize resource or social impacts.

- 1) Educate Visitors to Adopt Low Impact Practices
  - 1.1 Promote Selection and Use of Resistant Trails
  - 1.2 Promote Adoption of Low Impact ORV Use Practices
  - 1.3 Promote Actions that Reduce Visitor Conflict
  - 1.4 Require Attendance at an ORV Low Impact Workshop

#### Regulate Visitor Use Practices

This strategy regulates ORV use by prohibiting particularly damaging practices or by requiring practices that prevent or reduce resource or social impacts.

- 2) Regulate Visitor Use Practices
  - 2.1 Prohibit Particularly Damaging Practices
  - 2.2 Increase Enforcement Efforts
  - 2.3 Prohibit Practices that Cause Visitor Conflicts

### Modify Location of ORV Use

#### Encourage Dispersal of Traffic in Remote Areas

This strategy seeks to prevent or reduce resource impact by distributing ORV traffic over a large number of trails so that individual trails are lightly used and able to recover on an annual basis. This strategy will generally be effective only in remote or infrequently visited areas.

- 3) Encourage Dispersal of Traffic in Remote Areas
  - 3.1 Encourage Visitors to Avoid Existing Trails in Remote Areas

#### Encourage Concentration of Traffic in Popular Areas

The areal extent of resource impact is reduced with this strategy by promoting the repeated use of a common set of trails. Options for implementing this strategy range from indirect (educational) to direct (regulatory). Generally, greater concentration of traffic will result in greater reductions in the areal extent of resource impact. However, the severity of impact will increase on the trails receiving concentrated use, requiring maintenance to sustain traffic and limit development of multiple treads.

- 4) Encourage Concentration of Traffic in Popular Areas
  - 4.1 Encourage Visitors to Use Existing Trails
  - 4.2 Require Visitors to Use Existing Trails
  - 4.3 Concentrate Use by Designating Access Points
  - 4.4 Select and Mark Resistant Trails
  - 4.5 Require Use of Designated Trails in Selected Areas
  - 4.6 Require Use of Designated Trails in Selected Management Units

#### **Reduce Use in Problem Areas**

Resource or social problems are addressed by reducing use in problem areas. Significant problems are often common in only a few popular areas.

- 5) Reduce Use in Problem Areas
  - 5.1 Discourage Use in Problem Areas
  - 5.2 Make Access to Problem Areas More Difficult
  - 5.3 Establish Quotas for Use in Problem Areas
  - 5.4 Prohibit Traffic in Problem Areas

#### **Reduce or Prohibit Traffic in Sensitive Areas**

Resource impacts in areas with sensitive natural or cultural resources are regulated by reducing or prohibiting ORV traffic.

- 6) Reduce or Prohibit Traffic in Sensitive Areas
  - 6.1 Discourage Traffic in Sensitive Areas
  - 6.2 Establish Quotas for Traffic in Sensitive Areas
  - 6.3 Prohibit Traffic in Sensitive Areas

### **Modify the Resource**

#### **Maintain Marked Trails**

Trails receiving concentrated traffic are maintained or constructed to sustain traffic and limit development of multiple treads.

- 7) Maintain Marked Trails
  - 7.1 Add Fill Material in Problem Areas
  - 7.2 Use Geosynthetics in Problem Areas
  - 7.3 Construct At-Grade Trails
  - 7.4 Construct Above-Grade Roads

### **Rehabilitate ORV Trails**

Recovery of soils and/or vegetation on ORV trails closed to use is accelerated through resource rehabilitation efforts.

- 8) Rehabilitate Closed ORV Trails
  - 8.1 Restore Substrates
  - 8.2 Restore Vegetation

## **Modify ORVs**

### **Modify ORVs to Reduce Impacts**

Modifications to ORVs are made to reduce their potential for contributing to resource or social impacts.

- 9) Modify ORVs to Reduce Impacts
  - 9.1 Specify ORV Weights, PSI/Displacement, Clearance, Engine Size, or Tires
  - 9.2 Relate ORV Access to ORV Specifications
  - 9.3 Reduce ORV Noise

### **Restrict Particularly Damaging Types of ORVs**

This strategy seeks to reduce social or resource impacts by restricting or prohibiting particularly damaging types of ORVs. Restrictions may be area-specific, management unit-specific, or Preserve-wide.

- 10) Restrict Particularly Damaging Types of ORVs
  - 10.1 Discourage Use of Particularly Damaging Types of ORVs
  - 10.2 Prohibit Use of Particularly Damaging Types of ORVs
  - 10.3 Restrict Use of Particular ORV Types in Sensitive or Problem Areas

## **Modify Timing and Amount of ORV Use**

### **Modify Timing of ORV Use**

This strategy is based on the recognition that the sensitivity of soil, vegetation, and wildlife to ORV impacts vary by season. Impacts are reduced by limiting or prohibiting use during times of high resource sensitivity. Even social problems, such as crowding and conflicts, may be reduced by shifting use away from peak use periods.

- 11) Modify Timing of ORV Use
  - 11.1 Discourage Use During Times of Resource Susceptibility
  - 11.2 Prohibit Use During Times of Resource Susceptibility
  - 11.3 Regulate Timing of Use to Reduce Crowding and Conflict

### **Reduce ORV Use in General**

This more restrictive strategy seeks to reduce resource or social impacts by limiting visitation.

- 12) Reduce ORV Use in General
  - 12.1 Increase ORV Use Fees
  - 12.2 Establish Quotas
  - 12.3 Make Access More Difficult
  - 12.4 Limit Length of Stay
  - 12.5 Require Certain Skills
  - 12.6 Regulate Area of Use to Reduce Conflicts



<b>Strategy 1. Educate Visitors to Adopt Low Impact Practices</b>	
<b>Tactic 1.1 Promote Selection and Use of Resistant Trails</b>	
<b>Purpose</b>	Prevent or reduce resource damage by educating ORV riders in the selection and use of the most resistant trails based on vegetation and substrate characteristics.
<b>Description</b>	Research and monitoring data, in addition to ORV rider experience, is consulted to identify resource characteristics that contribute to resistant ORV trails. These characteristics are communicated to all visitors, who apply them to select and use resistant trails and to avoid travel in areas more sensitive to disturbance.
<b>Costs to ORV Visitors</b>	Low-Moderate. Receptive visitors lose some freedom to select and use preferred trails.
<b>Costs to Management</b>	Moderate. Information must be developed and communicated to all visitors. Printed material may not be sufficient, requiring either courses or development of a slide show or video. Use of volunteers from the ORV community can help reduce costs.
<b>Effectiveness</b>	Low-Moderate. Visitors may not learn or apply the recommended low impact trail selection practices.
<b>Comments</b>	This tactic is likely to be most effective in remote areas that receive light visitation and where many alternative routes exist.

