Litterfall and Tree Growth Dynamics in Pristine and Degraded Tree Islands in WCA-3A: The Importance of Ecological Functions on Tree Islands

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1. Monitor the environmental factors that collectively influence the sustainability, health and distribution on Tree Islands in the Water Conservation Areas

2. Evaluate the effect of hydrology on aboveground and belowground dynamics

Management Relevance

1. Establish guidelines to better manage water depths & hydric periods in the Water Conservation Areas

2. Use Science to establish performance measures and targets to evaluate restoration success (i.e. Incremental Adaptive Restoration).
Presentation Outline

- Pre-drainage and current hydrological conditions
- Landscape features controlling tree islands hydropatterns in the Everglades
- Tree island functions affected by the hydrologic heterogeneity of the Everglades landscape
SFWMD and Tree Islands: Pre-Drainage Water Depth Regime

Average Annual High = 3 feet
Average Annual Low = 1 foot

(Only long-term averages shown)

Source: McVoy, Said, Obeysekera, VanArman and Dreschel
Northern 3A: Water table drops below surface

Southern 3A: Water too deep; too long

ENP: Water depths too shallow

Source: McVoy, Said, Obeysekera, VanArman and Dreschel
Tree Island Basic Questions:

- What are the spatial and temporal patterns of water depths and hydroperiods needed to sustain plant diversity and optimum productivity patterns?

- What are the ecological and biological traits that best determine successful restoration trajectories?

- How results can be used to make management decisions?
Study Tree Islands

Tree Island 3AS3

Tree Island 3AS4

Tree Island 3AS5

Tree Island 3AS17-6
Results: Hydropatterns (2000-2014)

Head Av: -12.4 cm & 4 months
Near Tail: 24.4 cm & 11 months

Head Av: 5.2 cm & 7 months
Near Tail: 27.5 cm & 11 months

Head Av: -5 cm & 4 months
Near Tail: 19.7 cm & 9 months

Head Av: 30.6 cm & 11 months
Near Tail: 30.1 cm & 11 months
Results: Dominant Species and Water Tolerance

- Ann gla
- Bur sim
- Chr ica
- Chr oli
- Ile cas
- Mag vir
- Myr cer
- Per bor
- Sal car
- Sam can

10-yr WL

Days inn.

% Organic Peat depth

TP

Axis 1

Axis 2

E. axillars
C. oliviforme
B. simaruba
S. palmetto
S. terebinthifolius
C. tacco
S. canadensis
M. cerifera
F. aurea
S. caroliniana
A. glabra
I. cassine
P. palustris
M. virginiana
Tree Growth Rate Seasonal Patterns (mm day\(^{-1}\))

High growth: Wet season

High growth: Dry season

No seasonality

Growth Pattern A. glabra

Growth Pattern M. cerifera

Growth Pattern S. caroliniana

Growth Pattern C. icaco

Growth Pattern M. virginiana

Short Hydroperiod  Long Hydroperiod
Litterfall-Hydrology Relationship

Tree Island 3AS3

Dry Weight (g/m²/d)

Water Depth (cm)

-80 -60 -40 -20 0 20 40 60 80

Tree Island 3AS17-6

Dry Weight (g/m²/d)

Water Depth (cm)

-80 -60 -40 -20 0 20 40 60 80

Tree Island 3AS4

Dry Weight (g/m²/d)

Water Depth (cm)

-80 -60 -40 -20 0 20 40 60 80

Tree Island 3AS5

Dry Weight (g/m²/d)

Water Depth (cm)

80 60 40 20 0 -20 -40 -60 -80

Short Hydroperiod  ○  Long Hydroperiod  ○
Leaf fall (g m² d⁻¹): species temporal and spatial pattern
Leaf fall (g m$^2$ d$^{-1}$): species temporal and spatial pattern
Summary

Frequent fires
Sawgrass

Intermediate inundation
Tree island/sawgrass & slough

Frequent flooding
Sawgrass & slough

Island Vulnerability

Water Depth

Three islands with longer hydroperiods tend to have slower tree growth rates and lower litterfall production.

Long hydroperiods favor some species over others (i.e. water tolerant species over non-tolerant species).

Optimum tree growth and litterfall production will be sustained if a distinct wet-dry cycles is maintained.
Regional Flooding Tolerances of Tree Islands

Management Relevance

Results can be used to establish tree island performance measures and targets CERP. For instance, based on species composition and aboveground production, plant community on tree island tolerate water depth between 20-