17 The Hole-in-the-Donut Wetland Restoration and Mitigation Program

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Abstract

A major site of exotic plant invasion within Everglades National Park is an area of former freshwater prairie and upland pine and hardwood forest known as the Hole-in-the-Donut (HID). This area of about 4050 ha of abandoned farmland has within it an area of 2430 ha dominated by a stand of a single exotic woody species, Brazilian pepper (*Schinus terebinthifolius* Raddi). The objective of the HID Wetland Restoration and Mitigation Program is to eliminate *Schinus* and restore the wetland and forest ecosystems lost through agriculture. The program's restoration and mitigation procedures, in operation now for two years, include engineering, construction, and environmental monitoring methods.

Introduction

Everglades National Park encompasses 1.7 million ac and is the only subtropical wilderness in the continental United States. The principal ecosystem types within the Park include shallow marine habitats, saltwater wetland forests and marshes, freshwater marshes and prairies, and an upland complex of pine and hardwood forest communities. One of the major factors controlling the distribution of vegetation within the Everglades is the hydrological pattern as defined by the depth, timing, and duration of inundation, as well as the quality and salinity of the source water. Additionally, surficial geology and overlying soil types also influence plant species composition, and abundance. Natural disturbances (fire, freezes, hurricanes) and anthropogenic perturbation (altered fire regimes, drainage, development, introduction of invasive exotic plants) also have powerful effects on vegetation patterns.

The invasion of exotic plant species is threatening ecosystem form and function in many natural areas throughout the United States, including National Parks. The

invasion of these exotic species result in changes in plant communities, from natural systems and processes to altered systems and processes. Exotic plant species can be thought of as those plants that did not originally occur in the ecosystem, and have since been introduced to the area as a result of natural and human disturbances. Exotic species are so well adapted to and opportunistic on disturbed sites that they are able to out-compete native species. The National Park Service (NPS) defines exotic plant species as those that occur in a given place as a result of direct or indirect, deliberate, or accidental actions by humans (National Park Service 1991). Within Everglades National Park, at least 217 introduced plant species are known to occur (Whiteaker and Doren 1989). This accounts for about 25% of the total number of plant species in the park.

A major site of exotic plant invasion within the park is an area of former freshwater prairie and upland pine and hardwood forest known as the Hole-in-the Donut (HID). This area of about 10 000 ac of abandoned farmland has within it an area of about 6000 ac dominated by a stand of a single exotic woody species, Brazilian pepper (*Schinus terebinthifolius* Raddi).

History of Hole-in-the-Donut

Farming began in the HID in 1916. Agricultural methods used at that time primarily consisted of land clearing and crude mechanical soil preparation. In 1934, the U.S. Congress authorized the establishment of Everglades National Park but excluded the privately owned HID agricultural lands. In the early 1950s, rock plowing was developed. Rock plowing crushed the natural oolitic limestone rock into a growth medium better suited for row crop production than did prior soil preparation techniques. This disturbance changed the substrate from consolidated rock land (or parent material) characterized by low nutrient and anaerobic conditions to very coarse textured soil material characterized by higher nutrient and aerobic conditions. This artificial soil development process increased the susceptibility of the HID to invasion by exotic plant species.

Rock plowing continued in the HID through 1975, by which time about 6000 ac of land had been rock plowed. The remaining 4000 ac within the HID not subjected to rock plowing were abandoned between 1930 and the early 1960s. The non-rock plowed areas have returned to native vegetation through natural successional processes.

After all land in the HID was acquired by the NPS and farming ceased, the NPS was confronted with a dual problem, namely how to reestablish native vegetation and at the same time prevent the invasion of exotic species, particularly *Schinus*. At the time of abandonment, there was little scientifically based information available regarding the successional trends on abandoned rock plowed farmland in south Florida. Attempts to define and describe old field succession were undertaken by

several researchers (Ewel et al. 1982; Krauss 1987). Research showed that *Schinus* invasion proceeded from low densities in a mosaic of herbaceous vegetation 5-10 yr after abandonment, through extremely high densities 10-20 yr after abandonment, to self-sustaining *Schinus* stands after 20 yr since abandonment. Research also showed that for disturbed soil within the HID, proximity to seed source, seed rain intensity, and local distribution were primary causes for *Schinus* expansion in and around the site.

Research was also conducted on ways to restore the HID. Various projects included (1) planting pine seedlings and saplings, (2) seeding with pine and several species of hardwoods and grasses, (3) transplanting native grasses and sedges, (4) mowing, (5) discing, (6) bulldozing and other mechanical techniques to remove *Schinus*, (7) substrate removal, (8) planting hardwood saplings, and (9) chemical control. Although constant mowing and discing prevented *Schinus* reestablishment, both were cost prohibitive and, once stopped, succession proceeded to *Schinus*. The only method that successfully restored a portion of the HID was substrate removal. The net result of substrate removal was elimination of the effects of disturbed substrate and an increase in hydroperiod. Substrate removal was so successful that it was selected as the method of ecological restoration within the HID.