<b>Strategy 1. Educate Visitors to Adopt Low Impact Practices</b>	
<b>Tactic 1.2 Promote Adoption of Low Impact ORV Use Practices</b>	
<b>Purpose</b>	Prevent or reduce resource and social impacts by developing and communicating low impact ORV use practices.
<b>Description</b>	Research and monitoring data, in addition to ORV rider experience, is consulted to identify ORV use practices that will reduce ORV resource and social impact (e.g., drive slowly to avoid spinning mud out of ruts or be courteous and give a wide berth to other Preserve visitors). Low impact practices are communicated through a printed booklet, a short seminar, or a weekend workshop. Many of these actions could be done using volunteers from the ORV rider community.
<b>Costs to ORV Visitors</b>	Low-Moderate. Receptive visitors lose some freedom if they adopt recommended practices.
<b>Costs to Management</b>	Moderate. Information must be developed and communicated to all visitors. Printed material may not be sufficient, requiring either courses or development of a slide show or video. Use of volunteers from the ORV community can help reduce costs.
<b>Effectiveness</b>	Low-Moderate. Visitors may not learn or apply the recommended low impact practices. Most effective for specific practices that riders are not aware of. Communication focused on the representatives of larger organized groups can increase compliance and reduce implementation costs.
<b>Comments</b>	This tactic is applicable to all vehicle types and areas. Practices can be developed to address the following issues: ORV equipment, riding behavior, extraction of stuck vehicles, control of wildfires (smoking/campfires), control of exotic flora and fauna.

<b>Strategy 1. Educate Visitors to Adopt Low Impact Practices</b>	
<b>Tactic 1.3 Promote Actions that Reduce Visitor Conflict</b>	
<b>Purpose</b>	Prevent or reduce conflict between ORV riders and other riders and non-ORV recreationists.
<b>Description</b>	Consult with different groups of BICY recreationists to identify sources of conflict. Describe and communicate actions and practices that will reduce conflict.
<b>Costs to ORV Visitors</b>	Low. Visitors retain freedom to adopt or disregard recommended actions.
<b>Costs to Management</b>	Moderate. Information must be developed and communicated to all visitors. Use of volunteers from the ORV community can help reduce costs.
<b>Effectiveness</b>	Low-Moderate. Visitors may not adopt the recommended actions or change their riding practices. Communication focused on the representatives of larger organized groups can increase compliance and reduce implementation costs.
<b>Comments</b>	This tactic may help to identify and publicize issues that ORV riders may be unaware of but would be easily resolved through relatively small changes in their riding practices.

<b>Strategy 1. Educate Visitors to Adopt Low Impact Practices</b>	
<b>Tactic 1.4 Require Attendance at an ORV Low Impact Workshop</b>	
<b>Purpose</b>	Prevent or reduce resource damage by developing and communicating low impact ORV use practices.
<b>Description</b>	Attendance at a course on ORV use and low impact practices is required in order to obtain an ORV permit. Tour or trip leaders might also be required to attend courses and communicate certain information to their passengers or clients.
<b>Costs to ORV Visitors</b>	Moderate. Visitors must attend the course in order to obtain a permit.
<b>Costs to Management</b>	Moderate. Course content must be developed and the course must be offered several times each year. ORV organizations and riders could participate in developing and teaching the course or even assume responsibility for it.
<b>Effectiveness</b>	Moderate. Personal communication has been shown to be more successful than printed messages.
<b>Comments</b>	Possibly the only effective method for communicating difficult or complex information (such as the selection of resistant trails) and for teaching good judgement in selecting and applying the best low impact practices. Course could initially be offered on a voluntary basis.

<b>Strategy 2. Regulate Visitor Use Practices</b>	
<b>Tactic 2.1 Prohibit Particularly Damaging Practices</b>	
<b>Purpose</b>	Prevent or reduce resource damage by prohibiting ORV use practices that are particularly damaging.
<b>Description</b>	Some ORV use practices are severely damaging and often unnecessary or inappropriate.
<b>Costs to ORV Visitors</b>	Low-High. No cost to visitors who don't engage in these activities; high cost to visitors whose recreational activity is dependent upon the prohibited practice.
<b>Costs to Management</b>	Moderate. Effective communication and enforcement are necessary to success.
<b>Effectiveness</b>	Moderate. Most ORV riders will likely comply with such prohibitions. Enforcement, though difficult, will be needed to ensure high compliance.
<b>Comments</b>	Explaining the rationale for prohibiting selected practices will be necessary to increase compliance, reduce the need for enforcement efforts, and to instill an ethic that leads to more permanent changes in actions.

<b>Strategy 2. Regulate Visitor Use Practices</b>	
<b>Tactic 2.2 Increase Enforcement Efforts</b>	
<b>Purpose</b>	Prevent or reduce resource damage through greater agency staff presence in the backcountry, with an emphasis on visitor contact and law enforcement.
<b>Description</b>	Many visitors will respond to educational messages to reduce the resource impacts of their activities. However, for some visitors only the presence of agency staff and the threat of enforcement actions will be effective in modifying actions.
<b>Costs to ORV Visitors</b>	Low-Mod. No cost to visitors who follow ORV use regulations. Moderate cost to some visitors who may resent law enforcement presence or emphasis.
<b>Costs to Management</b>	High. Increasing agency staff presence in the backcountry requires additional staff, vehicles, and operational costs.
<b>Effectiveness</b>	Moderate. Most visitors will likely take note of expanded visitor contact and enforcement activities and reduce or stop participation in prohibited practices.
<b>Comments</b>	Visitor contact that focuses on describing the rationale for prohibited practices will reduce the need for use of law enforcement as an option.

<b>Strategy 2. Regulate Visitor Use Practices</b>	
<b>Tactic 2.3 Prohibit Practices that Cause Visitor Conflict</b>	
<b>Purpose</b>	Prevent or reduce visitor conflicts by prohibiting ORV riding practices that strongly interfere with the experience of other visitors.
<b>Description</b>	Prohibit specified ORV riding actions or use practices that are particularly bothersome to other ORV or non-ORV recreationists.
<b>Costs to ORV Visitors</b>	Low-Moderate. No cost to visitors who don't engage in prohibited activities; moderate cost to visitors who may resent further regulations or management enforcement presence.
<b>Costs to Management</b>	Moderate. Effective communication and enforcement are necessary for success.
<b>Effectiveness</b>	Moderate. Most ORV riders will likely comply with such prohibitions. Enforcement, though difficult, will be needed to ensure high compliance.
<b>Comments</b>	Explaining the rationale for prohibiting selected practices will be necessary to increase compliance, reduce the need for enforcement efforts, and to instill an ethic that leads to more permanent changes in actions.

