

Ochopee Prairie and Turner River Watershed Restoration

Mitigation for Construction of Facilities on US41 (Tamiami Trail)

Big Cypress National Preserve

Introduction

The objective of this project is hydrologic restoration of wetlands adjacent to the Ochopee Prairie and Turner River areas of Big Cypress National Preserve. Concomitant restoration of biological communities in these areas is expected as areas of soil disturbance are removed and hydroperiods are restored. The restoration will consist of removing elevated areas (roads, canal berms) that obstruct over-land flow of water, and filling drainage canals.

Site Location and Description

This restoration site is part of the Turner River headwaters complex, between Turner River and Ochopee, FL, in Big Cypress National Preserve, Collier County, FL. Part of the restoration occurs south of US41 (Tamiami Trail), where a drainage canal and adjacent canal spoil were restored to natural (surrounding) grade. Other restoration occurred north of US41 in the Bass Lake Estates area, and on the western side of Turner River Road (see illustrations).

Field Sampling Design

Vegetative Sampling. Vegetative community compositions in the restoration areas were estimated for the Baseline (before restoration), Time Zero (At conclusion of physical restoration work), and Year One (one year following physical restoration work) restoration conditions. To monitor changes in the restoration areas, we will establish permanent quadrats to measure plant cover; these measures will occur at least once every six months for at least five years from the time of habitat restoration. Measures of plant cover will be considered as indicators of site conditions, and will be compared with permanent quadrats that will be simultaneously established in the native communities surrounding the restoration areas. The quadrats in the surrounding natural communities will be established within 50 m of the edge of the restoration areas, and will be examined once every six months, simultaneous with the restoration area plant cover measures

(above) to estimate cover by vascular plant species. At each quadrat location, five m² quadrats will be established in the restoration area and five m² quadrats will be established in the surrounding community. One-meter-by-one-meter PVC quadrats that are divided into 100 dm² units will be placed in the restored community quadrat stations and in the surrounding natural community quadrat stations to estimate cover by all vascular plant and macro-algal species within the shadow of the quadrat.

Photographic Documentation. Permanent photo points will be established at restoration areas at the drainage canal south of US41, Bass Lake Estates and west of Turner River Road.

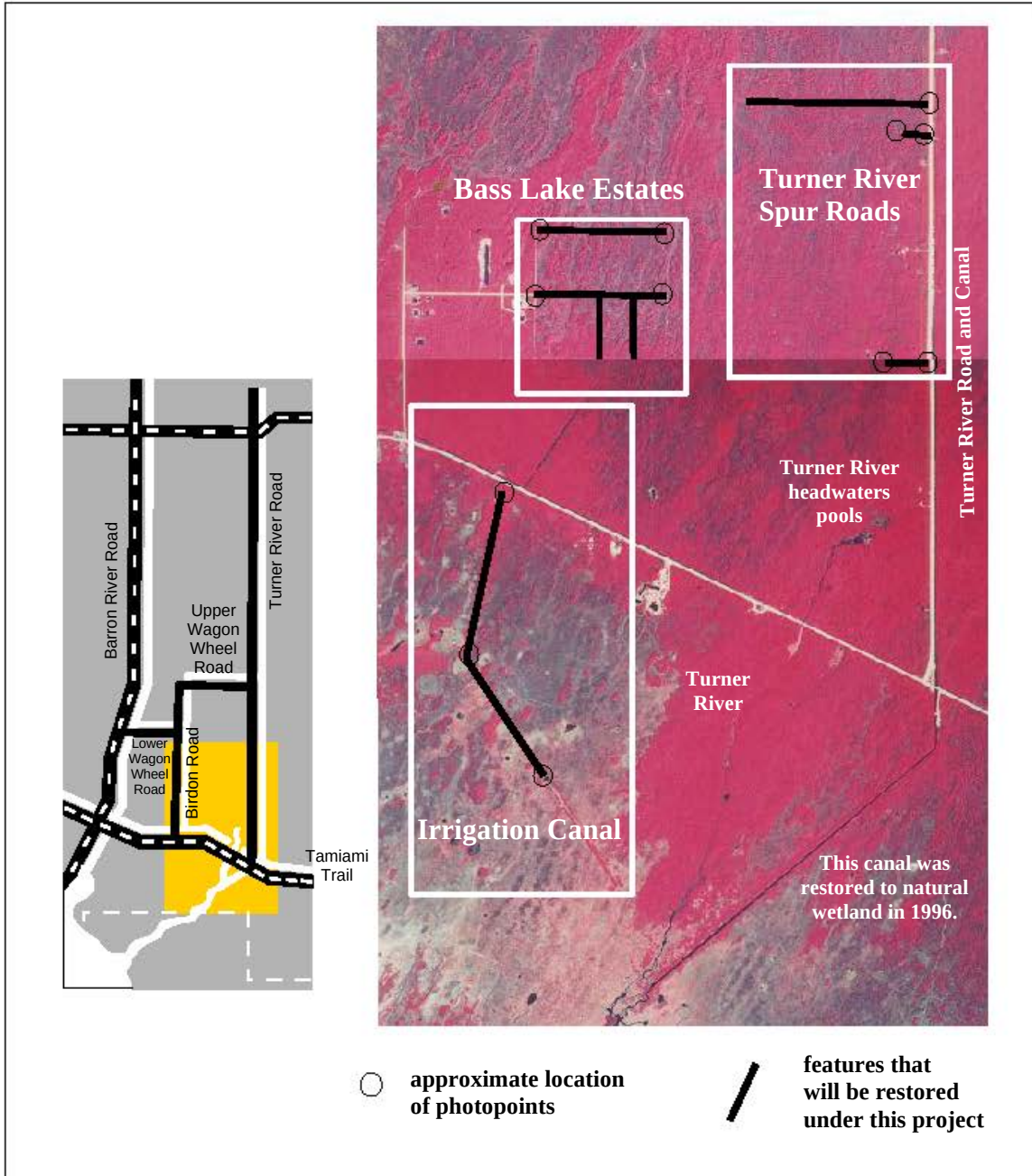
Aquatic Macrofauna Sampling. Funnel traps for crustaceans and small fish will be deployed in open water in or adjacent to the restoration areas. Dip nets will be considered for use in open water in or adjacent to restoration areas; standard procedures will be followed for dip net sampling.