Program Scope of Work

The program's original "Scope of Work" proposed minimum technical requirements for engineering, construction, and environmental monitoring. Engineering and construction tasks included (1) surveys and control sheets, (2) permanent concrete bench marks, (3) identifying remnant vegetation features worth protecting, (4) vegetation clearing and burning, (5) substrate nutrient analysis, (6) substrate removal and substrate disposal (7) hydrologic well installation, and (8) mapping. The environmental monitoring tasks included (1) vegetation monitoring to determine restoration success, e.g., restoration of wetland form and function, (2) hydrologic studies and monitoring, (3) animal studies to determine population dynamics, temporal relationships, and site-use comparisons, and (4) mapping.

Program Funding

The program will be funded by receipt of funds from the Miami-Dade County Freshwater Wetlands Mitigation Trust Fund. Miami-Dade County established the Trust Fund in 1992 as a result of a Special Area Management Plan to evaluate and manage growth and development within the county's Urban Development Zone. The Trust Fund was created for use in acquiring, restoring, enhancing, managing, monitoring, and studying freshwater wetlands within Miami-Dade County. Two-thirds of the funds from this trust will be directed to the park as an off-site mitiga-

tion bank for these urban development zones (Bird Drive Basin and North Trail Wetlands Basin) and for other permitted wetland losses within the area.

Off-Site Substrate Disposal

As originally proposed, about 10 million cu yd of material from the 6000 ac within the HID would have been excavated and removed from the park over a 15 to 20 year period. This excavated soil would have been deposited in nonjurisdictional wetlands east of the C-111 canal.

The original proposal estimates assumed about one truck trip every 4.6 minutes, 10 hours each day, six days per week for five to six months (December through May) during soil hauling operations. This comes to 6453 truck trips for the first 125 ac of soil removal. Once the project increased to 250 to 375 ac/yr (after two years), the number of truck trips would increase to between 13 000 and 16 000 during each construction period. The construction period (December through May) coincides with the peak of the park's visitor season.

Recent changes in overall hydrological restoration and water delivery models indicate a long-term increase in water levels in the C-111 and Shark Slough basins. After review of this issue and its possible impact on park roads by the U.S. Army Corps of Engineers, a determination was made that the park roads could not withstand repeated heavy traffic due to the project's soil hauling activities. Estimates ranged between two and four years until the roads would be unusable and need to be completely rebuilt. Considering the amount of truck traffic, it is assumed the entire 11 miles of road between the HID and the park's main entrance would need to be replaced.

The park is also concerned with safety and liability relating to this high level of truck use on public roads and attendant road damage, and with how the project will affect visitor and employee use of the park and park facilities near the project site. Specific concerns have been raised pertaining to the trucks using the same roads as visitors to the Royal Palm area and employees using the Daniel Beard Center and Iori Office facilities. While this has always been a concern, more recent and accurate assessments by the project's potential bidders of truck volume increases have heightened the park's awareness and apprehension of the haulage and off-site disposal task in the original scope of work. Consideration was given to whether or not the heavy truck use would prevent visitor use and enjoyment of the Royal Palm area, both by excluding visitor traffic during high activity periods of the project and by imposing noise levels in the area that visitors might find intrusive. While the magnitude of these disruptions to park visitors and employees are uncertain, and the project, as originally proposed, devotes substantial resources to traffic control and enforcement, the park has determined that the original program is no longer workable and alternatives to off-site disposal and associated long

haulage distances must be considered.

Alternative to Substrate Disposal Plans

Stockpile substrate on-site

This alternative temporarily stockpiles substrate on-site over the first two years of the project, allowing sufficient time for the evaluation and development of an on-site plan for substrate disposition. The stockpiling of substrate is currently permitted in the Department of the Army Environmental Assessment and Statement of Findings for Permit No. 199301691. During the construction of the temporary stockpile on-site, a supplemental Environmental Assessment (EA) will be conducted over 12 months to assess the opportunities for developing other disposal alternatives for HID substrate. This supplemental EA will address alternative disposal method(s), location(s), size, height, configuration, sloping, and revegetation preferences. The supplemental EA will also address the use of park borrow pits as disposal sites and will consider any wilderness or cultural values of possible on-site borrow pit disposal areas. The temporary stockpile will be kept free of exotics. This work began in September 1997 and will be completed by the end of September 1998.

Off-site disposal

The basic program goal remains the same as originally proposed, to restore about 6000 ac of wetlands within the park by removing exotic vegetation and excavating an average of six inches of soil to limestone base. Disposal of the scrape-down material would occur off-site (outside the park) at locations able to accept thousands of cubic yards of material.

On-site disposal

Rather than disposing of the scrape-down material off-site, this alternative would develop an on-site option for the use of the excavated material to create, over the 20 year life of the project, five to twelve upland forest sites and restore up to eight borrow pits to long hydroperiod wetlands within the project area.

Combination of on-site and off-site disposal

This disposal option is a possible combination of part on-site and part off-site disposal.

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