<b>Strategy 3. Encourage Dispersal of Traffic in Remote Areas</b>	
<b>Tactic 3.1 Encourage Visitors to Avoid Existing Trails in Remote Areas</b>	
<b>Purpose</b>	Prevent or reduce resource damage by dispersing traffic and avoiding existing trails in remote areas that receive light use.
<b>Description</b>	Research by Deuver (1981) indicates that trails receiving only a few passes per year can quickly recover. In areas that receive very limited traffic ORV riders would be encouraged to disperse their traffic to new resistant trails and avoid repeated use of existing trails. Annual traffic on any single trail should not exceed that which can recover within a one year period.
<b>Costs to ORV Visitors</b>	Mod-High. Visitors may have to travel further or in unfamiliar terrain in order to avoid repeat use of preferred trails. May restrict ability to visit traditional places.
<b>Costs to Management</b>	Low. Such a policy need only be communicated with supporting documentation of its rationale. Use of volunteers from the ORV community can help reduce costs.
<b>Effectiveness</b>	Very Low. Visitors may ignore recommendation and use the most common and direct trail.
<b>Comments</b>	Terrain features and vegetation tend to constrain traffic to a common set of trails, restricting the potential for dispersing traffic to a large number of trails that receive only a few passes annually. In practice, this strategy is rarely effective and often increases the total area of disturbance. May only be effective in dry seasons or with lighter vehicles.

<b>Strategy 4. Encourage Concentration of Traffic in Popular Areas</b>	
<b>Tactic 4.1 Encourage Visitors to Use Existing Trails</b>	
<b>Purpose</b>	Prevent or reduce resource damage by encouraging the repeated use of a common but limited set of ORV trails.
<b>Description</b>	In areas of moderate to heavy traffic research indicates that ORV resource damage is most effectively minimized by concentrating traffic on a limited set of trails (Deuver 1981). In these areas visitors would be encouraged to concentrate their travel on well-used ORV trails, avoiding lightly or moderately used trails and areas without trails.
<b>Costs to ORV Visitors</b>	Moderate. Visitors might not be able to access some areas due to lack of existing high-traffic trails. Concentration of traffic may lead to deeper rutting that would make travel more difficult. Visitor crowding and conflict with ORV and non-ORV visitors may increase.
<b>Costs to Management</b>	Low. Such a policy need only be communicated with supporting documentation of its rationale. Use of volunteers from the ORV community can help reduce costs.
<b>Effectiveness</b>	Low-Moderate. Visitors may ignore recommendation, however, this tactic would likely result in some concentration of use, reducing the area over which impacts are spread. These reductions should offset any increased vegetation disturbance and rutting created along the trails receiving more concentrated use.
<b>Comments</b>	Maintenance of the worst spots will become necessary to sustain use of these trails and prevent expansion of impact from visitors seeking to circumvent problem spots.

<b>Strategy 4. Encourage Concentration of Traffic in Popular Areas</b>	
<b>Tactic 4.2 Require Visitors to Use Existing Trails</b>	
<b>Purpose</b>	Prevent or reduce resource damage by requiring the repeated use of a common but limited set of ORV trails.
<b>Description</b>	In areas of moderate to heavy traffic research indicates that ORV resource damage is most effectively minimized by concentrating traffic on a limited set of trails (Deuver 1981). In these areas visitors would be required to travel on well-used ORV trails, avoiding lightly or moderately used trails and areas without trails. Creation of new trails would be prohibited.
<b>Costs to ORV Visitors</b>	Moderate. Visitors might not be able to access some areas due to lack of existing trails and concentration of traffic may lead to deeper rutting that would make travel more difficult. Visitor crowding and conflict with ORV or non-ORV visitors may increase.
<b>Costs to Management</b>	Moderate. The policy and its rationale would need to be clearly communicated to all ORV riders. Enforcement of prohibition on the creation of new trails would be difficult and expensive.
<b>Effectiveness</b>	Moderate. ORV traffic would likely be further concentrated, resulting in fewer trails and overall disturbance. These reductions should offset any increased vegetation disturbance and rutting created along the trails receiving more concentrated use.
<b>Comments</b>	Maintenance of the worst spots will become critical in order to sustain use of these trails and prevent expansion of impact from visitors seeking to circumvent problem spots.

<b>Strategy 4. Encourage Concentration of Traffic in Popular Areas</b>	
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<b>Tactic 4.3 Concentrate Use by Designating Access Points</b>	
<b>Purpose</b>	Prevent or reduce resource damage by encouraging the repeated use of a common set of ORV trails.
<b>Description</b>	Establishment of a fixed number of ORV accesses will concentrate ORV traffic onto a more limited set of travel routes. Access to the swamp would be restricted to these designated locations.
<b>Costs to ORV Visitors</b>	Moderate. Some visitors may have longer rides to access the places they want to go. Visitor crowding and conflict with ORV and non-ORV visitors may increase.
<b>Costs to Management</b>	High. ORV accesses would have to be selected, designed, and constructed. The policy and its rationale would need to be clearly communicated to all ORV riders. Actions to close and rehabilitate former access points would be necessary. Enforcement of the access policy could be difficult, controversial, and expensive.
<b>Effectiveness</b>	Moderate. ORV traffic would likely be further concentrated, resulting in fewer trails and overall disturbance. These reductions should offset any increased vegetation disturbance and rutting created along the trails receiving more concentrated use.
<b>Comments</b>	Maintenance of the worst spots will become critical in order for overall impact to be reduced under this tactic.

<b>Strategy 4. Encourage Concentration of Traffic in Popular Areas</b>	
<b>Tactic 4.4 Select and Mark Resistant Trails</b>	
<b>Purpose</b>	Prevent or reduce resource damage by encouraging the repeated use of a common set of ORV trails.
<b>Description</b>	Research and monitoring data, in addition to ORV rider experience, is consulted to identify resource characteristics that contribute to resistant ORV trails. These characteristics are used to select resistant trails which are then marked. Visitors are encouraged to use the marked trails where possible. This action reduces resource impact by shifting some traffic to the most resistant trails.
<b>Costs to ORV Visitors</b>	Low. Visitors retain the freedom to use or not use the marked trails. Visitor crowding and conflict with ORV and non-ORV visitors may increase.
<b>Costs to Management</b>	Moderate. Information must be developed and applied to identify and mark the most resistant trails. The policy, its rationale, and locations of marked trails would need to be communicated to all ORV riders.
<b>Effectiveness</b>	Moderate. ORV traffic would likely be further concentrated, resulting in fewer trails and overall disturbance. These reductions should offset any increased vegetation disturbance and rutting created along the trails receiving more concentrated use.
<b>Comments</b>	Maintenance of the worst spots will become necessary to permit vehicle use of these trails and to prevent the expansion of impact from visitors seeking to circumvent problem spots.

<b>Strategy 4. Encourage Concentration of Traffic in Popular Areas</b>	
<b>Tactic 4.5 Require Use of Designated Trails in Selected Areas</b>	

<b>Purpose</b>	Prevent or reduce resource damage by encouraging the repeated use of a common set of ORV trails in selected areas e.g. areas smaller than entire management units.
<b>Description</b>	Research and monitoring data, in addition to ORV rider experience, is consulted to identify resource characteristics that contribute to resistant ORV trails. These characteristics are used to select resistant trails which are then designated. Visitors are required to use the designated trails in selected areas (of high use and/or high impact). This action reduces resource impact by shifting traffic to a limited set of resistant trails.
<b>Costs to ORV Visitors</b>	High. Visitors would lose their freedom to travel off designated trails within the areas selected. Visitor crowding and conflict with ORV and non-ORV visitors may increase.
<b>Costs to Management</b>	High. Information must be developed and applied to identify and designate the most resistant trails. Construction and maintenance of these at- or above-grade trails would also be essential. Potential for controversy is high. The policy and its rationale would need to be communicated to all ORV riders.
<b>Effectiveness</b>	High. ORV traffic would be highly concentrated, resulting in fewer trails and overall disturbance. These reductions should offset any increased vegetation disturbance and rutting created along the trails receiving more concentrated use.
<b>Comments</b>	Maintenance of the designated trails will be essential to permit vehicle use and to prevent the expansion of impacts from visitors seeking to circumvent problem spots.