Fish and Wildlife Observations. Fish and wildlife or signs of wildlife, such as tracks spoor, prey kills, tree rubs, etc. will be noted and recorded during data collection and other times observers are in the restoration areas.

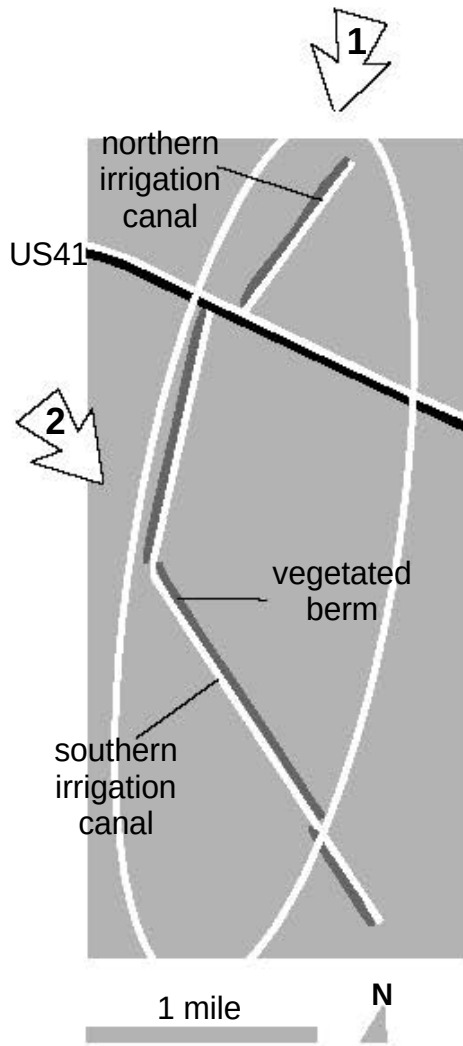
Hydrology. Rainfall is recorded at Oasis ranger Station and at the Ochopee Headquarters complex in Big Cypress National Preserve. These data will be made available. Measures of water flow beneath Bridge 81 at US41, the location of the restored drainage canal (canal restoration did not occur in the US41 Department of Transportation right-of-way) are available from the South Florida Water Management District.

Turner River Headwaters Disturbed Lands Restoration

Overview of Restoration Sites and Photopoint Locations



Aerial Photographs of the Southern and Northern Irrigation Canals



Explanation.

 Arrows indicate direction the photo was shot.

 Circles approximate the focus area of the photo.

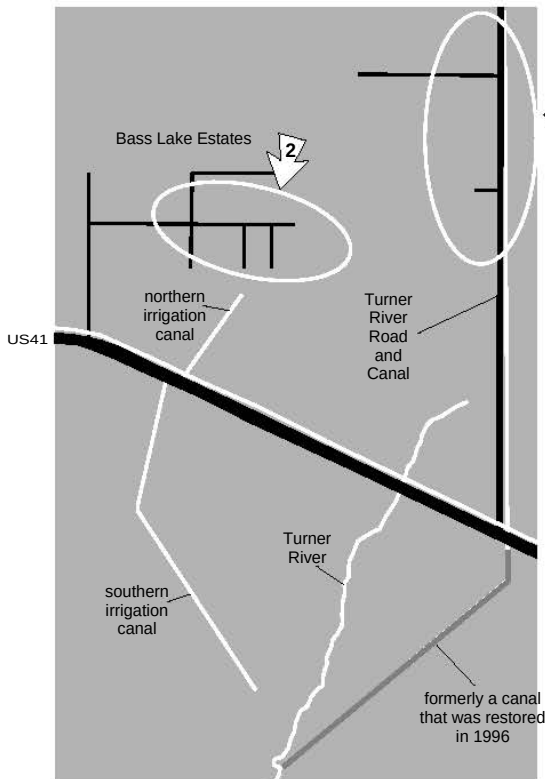


Photograph 1. Shot looking south at the northern and southern irrigation canals. The northern canal is in the foreground.



Photograph 2. Shot looking southwest at the bend in the southern irrigation canal. The berm switches sides at the bend.

Bass Lake Estates and Turner River Road



Explanation.



Arrows indicate direction the photo was shot.



Circles approximate the focus area of the photo.

1 mile

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Photograph 1. Aerial view of Turner River Road, looking west. Spur roads are beneath the canopy.



Photograph 2. Aerial view of non-residential east end of Bass Lake Estates, looking south. All elevated roads to the left of the borrow pits will be removed under this project.

Results and Discussion

Physical Changes. Since early 2000, 25.5 acres (10.3 ha.) of disturbed landscape near the Ochopee Prairie and Turner River Headwaters, Big Cypress National Preserve, have undergone initial restoration to re-establish native wetland communities. This restoration was primarily done through excavation of fill material and blocking drainage canals. This has restored the disturbed areas' topography and hydrology, and restoration of native wetland communities is expected to occur over time. In addition to the fill removal and canal filling, we conservatively estimate that ca. one square mile (640 ac., 259 ha.) of wetlands surrounding these restoration areas have been affected by the drainage and water diversion that occurred because of these structures. This restoration will help to return a more natural hydrology to the surrounding areas, so that they also will realize a return to more natural conditions and will undergo habitat restoration over time.

