

VEGETATION REGENERATION IN THE HOLE-IN-THE-DONUT, EVERGLADES NATIONAL PARK, MEETS SUCCESS TARGETS

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Hole-in-the-Donut (HID) Restoration

The Hole-in-the-Donut (HID), located in the southern portion of Everglades National Park (ENP), encompasses 6,300 acres (2,550 hectares; 9.84 square miles) of former freshwater hydric marl prairie, glades marsh, and pine rockland, which was farmed starting in the early 1900s. After farming ceased, the HID developed into a forested, monospecific, Brazilian pepper (*Schinus terebinthifolius*) stands averaging five meters tall (Figure 1).

In 1989, a pilot project tested multiple treatment and restoration methods. The treatment method found to successfully accomplish wetland restoration involved complete removal of disturbed substrate (Figure 2) and exposing bare limestone (Figure 3). After disturbed substrate removal, the area was left to re-vegetate naturally (Figures 4, 5, 6).

An ENP sponsored in-lieu-fee freshwater wetland restoration project drives yearly efforts to restore additional HID areas and continually assess success. In 1997, the project cleared the first major Brazilian Pepper area and established vegetation monitoring plots (Figures 5, 7, 8). Since 1989, ENP has progressively treated additional acreage and continually monitored restoration progress using quantitative methods.

Removing altered and fertilized, rock-plowed soil promotes native plant species colonization conditions that successfully regenerate naturally occurring southern Everglades vegetation communities. Over the last twenty six years, the ENP has successfully restored approximately 4,895 acres to natural wetlands.

Figure 1. Brazilian Pepper Stands



Figure 2. Removal of Brazilian Pepper, Disturbed Soils



Figure 3. Bare Limestone Substrate; remaining Brazilian Pepper stand in background (Res2014)



HID Monitoring and Analyses

Over the past 15 years, ENP has sponsored quantitative monitoring and analysis to assess restoration success and compliance with permit criteria. The current HID monitoring strategy is annually for the first 5 years, then at year 7 and year 10, and then every 5 years. Since 2009, CSS-Dynamac has annually monitored 10x10 meter vegetation plots and performed permit compliance analyses to evaluate:

- Vegetation community composition (Table 1)
- Native plant species recruitment, establishment, and persistence
- Exotic and nuisance plant species cover
- Jurisdictional wetland determinations

Across the HID, CSS-Dynamac performs topographic surveys, surveys elevation, models hydroperiod, and determines vegetation colonization rates and distribution.

Figure 4. Natural Vegetation & Periphyton Colonization, one-year post scraping (Res2014)



Figure 5. Typical 10m x 10m Permanent Vegetation Monitoring Plot, ten-years post scraping



Figure 6. Abundant Sawgrass, and *Colapogon tuberosus*, 10 to 15 years post-scraping



Hydrology (Figure 7) and elevation (Figure 8) significantly affect HID Vegetation Communities' structures (Dynamac, 2012) and influence species diversity (ERG, 2008). The ENP HID restoration technique restores wetland functions and native Everglades plant communities (Table 1).

Table 1: South Florida Vegetation Community (Rutchev et al. 2009) and Florida Natural Areas Inventory (FNAI) Vegetation Classes Identified in HID Restored Areas

South Florida Vegetation Community Classification Name (Rutchev et al. 2009)	Class ID	Class Level	Florida Natural Areas (FNAI) Habitat Name	HID Restoration (Res) Areas with Permanent Vegetation Monitoring Plots Containing the Associated Community Class and FNAI Habitat Names
Freshwater Graminoid Prairie	MFPG	3	Marl Prairie	Res1989, Res1997, Res1998, Res1998North, Res1999, Res2000, Res2001, Res2003, Res2004East, Res2005
Herbaceous Freshwater Marsh	MFH	3	Glades Marsh	Res1989, Res1997, Res1998, Res1998North, Res1999, Res2000, Res2001, Res2003, Res2004East, Res2005
Open Freshwater Marsh	MFO	3	Glades Marsh	Res1999, Res2004East, Res2009East, Res2009West
Open Freshwater Prairie	MFPO	3	Marl Prairie	Res1999
False Willow Shrubland	SSr	3	Marl Prairie	Res2003
Willow Scrub	CSs	3	Marl Prairie	Res1998North, Res2003, Res2004West, Res2005
Willow Shrubland	SSs	3	Glades Marsh	Res1998
Pine Lowland	WSp	3	Wet Flatwoods	Res1998North, Res2005

ENP sponsored vegetation monitoring and scientific analysis indicates the HID restoration approach successfully restores jurisdictional herbaceous wetlands in heavily disturbed substrate areas. HID is meeting regulatory wetland success criteria, re-vegetation is trending toward natural wetland community types, wildlife usage is similar to natural areas, and exotic and nuisance species cover is very low. Substrate removal is a viable restoration technique for areas with massive substrate disturbance.