<b>Strategy 4.</b>	<b>Encourage Concentration of Traffic in Popular Areas</b>
<b>Tactic 4.6</b>	<b>Require Use of Designated Trails in Selected Management Units</b>
<b>Purpose</b>	Prevent or reduce resource damage by encouraging the repeated use of a common set of ORV trails e.g. as in the Bear Island Unit currently.
<b>Description</b>	Research and monitoring data, in addition to ORV rider experience, is consulted to identify resource characteristics that contribute to resistant ORV trails. These characteristics are used to select resistant trails which are then designated. Visitors are required to use the designated trails in selected management units (including possibly all management units). This action reduces resource impact by shifting traffic to a limited set of resistant trails.
<b>Costs to ORV Visitors</b>	High. Visitors would lose their freedom to travel off the designated trails within selected management units. Visitor crowding and conflict with ORV and non-ORV visitors may increase.
<b>Costs to Management</b>	High. Information must be developed and applied to identify and designate the most resistant trails. Construction and maintenance of these at- or above-grade trails would also be essential. Potential for controversy is high. The policy and its rationale would need to be communicated to all ORV riders.
<b>Effectiveness</b>	High. ORV traffic would be highly concentrated, resulting in fewer trails and overall disturbance. These reductions should offset any increased vegetation disturbance and rutting created along the trails receiving more concentrated use.
<b>Comments</b>	Maintenance of the designated trails will be essential to permit vehicle use and to prevent the expansion of impact from visitors seeking to circumvent problem spots.

<b>Strategy 5.</b>	<b>Reduce Use in Problem Areas</b>
<b>Tactic 5.1</b>	<b>Discourage Use in Problem Areas</b>

<b>Purpose</b>	Prevent or reduce resource damage and visitor crowding and conflicts by discouraging the use of problem areas (e.g., areas of high disturbance that are smaller than entire management units).
<b>Description</b>	Information describing the resource or social problem, the area(s) in which problems are occurring, and alternative areas are communicated to visitors to discourage use.
<b>Costs to ORV Visitors</b>	Low-Moderate. Visitors retain the freedom to voluntarily comply. Costs to visitors could be higher if similar problems develop in the areas to which visitor use is shifted.
<b>Costs to Management</b>	Low. Such a policy need only be communicated with supporting documentation of its rationale. Use of volunteers from the ORV community can help reduce costs.
<b>Effectiveness</b>	Low-Moderate. Visitor may ignore recommendation. Effectiveness can be increased by describing similar alternative areas and providing information during the planning stage of their trip.
<b>Comments</b>	Attention should be given to the issue of shifting use and problems from one location to another. For resource protection, shifting use is only effective if use is shifted from fragile to resistant places. For social issues, shifting use can be effective if conflicting uses can be separated or crowding reduced to tolerable levels.

<b>Strategy 5. Reduce Use in Problem Areas</b>	
<b>Tactic 5.2 Make Access to Problem Areas More Difficult</b>	
<b>Purpose</b>	Prevent or reduce resource damage and visitor crowding and conflicts by making access to problem areas more difficult e.g. areas of high disturbance that are smaller than entire management units.
<b>Description</b>	Access points near problem areas can be closed or reduced in size in order to reduce use of problem areas. Alternately, maintenance of access trails to problem areas can be reduced or discontinued.
<b>Costs to ORV Visitors</b>	Moderate. Action requires visitor to substitute alternate areas. Costs to visitors could be higher if problems develop in the areas to which visitor use is shifted.
<b>Costs to Management</b>	Moderate. The policy must be communicated with supporting documentation of its rationale. Onsite work may be needed to close or reduce the size of access points.
<b>Effectiveness</b>	Moderate. Though more difficult, visitors retain the option of traveling to the problem areas. Impact may be increased if visitors simply travel further to reach their preferred spots. Effectiveness can be increased by describing similar alternative areas and providing information during the planning stage of their trip.
<b>Comments</b>	Attention should be given to the issue of shifting use and problems from one location to another. For resource protection, shifting use is only effective if use is shifted from fragile to resistant places. For social issues, shifting use can be effective if conflicting uses can be separated or crowding reduced to tolerable levels.

<b>Strategy 5. Reduce Use in Problem Areas</b>	
<b>Tactic 5.3 Establish Quotas for Use in Problem Areas</b>	
<b>Purpose</b>	Prevent or reduce resource damage and visitor crowding and conflicts by limiting use to problem areas through quotas.
<b>Description</b>	Visitor use permitted within problem areas is restricted by the establishment of quotas. Amount of use is regulated to determine the level at which acceptable resource or social conditions can be maintained. For effective implementation, problem areas may have to be defined on the basis of entire management units.
<b>Costs to ORV Visitors</b>	Moderate. Visitor access is retained, though some visitors are prohibited from entering. Costs to visitors could be higher if problems develop in the areas to which use is shifted.
<b>Costs to Management</b>	High. The policy must be communicated with supporting documentation of its rationale. A system for determining quotas, managing access, and enforcement must be developed and managed.
<b>Effectiveness</b>	High. Visitation is reduced to levels that resolve resource and social problems. Agency presence and enforcement may also be critical to success.
<b>Comments</b>	Attention should be given to the issue of shifting use and problems from one location to another. For resource protection, shifting use is only effective if use is shifted from fragile to resistant places. For social issues, shifting use can be effective if conflicting uses can be separated or crowding reduced to tolerable levels.

<b>Strategy 5. Reduce Use in Problem Areas</b>	
<b>Tactic 5.4 Prohibit Traffic in Problem Areas</b>	
<b>Purpose</b>	Prevent or reduce resource damage and visitor crowding and conflicts by prohibiting ORV traffic in problem areas.
<b>Description</b>	Visitor use is temporarily or permanently prohibited within problem areas. Temporary restrictions may be necessary to halt unacceptable levels of impact until control measures may be implemented.
<b>Costs to ORV Visitors</b>	High. Visitors lose the freedom to enter the problem area. Costs to visitors could be higher if problems develop in the areas to which visitor use is shifted.
<b>Costs to Management</b>	Moderate. The policy must be communicated with supporting documentation of its rationale. Agency presence and enforcement must be provided.
<b>Effectiveness</b>	High. Most visitors will likely comply. Effectiveness can be increased by describing similar alternative areas and providing information during the planning stage of their trip.
<b>Comments</b>	Temporary closures may be necessary to prevent unacceptable impacts from continuing while appropriate management actions are considered and implemented. However, attention should be given to the issue of shifting use and problems from one location to another. For resource protection, shifting use is only effective if use is shifted from fragile to resistant places. For social issues, shifting use can be effective if conflicting uses can be separated or crowding reduced to tolerable levels.