Exotic Species Removal. Almost all of the areas that had been elevated with fill were infested with Brazilian pepper (*Schinus therbinthifolius*). These trees were removed with the fill that created the change in elevation or other soil disturbance, so that 10 – 12 ac. of monocultural Brazilian pepper stands were removed. The lower ground elevations and restored hydroperiods that were created in these restored areas will decrease the chances of re-establishment by Brazilian pepper; however, some colonization by this and other exotics can be expected. Big Cypress National Preserve has strong and aggressive program of exotic removal and maintenance that includes ongoing Brazilian pepper containment and removal. We anticipate providing this demonstrated ability to manage exotics by periodic maintenance to keep exotics at a minimum in the restoration areas.

The submersed aquatic hydrilla (*Hydrilla verticillata*) was also common in the drainage canal south of US41. This exotic has been almost completely removed from the restoration site, as the canal has been displaced by the upland berm that had been adjacent to the canal. Hydrilla may still occur in the part of the canal that remains near US41, but this has been largely displaced by the native common naiad (*Najas guadelupensis*).

South of US41, Drainage Canal

Progress Report, 2001

Project Description

Problem Statement

This project resulted in restoration of 25.5 acres of wetland within Big Cypress National Preserve near the headwaters of the Turner River. Under pre-project conditions, the 25.5 acres of elevated roadbeds, canal-side berms, and canals caused hydrologic and vegetative disturbances. The elevated features blocked the natural movement of surface water across the wetlands and also served as an ideal media for invasive exotic and unnatural vegetation growth. The canal features drained water away from the surrounding wetland and nearby natural drainage features such as

the Turner River. Restoration of these features to natural grade is anticipated to result in immediate hydrologic and vegetative improvements to the affected areas. The long-term benefit of the restoration is that it opens the door for future actions to improve the natural flow regime in the Turner River.

Annual Objectives – 2000 (year 1)

Accomplishments for the 2000 field season were as follows:

1. Remove the three (3) elevated roadbeds that spur off Turner River Road and return areas to natural wetland grade.
2. Remove the network of elevated roadbeds on the eastern end of Bass Lake Estates and return areas to natural wetland grade. Total restoration acreage of task items 1 and 2 is 5.6 acres.

Annual Objectives – 2001 (year 2)

Accomplishments for the 2001 field season are as follows:

3. Use “cut and fill” techniques to restore 1.5 miles of a defunct irrigation canal and adjacent earthen berm to natural wetland grade. Total restoration acreage was 20 acres.

Photographic Documentation.



Former drainage canal immediately after filling with adjacent spoil and grading to surrounding ground levels. US41 is in the immediate foreground and the former canal and spoil bank extended south (reach 2) and then southwest (reach 3). Brazilian pepper formerly dominated the areas adjacent to the canal.



Former drainage canal immediately after filling with adjacent spoil and grading to surrounding ground levels. This area is ca. 1 km south of US41, looking north, immediately after topographic restoration (left), and less than one year after topographic restoration (right). Wetland graminoids are becoming established on the exposed soil after the wet season inundation; willows and occasional wax myrtles have undergone robust growth in the areas adjacent to the restoration (right).

Vegetative Sampling.

Percent cover for Baseline and Time Zero restoration stages was estimated with photographs and limited site inspection; estimated percent cover for Year one was done by on-site inspection (Table 1.).

Table 1. Former Drainage Canal South of US41, Reach 2: common vascular plant species.

Species:	Time:	<u>Baseline</u>	<u>Time Zero</u>	<u>Year One</u>
	Estimated Percent Cover:			
<i>Amaranthus australis</i>		0	0	*
<i>Boehmeria cylindrica</i>		0	0	*
<i>Cephalanthus occidentalis</i>		0	0	*
<i>Chara</i> sp.		<10	0	*
<i>Crinum americanum</i>		0	0	*
<i>Dichromena colorata</i>		0	0	*
<i>Eleocharis greniculata</i>		0	0	*
<i>Eleusine indica</i>		0	0	*
<i>Fuirena breviseta</i>		0	0	*
<i>Hydrilla verticillata</i>		>90	<10	0
<i>Ipomoea sagittata</i>		0	0	*

<i>Juncus megacephalus</i>	0	0	*
<i>Kosteletzkya virginica</i>	0	0	*
<i>Ludwigia microcarpa</i>	0	0	*
<i>Ludwigia repens</i>	>10	0	*
<i>Najas guadelupensis</i>	<10	0	10
<i>Panicum hemiotomon</i>	0	0	*
<i>Pontederia cordata</i>	0	0	*
<i>Salix caroliniana</i>	10	<10	<10
<i>Schinus terebinthifolius</i>	>90	<10	*
<i>Senecio galabellus</i>	0	0	*
<i>Spartina bakeri</i>	0	0	*
<i>Thalia geniculata</i>	<10	0	<10
<i>Typha domingensis</i>	<10	0	10

* species noted as present, but not sufficiently common to estimate cover.

Aquatic Macrofauna Sampling. Sampling for crayfish (*Procambrus* spp.) produced no specimens from 15 February to 04 March 2002; no other macro invertebrate sampling was done.