Figure 7. HID Continuous Hydroperiod Averaged from 1991-2012

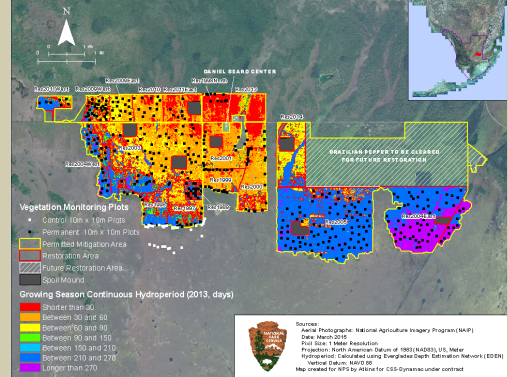
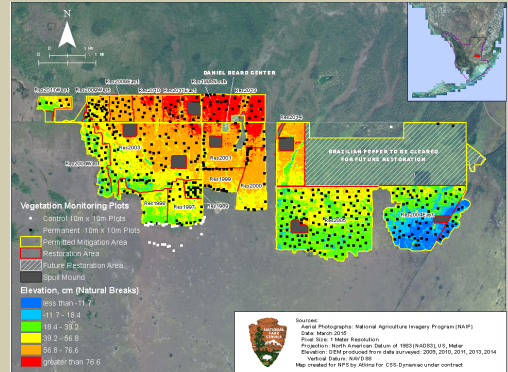


Figure 8. HID Digital Elevation Model (DEM) Gradient



HID Continuous Restoration Success

Natural Re-Vegetation

- Over 350 native vascular plant species are colonizing the restored HID, of which 18 are state-listed endangered or threatened (Dynamac 2013).
- Within the first two restoration years, restoration area species diversity reaches 66% to 97% of maximum ever identified (Dynamac 2012).
- Native wetland species comprise 88% to 100% of observed vegetation within the first five restoration years (Dynamac 2013).
- Periphyton rapidly colonizes HID and ranges 50%-98% areal cover within first five restoration years (Dynamac 2013)

HID Vegetation Communities:

Analysis identifies eight Level III Vegetation Communities within the HID. Restoration area is predominantly Freshwater Graminoid Marsh and Freshwater Graminoid Prairie (Table 1).

The Willow Scrub areas are predominantly herbaceous or graminoid vegetation. With fire management, shrub or taller forb Vegetation Communities (False Willow Shrubland, Swamp Scrub, Willow Scrub, Willow Shrubland, and Swamp Scrub) typically transition into a Vegetation Community more closely associated with graminoids.

Hydrology & Elevation:

Hydrology appropriate for short-hydroperiod herbaceous wetlands has been restored. Over 90% of the project area experiences 30 or more days of continuous inundation during the growing season. Surface elevations across the restored units range from -3.83 feet (-116.6 cm) to 4.87 feet (148.3 cm) (Figure 8) during the wet season; hydroperiod days range from short to very long and have strong negative correlations with elevation (Figures 7 and 8).

Citations

- CSS-Dynamac Corporation. 2014. Environmental Monitoring of Restored Wetlands in the Hole-in-the-Donut, Final Annual Report for 2013-2014. Everglades National Park.
- Dynamac Corporation. 2013. Environmental Monitoring of Restored Wetlands in the Hole-in-the-Donut, Final Annual Report for 2011-2012. Everglades National Park.
- Dynamac Corporation. 2012. Environmental Monitoring of Restored Wetlands in the Hole-in-the-Donut, Final Annual Report for 2010-2011. Everglades National Park.
- Everglades Research Group Inc. (ERG). 2008. Biological Monitoring of the HID Restoration Areas. Final Annual Report #11. Everglades National Park.
- Rutchev, K., Schall, T. N., Doren, R. F., et al. 2009. Version. Vegetation Classification for South Florida Natural Areas: Saint Petersburg, FL, United States Geological Survey, Open-File Report 2006-1240. 142 pps.