<b>Strategy 6. Reduce or Prohibit Traffic in Sensitive Areas</b>	
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<b>Tactic 6.1 Discourage Traffic in Sensitive Areas</b>	
<b>Purpose</b>	Prevent or reduce resource damage by discouraging traffic of sensitive areas e.g. areas smaller than entire management units.
<b>Description</b>	Information describing the area(s) that are particularly sensitive or fragile to ORV use and recommended alternative areas are communicated to visitors to reduce or eliminate traffic in sensitive areas.
<b>Costs to ORV Visitors</b>	Low. Visitors retain the freedom to voluntarily comply. Costs to ORV and non-ORV visitors could be higher if crowding or conflicts develop in the areas to which visitor use is shifted.
<b>Costs to Management</b>	Low. Such a policy need only be communicated with supporting documentation of its rationale. Use of volunteers from the ORV community can help reduce costs.
<b>Effectiveness</b>	Low-Moderate. Visitor may ignore recommendation. Effectiveness can be increased by describing similar alternative areas and providing information during the planning stage of their trip.
<b>Comments</b>	Sensitive areas might include sites of significant cultural or historic value, areas of critical wildlife habitat, areas with rare or endangered species of flora or fauna, or areas with vegetation or soils that are particularly susceptible to impact from ORV use.

<b>Strategy 6. Reduce or Prohibit Traffic in Sensitive Areas</b>	
<b>Tactic 6.2 Establish Quotas for Traffic in Sensitive Areas</b>	
<b>Purpose</b>	Prevent or reduce resource damage by limiting traffic within sensitive areas through quotas e.g. areas smaller than entire management units.
<b>Description</b>	ORV traffic permitted within sensitive areas is restricted by the establishment of quotas. Amount of use is regulated to determine the level at which acceptable resource conditions can be maintained. For effective implementation, sensitive areas may have to be defined on the basis of entire management units.
<b>Costs to ORV Visitors</b>	Moderate. Visitor access is retained, though some visitors are prohibited from entering with vehicles. Costs to ORV and non-ORV visitors could be higher if crowding or conflicts develop in the areas to which visitor use is shifted.
<b>Costs to Management</b>	High. The policy must be communicated with supporting documentation of its rationale. A system for determining quotas, managing access, and enforcement must be developed and managed.
<b>Effectiveness</b>	High. Visitation is reduced to levels that resolve unacceptable impacts to sensitive resources. Agency presence and enforcement may also be critical to success.
<b>Comments</b>	Sensitive areas might include sites of significant cultural or historic value, areas of critical wildlife habitat, areas with rare or endangered species of flora or fauna, or areas with vegetation or soils that are particularly susceptible to impact from ORV use.

<b>Strategy 6. Reduce or Prohibit Traffic in Sensitive Areas</b>	
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<b>Tactic 6.3 Prohibit Traffic in Sensitive Areas</b>	
<b>Purpose</b>	Prevent or reduce resource damage by prohibiting ORV traffic in sensitive areas.
<b>Description</b>	Visitation is prohibited in sensitive areas.
<b>Costs to ORV Visitors</b>	High. Visitors lose the freedom to enter the sensitive area(s) with ORVs. Costs to ORV and non-ORV visitors could be higher if similar problems develop in the areas to which visitor use is shifted.
<b>Costs to Management</b>	Moderate. Policy must be communicated with supporting documentation of its rationale. Agency presence and enforcement must be provided.
<b>Effectiveness</b>	High. Most visitors will likely comply. Effectiveness can be increased by describing similar alternative areas and providing information during the planning stage of their trip.
<b>Comments</b>	Sensitive areas might include sites of significant cultural or historic value, areas of critical wildlife habitat, areas with rare or endangered species of flora or fauna, or areas with vegetation or soils that are particularly susceptible to impact from ORV use.

<b>Strategy 7. Maintain Marked Trails</b>	
<b>Tactic 7.1 Add Fill Material in Problem Areas</b>	
<b>Purpose</b>	Prevent or reduce resource damage through trail maintenance that corrects impassable problem spots.
<b>Description</b>	Fill material is applied to problem spots along commonly used trails to ensure that the majority of vehicles can pass safely. Level of maintenance must be minimally sufficient to prevent excessive trail widening or development of parallel trails.
<b>Costs to ORV Visitors</b>	Low. Trail improvement is beneficial, lessening the chance of becoming stuck. Additional traffic on maintained trails may contribute to visitor crowding or conflicts with ORV and non-ORV visitors.
<b>Costs to Management</b>	High. Trail maintenance is expensive, requiring staff, heavy equipment, and fill material (locally available or purchased). Use of volunteers from the ORV community can help reduce costs.
<b>Effectiveness</b>	Moderate-High. High management costs may prevent an adequate level of maintenance. Also dependent upon the amount of traffic that trails receive. Long-term effectiveness of adding fill material is unknown.
<b>Comments</b>	Maintenance work can only be done during the driest seasons (late winter and spring). Many areas requiring work are remote and difficult to access. Short problem spots could be corrected to the width of a single vehicle, longer sections would require a width sufficient to allow two vehicles to pass each other. The goal of maintenance is to sustain existing traffic, not to improve a trail such that additional traffic is attracted.

<b>Strategy 7. Maintain Marked Trails</b>	
<b>Tactic 7.2 Use Geosynthetics in Problem Areas</b>	
<b>Purpose</b>	Prevent or reduce resource damage through trail maintenance that corrects impassable problem spots.
<b>Description</b>	Geosynthetic materials and fill is applied to problem spots along high-use trails so that the majority of vehicles can pass safely. Level of maintenance must be minimally sufficient to prevent excessive trail widening or development of parallel trails.
<b>Costs to ORV Visitors</b>	Low. Trail improvement is beneficial, lessening the chance of becoming stuck. Additional traffic on maintained trails may contribute to visitor crowding or conflicts with ORV and non-ORV visitors.
<b>Costs to Management</b>	High. Trail maintenance is expensive, requiring staff, heavy equipment, fill material, and geosynthetics. Use of geosynthetics may not be more expensive than use of fill alone as geosynthetics require less fill material and work may last longer. Use of volunteers from the ORV community can help reduce costs.
<b>Effectiveness</b>	High. High management costs may prevent an adequate level of maintenance. Also dependent upon the amount of traffic that trails receive. Geosynthetics should improve the effectiveness of this work though their long-term effectiveness is unknown.
<b>Comments</b>	See comments under 7.1.