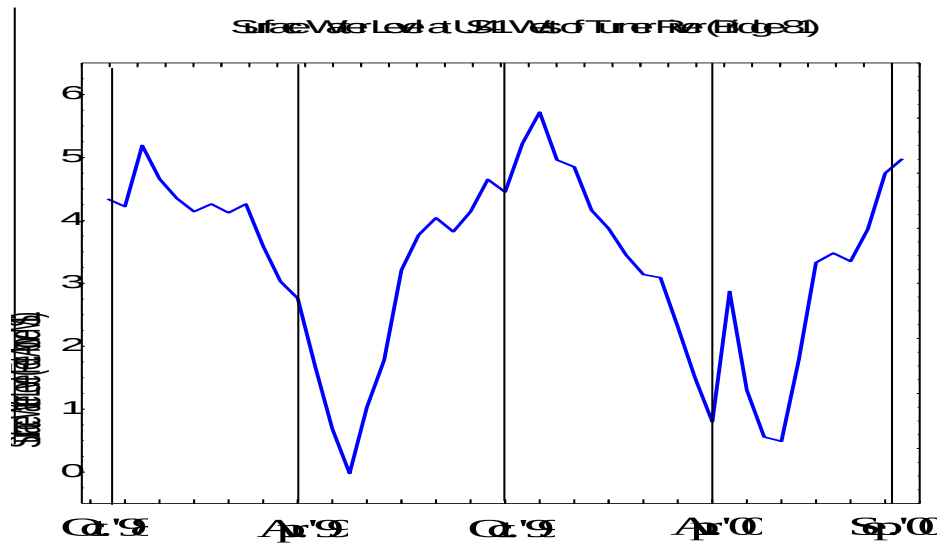
Fish and Wildlife Observations. The following wildlife observations were noted:

On 28 February 2002 a juvenile black bear (*Ursus americanus*) was noted crossing US41 within 50 m of the restoration area south of US41; about 24 white ibis (*Eudocimus albus*) were noted foraging in the same restoration area.

On 04 March 2002 four white-tailed deer (*Odocoileus virginicus*) were noted in the restoration area south of US41.

On 28 February and 04 March 2002 tracks of several animals were noted in the restoration area south of US41, these animal tracks included common alligator (*Alligator mississippiensis*), white-tailed deer (*Odocoileus virginicus*), an adult black bear (*Ursus americanus*), raccoon (*Procyon lotor*), undetermined turtles, and several undetermined wading birds.

Hydrology.



Hydrology of the area west of Turner River at Bridge 81, Tamiami Trail for two years before restoration. Levels of surface water above mean sea level are indicated.

Biological Communities

The area at Bass Lake in which this restoration occurs is largely hydric pine flatwoods, cypress slough, and marl prairies with broad ecotonal communities intergrading between these identified communities. In the areas west of Turner River Road, the area is dominated by cypress slough and mixed cypress and hydric hardwoods, with occasional hydric pine flatwoods on sandy, slightly elevated soils.

Roads and abandoned camps in these areas were placed on fill that was taken from adjacent areas, and had become partly to completely dominated by Brazilian pepper trees (*Schinus terebinthifolius*). Restoration in this area has removed and replaced the local fill material to restore sheet-flow and local hydrology. At the same time this removed several acres of Brazilian pepper, and furthermore removed much of the disturbed, elevated soil that provides good growing conditions for this exotic.

Recruitment of native wetland species is occurring in the restoration areas sites; almost no exotics were noted. At the Bass Lake sites, native vascular plants in the restored areas are mostly ruderal grasses with occasional herbs, to produce 30% - 50% ground cover. Chalky blue-stem grass (*Andropogon virginicus*) is the most common ground cover.

At the Turner River Road sites, ground cover is more sparse, probably because of a more dense tree canopy. In this area occasional cypress and pine seedlings appear to b

becoming established in the restoration sites. In areas with longer hydroperiods, red ludwigia (*Ludwigia repens*) commonly dominates the ground cover.

Restoration Areas at Bass Lake

Vegetative Sampling.

Percent cover for Baseline and Time Zero restoration stages was estimated with photographs and limited site inspection; estimated percent cover for Year one was done by on-site inspection (Table 2.).

Table 2. Bass Lake, northern and southern east-to-west roads: common vascular plant species.

Species:	Time: Estimated Percent Cover:	<u>Baseline</u>	<u>Time Zero</u>	<u>Year One</u>
<i>Ammannia latifolia</i>		0	0	*
<i>Andropogon virginicus</i>		10	0	25
<i>Cladium jamaicense</i>		0	0	*
<i>Cirsium horridulum</i>		0	0	*
<i>Crinum americanum</i>		0	0	*
<i>Cyperus haspan</i>		0	0	*
<i>Dichromena colorata</i>		0	0	*
<i>Diodia virginiana</i>		0	0	*
<i>Hymenocallis palmeri</i>		0	0	*
<i>Hyptis alata</i>		0	0	*
<i>Iva microcephala</i>		0	0	*
<i>Lippia nodiflora</i>		0	0	*
<i>Ludwigia microcarpa</i>		0	0	*
<i>Melanthera parviflora</i>		0	0	*
<i>Mikania scandens</i>		0	0	*
<i>Pluchea odorata</i>		0	0	*
<i>Proserpinaca pectinata</i>		0	0	<10
<i>Ruellia caroliniensis</i>		0	0	*
<i>Sagittaria graminea</i>		0	0	*
<i>Sagittaria lancifolia</i>		0	0	*
<i>Schinus terebinthifolius</i>		80**	0	*
<i>Schizachyrium rhizomatum</i>		0	0	<10
<i>Solidago</i> sp.		0	0	*
<i>Sporobolus indicus</i>		0	0	*
<i>Teucrium canadense</i>		0	0	*

* species noted as present, but not sufficiently common to estimate cover.

**** Brazilian pepper thoroughly dominated the roadsides before restoration, but little cover occurred on the road, so that less than 100% total cover occurs here.**

Photo Documentation



Bass Lake Estates area, Fill Removal and Restoration: southern east-to-west road. Former road from which fill has been removed (left); former road after ca. 1.5 yr. recovery (right).

Aquatic Macrofauna Sampling. No macro invertebrate sampling was done.

Fish and Wildlife Observations. The following wildlife observations were noted:

On 14 March 2002 two white-tailed deer (*Odocoileus virginicus*) were noted in the restoration area.

On 14 March 2002 tracks of several animals were noted in the restoration area of Bass Lake, these animal tracks included common white-tailed deer (*Odocoileus virginicus*), an adult black bear (*Ursus americanus*), Florida Panther (*Felis concolor coreyi*), bobcat (*Lynx rufus*), raccoon (*Procyon lotor*), domestic dog (*Canis familiaris*), wild pig (*Sus scrofa*) and several undetermined wading birds.

Hydrology see “Restoration Sites West of Turner River Road Hydrology.” (below).

Restoration Sites West of Turner River Road

Vegetative Sampling.

Percent cover for Baseline and Time Zero restoration stages was estimated with photographs and limited site inspection; estimated percent cover for Year one was done by on-site inspection (Table 3.).

Table 3. West of Turner River Road, east-to-west roads: common vascular plant species.

Species:	Time:	Baseline	Time Zero	Year One
	Estimated Percent Cover:			
<i>Ammannia latifolia</i>		0	0	*
<i>Andropogon virginicus</i>		10	0	10
<i>Aster tenuifolius</i>		0	0	*
<i>Bacopa monieri</i>		0	0	*
<i>Conoclinium coelestinum</i>		0	0	*
<i>Coreopsis leavenworthii</i>		0	0	*
<i>Cirsium horridulum</i>		0	0	*
<i>Cynanchum scoparium</i>		0	0	*
<i>Cyperus haspan</i>		0	0	*
<i>Cyperus sp.</i>		0	0	*
<i>Dichromena colorata</i>		0	0	*
<i>Eragrostis elliottii</i>		0	0	*
<i>Erigeron quercifolius</i>		0	0	*
<i>Eupatorium capillifolium</i>		0	0	*
<i>Flaveria linearis</i>		0	0	*
<i>Ipomoea sagittata</i>		0	0	*
<i>Iva microcephala</i>		0	0	*
<i>Juncus megacephalus</i>		0	0	<10
<i>Juncus sp.</i>		0	0	<10
<i>Ludwigia microcarpa</i>		0	0	10
<i>Ludwigia octovalvis</i>		0	0	*
<i>Mikania scandens</i>		0	0	*
<i>Mitreola petiolata</i>		0	0	*
<i>Pinus elliottii</i>		0	0	*
<i>Pluchea odorata</i>		0	0	*
<i>Proserpinaca pectinata</i>		0	0	<10
<i>Sagittaria graminea</i>		0	0	*
<i>Sagittaria lancifolia</i>		0	0	*
<i>Salix caroliniana</i>		0	0	*
<i>Schinus terebinthifolius</i>		80**	0	*
<i>Schizachyrium rhizomatum</i>		0	0	*
<i>Solidago sp.</i>		0	0	*
<i>Taxodium distichum</i>		0	0	*
<i>Teucrium canadense</i>		0	0	*
<i>Utricularia foliosa</i>		0	0	*
<i>Utricularia purpurea</i>		0	0	*

* species noted as present, but not sufficiently common to estimate cover.

** Brazilian pepper thoroughly dominated the roadsides before restoration, but little cover occurred on the road, so that less than 100% total cover occurs here.

Aquatic Macrofauna Sampling. No macro invertebrate sampling was done.

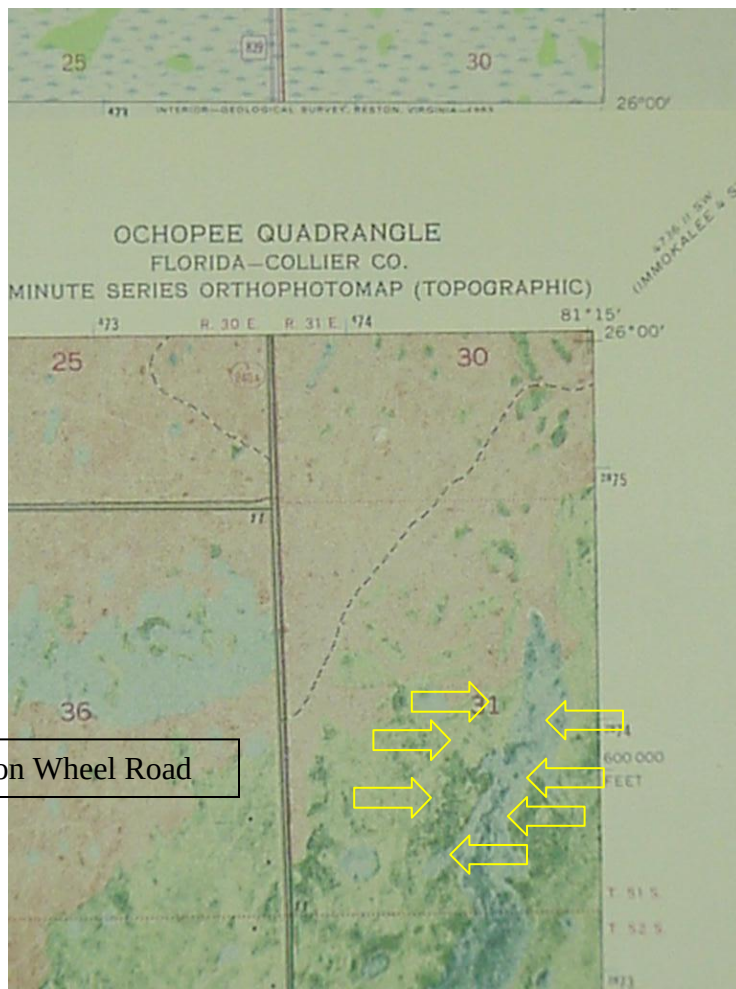
Fish and Wildlife Observations. The following wildlife observations were noted:

On 14 March 2002 tracks of several animals were noted in the restoration areas west of Turner River Road, these animal tracks included common white-tailed deer (*Odocoileus virginicus*), raccoon (*Procyon lotor*).