<b>Strategy 7. Maintain Marked Trails</b>	
<b>Tactic 7.3 Construct At-Grade Trails</b>	
<b>Purpose</b>	Prevent or reduce resource damage by constructing at-grade trails able to sustain intensive traffic.
<b>Description</b>	At-grade trails are constructed using larger aggregate fill material, replacing unstable substrates where necessary. Tread surfaces are constructed to be level with adjacent substrates and designed to minimize interference with surface water movement.
<b>Costs to ORV Visitors</b>	Low. Trail improvement is beneficial, lessening the chance of becoming stuck. Additional traffic on maintained trails may contribute to visitor crowding or conflicts with ORV and non-ORV visitors.
<b>Costs to Management</b>	High. Trail construction is expensive, requiring staff, heavy equipment, and imported fill.
<b>Effectiveness</b>	High. High management costs will limit the use of this tactic. Also dependent upon the amount of traffic that trails receive. The long-term effectiveness of such at-grade trails is unknown.
<b>Comments</b>	Construction work can only be done during the driest seasons (late winter and spring). This option is likely to be applicable only in the most highly visited and more accessible areas.

<b>Strategy 7. Maintain Marked Trails</b>	
<b>Tactic 7.4 Designate or Maintain Above-Grade Roads</b>	
<b>Purpose</b>	Prevent or reduce resource damage by designating and/or maintaining above-grade trails able to sustain intensive traffic.
<b>Description</b>	Traditional above-grade trails are designated and/or maintained for ORV use, replacing unstable substrates where necessary.
<b>Costs to ORV Visitors</b>	Low. Trail improvement is beneficial, lessening the chance of becoming stuck. Additional traffic on maintained trails may contribute to visitor crowding or conflicts with ORV and non-ORV visitors.
<b>Costs to Management</b>	Moderate. Road designation is inexpensive, maintenance is much more costly, requiring staff, heavy equipment, and fill. Use of volunteers from the ORV community can help reduce costs.
<b>Effectiveness</b>	High. Traffic is sustained on above grade roadbeds.
<b>Comments</b>	Trails should be oriented parallel to water flow where possible and frequent water conveyance across trails must be provided.

<b>Strategy 8. Rehabilitate Closed ORV Trails</b>	
<b>Tactic 8.1 Restore Substrates</b>	
<b>Purpose</b>	Assist recovery of former ORV trails through restoration of substrates.
<b>Description</b>	Fill material from trail berms is redeposited in ruts to restore substrates to their pre-use configuration.
<b>Costs to ORV Visitors</b>	Low. Visitors are unaffected by restoration work.
<b>Costs to Management</b>	High. Trail restoration work is expensive, requiring staff, heavy equipment, and fill material (locally available or purchased).
<b>Effectiveness</b>	Moderate. High management costs may prevent an adequate level of restoration. Long-term effectiveness of substrate restoration work is unknown. Use of volunteers from the ORV community can help reduce costs.
<b>Comments</b>	Substrate restoration work can only be done during the driest seasons (late winter and spring). Many areas requiring work are remote and difficult to access. Research indicates that natural processes act very slowly to erode ORV trail berms and fill in ruts (Deuver 1986). Restoration work on closed ORV trails would speed the recovery process.

<b>Strategy 8. Rehabilitate Closed ORV Trails</b>	
<b>Tactic 8.2 Restore Vegetation</b>	
<b>Purpose</b>	Assist recovery of former ORV trails through restoration of vegetation.
<b>Description</b>	Native vegetation from adjacent off-trail areas or from off-site sources can be planted on former ORV trails to accelerate the recovery process.
<b>Costs to ORV Visitors</b>	Low. Visitors are unaffected by restoration work.
<b>Costs to Management</b>	High. Trail restoration work is expensive, requiring staff, equipment, and vegetative stock (locally available or grown). Use of volunteers from the ORV community can help reduce costs.
<b>Effectiveness</b>	Moderate. High management costs may prevent an adequate level of restoration.
<b>Comments</b>	Vegetation restoration work may not be effective during the drier season. Many areas requiring work are remote and difficult to access. Research suggests that natural unassisted vegetative recover occurs relatively quickly so assisted recovery work may not be necessary (Deuver 1986).

<b>Strategy 9. Modify ORVs to Reduce Impacts</b>	
<b>Tactic 9.1 Specify ORV Weights, PSI/Displacement, Clearance, Engine Size, or Tires</b>	
<b>Purpose</b>	Prevent or reduce resource damage by modifying ORV specifications or vehicle types
<b>Description</b>	Vegetation and soil disturbance can be minimized by encouraging or requiring use of lower impact ORVs.
<b>Costs to ORV Visitors</b>	Moderate-High. ORV owners may have to modify existing vehicles or purchase new vehicles. These vehicles may be less effective in certain soil types.
<b>Costs to Management</b>	Moderate-High. A review of research and ORV use experience should be conducted and implications for preferred ORV specifications communicated to all ORV riders. Conduct new research where needed. If requirements are used, an inspection and enforcement program must be administered.
<b>Effectiveness</b>	Moderate-High. Low-impact ORVs have the potential to substantially reduce environmental effects.
<b>Comments</b>	Specifications may pertain to ORV weight, ground pressure (pounds/sq. in. or displacement), clearance, engine size, tire type (including number, size, arrangement, and tread type), or noise. Owners of vehicles that fail to meet specifications would be given a grace period to modify their vehicles or purchase new ones. The current ban on tracked vehicles should be revisited as technological improvements appear to be producing new low impact vehicles.

<b>Strategy 9. Modify ORVs to Reduce Impacts</b>	
<b>Tactic 9.2 Relate ORV Access to ORV Specifications</b>	
<b>Purpose</b>	Prevent or reduce resource damage by regulating ORV access within the Preserve based on vehicle specifications.
<b>Description</b>	Vegetation, soil disturbance, and wildlife disturbance can be minimized by restricting access to ORV types that have a higher potential for creating impact.
<b>Costs to ORV Visitors</b>	Moderate-High. ORV owners with higher impact ORV's may be prohibited from entering certain areas of the Preserve.
<b>Costs to Management</b>	Moderate. Managers would have to devise, implement, and operate a system that matches vehicle specifications to environmental attributes and conditions within different areas of the Preserve.
<b>Effectiveness</b>	Moderate-High. ORVs with a higher potential for creating impacts would be prohibited from more sensitive areas.
<b>Comments</b>	A formula based on specifications developed for Tactic 9.1 would be applied to rate ORVs based on their potential to cause environmental impact. Subsequent ratings could be classified and ranked from low impact vehicles (Class A) to high impact vehicles (Class F). Class A vehicles would have broader access within the Preserve than Class B vehicles and so on. Lower class vehicles might be entirely prohibited after some period of time.