Concho Billy Off Road Trail Vehicle Restoration

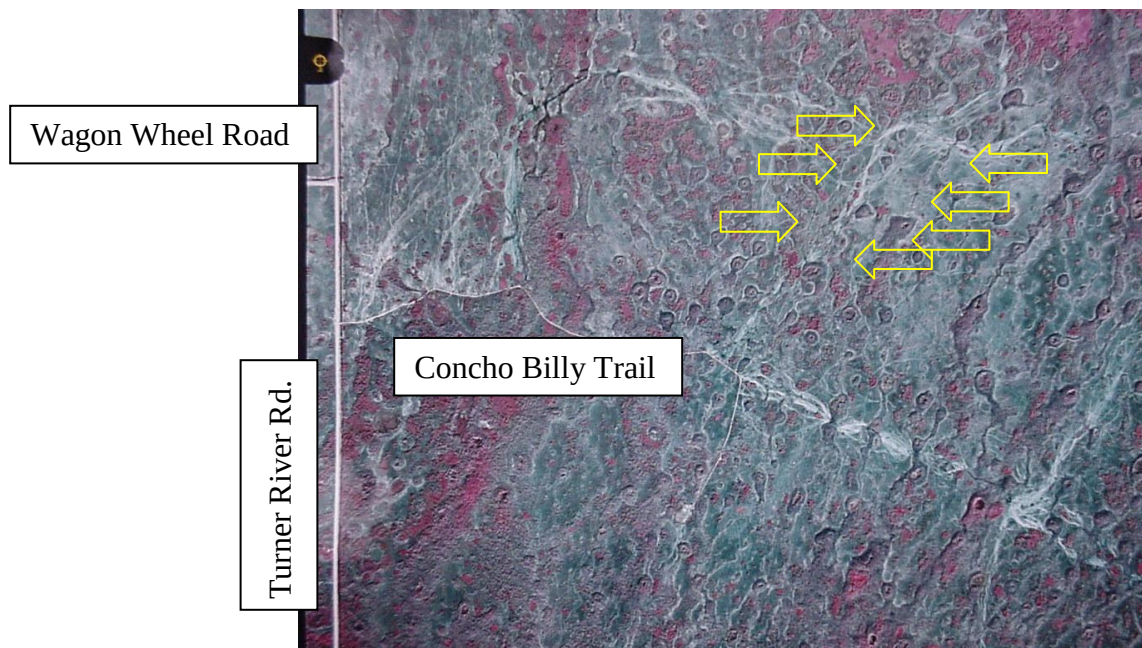
Introduction

As part of an Off Road Vehicle Management Plan that was approved by the National Park Service, US Department of the Interior, Big Cypress National Preserve has undertaken restoration activities in several areas that have been ecologically compromised by off road vehicle activities. An area of approximately 60 acres adjacent to Concho Billy Trail has been identified as a research site for restoration. Within this area are two single hectare quadrats and five transects that have been established to



Northeastern corner of USGS Ochopee Quadrangle map with Concho Billy Trail area indicated. The location of the approximately sixty acre Off Road Vehicle trail restoration area is outlined with yellow arrows.

monitor the progress of habitat regeneration and succession. Also within this area, two restoration treatments have been put in place: one treatment is completely natural regeneration in which no site alteration will occur; the second treatment uses mechanical equipment to level the vehicle ruts in the soil without mixing the surface soil with subsurface components. Plant cover will be monitored to determine whether either of these treatments is more effective for prairie community recovery. Data were gathered from the restoration areas in the spring of 2001, immediately after site identification and preparation, to quantify plant cover and site topography.



False color infra-red satellite imagery of the Concho Billy Trail area. The location of the approximately sixty acre Off Road Vehicle trail restoration area is outlined with yellow arrows. Other trails and areas heavily used by off road vehicles produce light colored registers on this imagery.

Vegetative Sampling.

Percent plant cover for Baseline was estimated with photographs and limited site inspection and Time Zero restoration stage was estimated with quadrat and transect cover measures. Percent cover for Year One will be estimated with transect and quadrat cover measures in late spring 2002 (Table 3.).

Table 3. Concho Billy Off Road Vehicle Trail Restoration site: common vascular plant species.

Species:	Time: Estimated Percent Cover:	Baseline	Time Zero
<i>Agalinis</i> sp.		<10	1
<i>Annona glabra</i>		<1	*
<i>Aster bracei</i>		<1	*
<i>Bacopa caroliniana</i>		<10	*
<i>Cassytha filiformis</i>		<1	*
<i>Cladium jamaicense</i>		10	3
<i>Crinum americanum</i>		<10	2
<i>Dichanthelium</i> sp.		<10	*
<i>Dyschoriste angulata</i>		<1	*
<i>Eleocharis geniculata</i>		<1	*
<i>Elytraria caroliniana</i>		<1	*
<i>Eragrostis elliottii</i>		<10	*
<i>Flaveria linearis</i>		<10	*
<i>Heliotropium polyphyllum</i>		<1	*
<i>Hymenocallis palmeri</i>		<10	*
<i>Iva microcephala</i>		<1	*
<i>Juncus megacephalus</i>		<1	*
<i>Mitreola sessilifolia</i>		<1	*
<i>Muhlenbergia capillacea</i>		10	*
<i>Panicum repens</i>		<10	2
<i>Panicum tenerum</i>		<10	3
<i>Paspalum monostachium</i>		<10	2
<i>Phragmites australis</i>		<1	*
<i>Pluchea odorata</i>		<10	*
<i>Proserpinaca pectinata</i>		<1	*
<i>Rhynchospora divergens</i>		<10	4
<i>Rhynchospora</i> sp.		<1	*
<i>Sabatia grandiflora</i>		<1	*
<i>Schizachyrium rhizomatum</i>		<10	*
<i>Setaria geniculata</i>		<10	*
<i>Solidago stricta</i>		<1	*
<i>Taxodium distichum</i>		1	*

* species noted as present, but not sufficiently common to estimate cover.