<b>Strategy 9. Modify ORVs to Reduce Impacts</b>	
<b>Tactic 9.3 Reduce ORV Noise</b>	
<b>Purpose</b>	Prevent or reduce wildlife disturbance and visitor conflicts by restricting ORV noise levels.
<b>Description</b>	If shown by research to be important, noise specifications for each type of ORV could be established (voluntary or regulatory) to reduce the potential for wildlife or visitor disturbance. Quiet times could also be established when ORV could not be operated.
<b>Costs to ORV Visitors</b>	Moderate-High. ORV owners may have to purchase new mufflers or even engines in order to be in compliance with noise specifications. Alternately, ORVs could not be operated during certain times of the day (e.g. night time).
<b>Costs to Management</b>	Moderate. A review of research and ORV use experience should be conducted and implications for noise restrictions communicated to all ORV riders. If requirements are used, an inspection and enforcement program must be administered.
<b>Effectiveness</b>	Low-Moderate. If voluntary, visitors may not modify their vehicles to comply with specifications.
<b>Comments</b>	Existing literature on noise effects to both recreationists and wildlife is sparse, new research may be needed.

<b>Strategy 10. Restrict Particularly Damaging Types of ORVs</b>	
<b>Tactic 10.1 Discourage Use of Particularly Damaging Types of ORVs</b>	
<b>Purpose</b>	Prevent or reduce resource damage by discouraging use of ORV types demonstrated to be particularly damaging.
<b>Description</b>	Some ORV types may be particularly damaging. Impacts to vegetation and soils might be minimized by discouraging or phasing out the use of these vehicles, thus encouraging development and use of more lightly impacting vehicle types.
<b>Costs to ORV Visitors</b>	High. ORV owners may have to purchase new ORVs.
<b>Costs to Management</b>	Moderate. A review of research and ORV use experience should be conducted and implications for vehicle type communicated to all ORV riders.
<b>Effectiveness</b>	Low. Visitors are not likely to voluntarily purchase new, less impacting, ORVs.
<b>Comments</b>	While tracked vehicles are currently prohibited, new tracked vehicle designs appear to be less impacting and should be reexamined.

<b>Strategy 10. Restrict Particularly Damaging Types of ORVs</b>	
<b>Tactic 10.2 Prohibit Use of Particularly Damaging Types of ORVs</b>	
<b>Purpose</b>	Prevent or reduce resource damage by prohibiting use of ORV types demonstrated to be particularly damaging.
<b>Description</b>	Some ORV types may be particularly damaging. Impacts to vegetation and soils might be minimized by prohibiting the use of these vehicles and requiring the use of more lightly impacting vehicle types.
<b>Costs to ORV Visitors</b>	High. ORV owners would have to purchase new ORVs.
<b>Costs to Management</b>	Moderate-High. A review of research and ORV use experience should be conducted and implications for vehicle type communicated to all ORV riders. Conduct new research where needed. An inspection and enforcement program must be administered.
<b>Effectiveness</b>	Moderate-High. Effectiveness depends upon the magnitude of difference in impact between high- and low-impact ORV types.
<b>Comments</b>	See Comment in 10.1.

<b>Strategy 10. Restrict Particularly Damaging Types of ORVs</b>	
<b>Tactic 10.3 Restrict Use of Particular ORV Types in Sensitive or Problem Areas</b>	
<b>Purpose</b>	Prevent or reduce resource damage by restricting the use of particular ORV types demonstrated to be particularly damaging within sensitive or problem areas.
<b>Description</b>	Some ORV types are particularly damaging. Impacts to vegetation and soils can be minimized by restricting their use in selected sensitive or problem areas.
<b>Costs to ORV Visitors</b>	High. ORV owners may have to convert or purchase new ORVs.
<b>Costs to Management</b>	Moderate-High. A review of research and ORV use experience should be conducted and implications for vehicle type communicated to all ORV riders. Conduct new research where needed. An inspection and enforcement program must be administered.
<b>Effectiveness</b>	Moderate-High. Effectiveness depends upon the magnitude of difference in impact between high- and low-impact ORV types.
<b>Comments</b>	Prohibiting certain vehicle types in selected areas but not in others provides incentives (rather than requirements) for individuals to convert or purchase less damaging vehicle types.

<b>Strategy 11. Modify Timing of ORV Use</b>	
<b>Tactic 11.1 Discourage Use During Times of Resource Susceptibility</b>	
<b>Purpose</b>	Prevent or reduce resource damage by discouraging use when resources are particularly susceptible to disturbance.
<b>Description</b>	This strategy is based on the recognition that the sensitivity of soil, vegetation, and wildlife to ORV impacts vary by season e.g. water level, vegetation, wildlife activity. Impacts are reduced by discouraging use during times of high resource sensitivity. The area affected could be of any size.
<b>Costs to ORV Visitors</b>	Low-Moderate. ORV riders would voluntarily alter the preferred timing of their visits.
<b>Costs to Management</b>	Moderate-High. A review of research and ORV use experience should be conducted and implications for trip timing communicated to all ORV riders. Conduct new research where needed.
<b>Effectiveness</b>	Low-Moderate. Visitors may not modify their trip times. Impacts would still occur during other times of the year.
<b>Comments</b>	Resource susceptibility to ORV use varies with season. Shifting the timing of visitation (or even hunting seasons) could result in less impact. In particular, airboat use in areas or during times when water levels are low has been shown to cause greater substrate disturbance and erosion.

<b>Strategy 11. Modify Timing of ORV Use</b>	
<b>Tactic 11.2 Prohibit Use During Times of Resource Susceptibility</b>	
<b>Purpose</b>	Prevent or reduce resource damage by prohibiting use when resources are particularly susceptible to disturbance.
<b>Description</b>	This strategy is based on the recognition that the sensitivity of soil, vegetation, and wildlife to ORV impacts vary by season e.g. water level, vegetation, wildlife activity. Impacts are reduced by prohibiting use during times of high resource sensitivity. The area affected could be of any size.
<b>Costs to ORV Visitors</b>	High. ORV riders would have to alter the preferred timing of their visits.
<b>Costs to Management</b>	Moderate-High. A review of research and ORV use experience should be conducted and implications for trip timing communicated to all ORV riders. Conduct new research where needed. Additional patrols might be necessary to provide enforcement.
<b>Effectiveness</b>	Moderate. Impacts would still occur during other times of the year.
<b>Comments</b>	See Comment under 11.1.

<b>Strategy 11. Modify Timing of ORV Use</b>	
<b>Tactic 11.3 Regulate Timing of Use to Reduce Crowding and Conflict</b>	
<b>Purpose</b>	Prevent or reduce social problems by reducing or shifting use away from peak use periods or from times that cause greater conflict between user groups.
<b>Description</b>	Visitors are encouraged or required to shift the timing of their visits to avoid periods when visitor crowding and/or the potential for conflicts with other visitors is high.
<b>Costs to ORV Visitors</b>	Moderate to High. ORV riders would have to alter the preferred timing of their visits. Similar problems might develop during the times that receive additional visitation.
<b>Costs to Management</b>	Moderate-High. A review of research and ORV use experience should be conducted and implications for trip timing communicated to all ORV riders. Conduct new research where needed.
<b>Effectiveness</b>	Moderate. If voluntary, visitors may not modify their trip times. This action could also retard vegetation recovery that currently occurs in off-seasons.
<b>Comments</b>	Social science research can help to document these issues and how shifting the timing of ORV use might address any problems.