Photographic Documentation.



Restoration sites southeast of Concho Billy Trail (May 2001). One site (left) was prepared by leveling wheel ruts without mixing the surface soils with deeper substrates; another area (right) was left with no surface preparation. Both will be left to allow natural establishment, recruitment, and succession of plants. Plant cover and diversity will be monitored in each area.

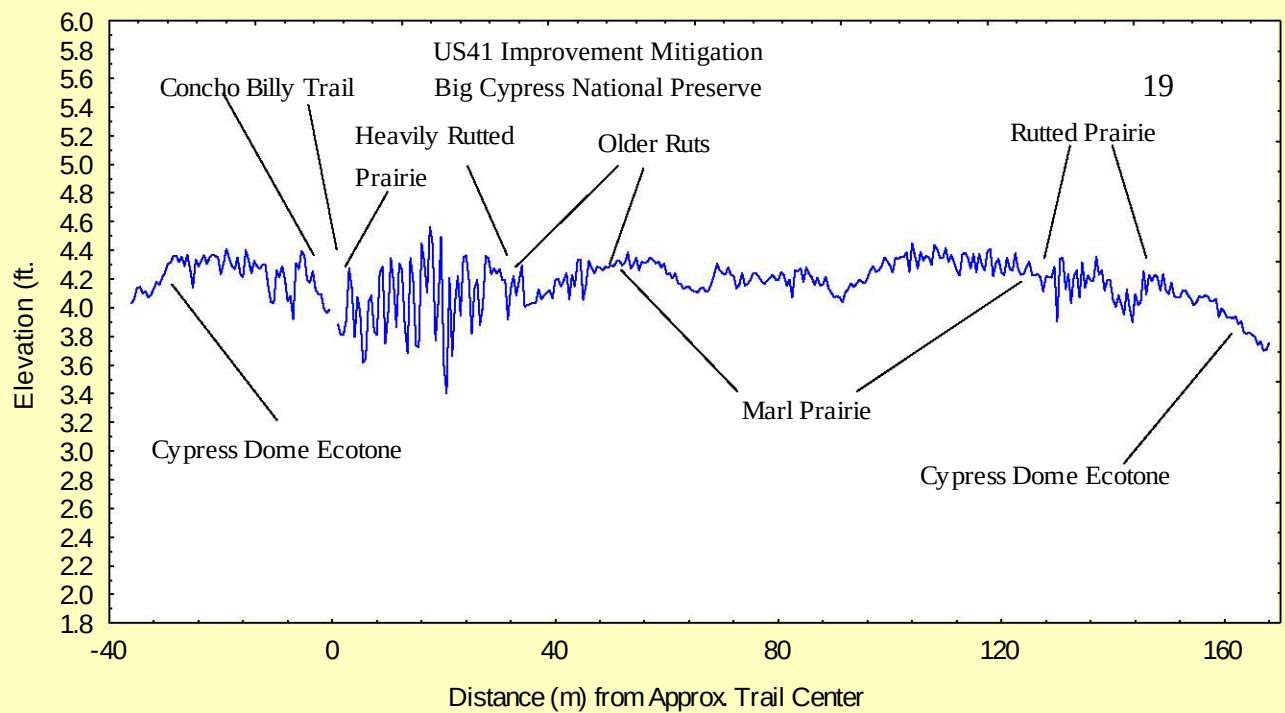


Restoration sites southeast of Concho Billy Trail (May 2001). Aerial aspects of the restoration site with substrate prepared by leveling wheel ruts (left), and the restoration site with no substrate restoration (right). Each of these sites is identified for photo-documentation so that subsequent photos of each area can be made to compare growth of plants and succession.