<b>Strategy 12. Reduce ORV Use in General</b>	
<b>Tactic 12.1 Increase ORV Use Fees</b>	
<b>Purpose</b>	Prevent or reduce resource damage or crowding and conflicts by increasing ORV use fees to reduce visitation and/or cover costs of ORV management and trail maintenance.
<b>Description</b>	Visitation is reduced to limit associated resource and social impacts. Visitation reduction is achieved by modifying the cost of ORV use fees.
<b>Costs to ORV Visitors</b>	Moderate. Visitor access is retained, though at greater cost. Visitors with less commitment to ORV riding or with less wealth will reduce or discontinue their use.
<b>Costs to Management</b>	Moderate. The policy must be communicated with supporting documentation of its rationale. A system for determining a fee structure and its impact on visitation must be developed and managed.
<b>Effectiveness</b>	High. Visitation is reduced to levels that resolve unacceptable impacts. Agency presence and enforcement may also be critical to success.
<b>Comments</b>	Fees charged on a per-visit basis would have greater effect than annual fees. Use of this option is uncommon.

<b>Strategy 12. Reduce ORV Use in General</b>	
<b>Tactic 12.2 Establish Quotas</b>	
<b>Purpose</b>	Prevent or reduce resource damage or crowding and conflicts by establishing quotas that restrict ORV use within specified areas or management units.
<b>Description</b>	Visitation is reduced to limit associated resource and social impacts. Visitation reduction is achieved by setting quotas for individual areas or management units.
<b>Costs to ORV Visitors</b>	Moderate-High. Visitor access is retained, though only for those able to gain entry.
<b>Costs to Management</b>	Moderate. The policy must be communicated with supporting documentation of its rationale. A system for determining who will gain entry, such as a lottery, must be developed and managed.
<b>Effectiveness</b>	High. Visitation is reduced to levels that resolve unacceptable impacts. Agency presence and enforcement may also be critical to success.
<b>Comments</b>	A monitoring program could provide feedback on relationships between amount of use and impact for the purpose of adjusting the quotas.

<b>Strategy 12.</b>	<b>Reduce ORV Use in General</b>
<b>Tactic 12.3</b>	<b>Make Access More Difficult</b>
<b>Purpose</b>	Prevent or reduce resource damage or crowding and conflicts by making access more difficult to reduce visitation.
<b>Description</b>	Visitation is reduced to limit associated resource and social impacts. Visitation reduction is achieved by increasing the difficulty of access, either by reducing the number of accesses or restricting parking lot sizes under a designated access point policy (see Tactic 4.3), or by not maintaining initial segments of ORV trails.
<b>Costs to ORV Visitors</b>	Moderate. Visitor access is retained, though additional travel time may be required to reach preferred destination areas.
<b>Costs to Management</b>	Moderate. The policy must be communicated with supporting documentation of its rationale. Access areas may need to be moved, closed, or reduced in size.
<b>Effectiveness</b>	Moderate. Visitation is reduced, though not necessarily to levels that resolve unacceptable impacts.
<b>Comments</b>	A monitoring program could provide feedback on relationships between amount of use and impact for the purpose of adjusting the number, location, and size of accesses.

<b>Strategy 12.</b>	<b>Reduce ORV Use in General</b>
<b>Tactic 12.4</b>	<b>Limit Length of Stay</b>
<b>Purpose</b>	Prevent or reduce resource damage or crowding and conflicts by limiting length of stay to reduce visitation.
<b>Description</b>	Visitation is reduced to limit associated resource and social impacts. Visitation reduction is achieved by setting limits on length of stay.
<b>Costs to ORV Visitors</b>	Moderate. Visitor access is retained, though trip lengths may be reduced.
<b>Costs to Management</b>	Low. The policy must be communicated with supporting documentation of its rationale. Increased visitor contact and enforcement may be required.
<b>Effectiveness</b>	Low. Visitation may not be reduced if individuals respond by increasing the number of trips. This tactic is likely more effective in reducing camping impacts, travel-related impacts may be unaffected or even increased.
<b>Comments</b>	Use and impact may be shifted from remote areas to more accessible areas

<b>Strategy 12. Reduce ORV Use in General</b>	
<b>Tactic 12.5 Require Certain Skills</b>	
<b>Purpose</b>	Prevent or reduce resource damage or crowding and conflicts by requiring certain skills to reduce visitation.
<b>Description</b>	Visitation is reduced to limit associated resource and social impacts. Visitation reduction is achieved by requiring ORV riders to have certain knowledge and/or low impact travel and vehicle use skills.
<b>Costs to ORV Visitors</b>	Moderate. Visitor access is retained, though visitors must attend courses and learn low impact skills.
<b>Costs to Management</b>	High. The policy must be communicated with supporting documentation of its rationale. Courses in low impact travel skills (e.g. locating and using resistant trails) must be developed and offered. A verification and/or testing program for skills must be developed and administered.
<b>Effectiveness</b>	Moderate. Visitation is reduced, though not necessarily to levels that resolve unacceptable impacts. Visitors may not apply learned new knowledge or skills.
<b>Comments</b>	A standard course could be developed to communicate ORV use regulations and recommended low impact travel and camping practices. Completion of in-class exercises and/or a passing grade on an exam (similar to a drivers license test), would be required to obtain an ORV use permit.

<b>Strategy 12. Reduce ORV Use in General</b>	
<b>Tactic 12.6 Regulate Area of Use to Reduce Conflicts</b>	
<b>Purpose</b>	Prevent or reduce social conflict problems with other user groups by reducing or prohibiting ORV use in selected areas or management units to spatially separate conflicting user groups.
<b>Description</b>	Visitors are discouraged or prohibited from operating ORVs in selected areas to reduce or avoid problems with conflicts between user groups.
<b>Costs to ORV Visitors</b>	Moderate to High. ORV riders would have to alter their preferred travel routes to avoid the selected areas.
<b>Costs to Management</b>	Moderate. Areas would have to be identified and advertised, possibly signed. Enforcement may be necessary to ensure compliance.
<b>Effectiveness</b>	Moderate-High. If voluntary, visitors may not modify their travel routes.
<b>Comments</b>	ORV use is already prohibited within two management units.

## **References**

- Cole, David N., Margaret E. Petersen, and Robert C. Lucas. 1987. Managing wilderness recreation use: Common problems and potential solutions. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Ogden, UT. General Technical Report INT-230. 60 p.
- Duever, Michael J., John E. Carlson and Lawrence A. Riopelle. 1981. Off road vehicles and their impacts in the Big Cypress National Preserve. USDI National Park Service, Big Cypress National Preserve. T-614. National Audubon Society, Ecosystem Research Unit, 214 pp.
- Duever, Michael J., Lawrence A. Riopelle and Jean M. McCollom. 1986. Long term recovery of experimental off-road vehicle impacts and abandoned old trails in the Big Cypress National Preserve. USDI National Park Service, Big Cypress National Preserve. SFRC-86/09. National Audubon Society, Ecosystem Research Unit.
- Manning, Robert E. 1979. Strategies for managing recreational use of National Parks. Parks 4(1): 13-15.