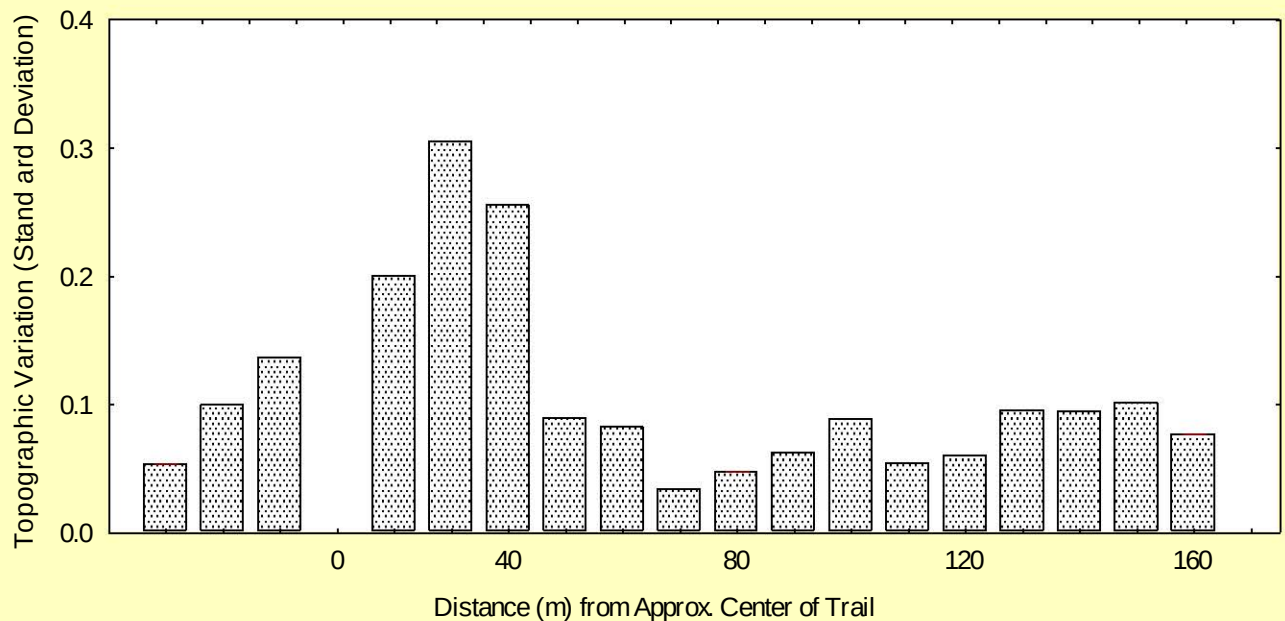
**Big Cypress National Preserve
US41 Improvement Project
Schedule of Mitigation Activities**

<u>Restoration Site</u>	<u>Area (Ac)</u>	<u>Restoration</u>	<u>Time Zero</u>	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>
Canal S. of 41	20.0	spring 2001	spring 2001	4/21/02	4/21/03	4/21/04	4/21/05
Bass Lake	3.6	fall 2000	fall 2000	4/21/02	4/21/03	4/21/04	4/21/05
Turner River Rd	2.0	fall 2000	fall 2000	4/21/02	4/21/03	4/21/04	4/21/05
Concho Billy	60.0	spring 2001	spring 2001	4/21/02	4/21/03	4/21/04	4/21/05

Concho Billy Trail, Transect 1. May 2001



Topographic Variation in Areas Adjacent to Concho Billy Trail. May 2001. Transect 1



Concho Billy Trail, Transect 1 (top graph). This graph indicates topography on a transect that extends approximately east to west and perpendicular to Concho Billy Trail, Big Cypress National Preserve. The transect is continuous from the center of the trail, across prairies, to cypress domes on each side of the trail. Elevations were measured every 0.50

m. Areas of prairie adjacent to the trail were heavily rutted by ORV traffic, and a similarly heavily used area adjacent to a cypress dome is evident as variation in elevation.

Topographic Variation in Areas Adjacent to Concho Billy Trail (bottom graph). The bar graph indicates standard deviations (S. D.) of transect (above) segments. S. D. was calculated for each 10 m transect segment as measured from the center of the trail. Elevations were measured every 0.50 m. Greater S. D.s occurred in areas of greater variation from the mean; these are also areas with more habitat alteration and more intense ORV use. Measures of deviation such as this will be used as a measure of habitat disturbance by ORV traffic.

Proposed Monitoring

Ecological studies and concomitant monitoring of study areas similar to the ongoing study areas at Concho Billy Trail (above) will be organized to mitigate ground-level trail strengthening activities. These areas will be studied to determine conditions of soils, and their biological communities. Measures of plant communities will be taken during the dry season each year to minimize compromises to the wetland systems by data collection activities, and to maximize the efficiency of data collection. Data will be collected in these areas to measure changes in plant communities over time, so that they can be compared to communities with similar abiotic characters, but with no apparent alteration by off road vehicles. Plant community measures will include densities and diversities of ground cover, shrub canopy, and tree canopy, amounts of wetland-dependent plants, and recruitment of exotic species.

Areas to be Monitored

Study areas have been identified and preliminary data have been collected at three sites: Concho Billy Trail, Oasis Prairie, and Monroe Station Prairie. In areas that have received trail stabilization this year two more areas for ecological recovery data collection have been identified: Buckskin Prairie and South Monroe Station. Virtually the entire preserve has been affected by off road vehicle traffic, so that additional ecological survey areas can be quickly identified. Places that are located in areas that will help facilitate the logistics of data collection include the Miami-Dade jetport, Raccoon Point, Loop Road management area, Deep Lake management area, and Bear Island.

Proposed Analyses

Measures of plant communities will be gathered to assess changes associated with succession. Data will be collected in these areas to measure changes in plant communities

over time, so that they can be compared to communities with similar abiotic characters, but with no apparent alteration by off road vehicles. Statistical analyses will compare the differences among these communities these communities, and differences between the test areas and areas with no apparent disturbance by off road vehicle use. Multivariate analyses are anticipated to evaluate community changes, and their differences with similar undisturbed communities over time. Changes in amounts of ruderal plants and wetland-dependent plants as a metric of succession will be considered. Recruitment of large numbers of invasive non-native plants will receive two considerations: 1) the exotic plant removal program will consider this as a high priority area for treatment; 2) as a high incidence of exotic recruitment often indicates a disturbance, restoration activities the area will be evaluated to determine whether restoration activities at that site are effective.

Predicted Outcomes

Comparison of prairie sites that receive surface leveling without soil mixing, with sites that receive no treatment will help determine whether soil leveling treatments may be a worthwhile restoration method in disturbed prairies. Surface leveling will apparently minimize chances that small channels are formed on the substrate that may affect local water movement, but whether this may have an affect on large areas is uncertain. By obtaining detailed information of plant communities we will be able to determine whether significant areas may be affected by small differences in ground surface topography.