Stand Density Index in Everglades tree islands: implications for forest restoration
Objectives


2. Explore the usefulness of stand density in the management of tree islands containing such forests within the Everglades restoration.
South Florida’s subtropical forests (hardwood hammocks)

<table>
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<th>Characteristics, hardwood hammocks in upper Florida Keys</th>
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<tr>
<td><strong>Canopy Height</strong></td>
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<td><strong>Basal area</strong></td>
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<td><strong>Annual production</strong></td>
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<td><strong>Soils</strong></td>
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<td><strong>Species density</strong></td>
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<td><strong>Species origin</strong></td>
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</table>
Hardwood hammocks occur on several types of Everglades tree island...

Large, complex, tear-drop shaped islands forming on & downstream of bedrock outcrops in the semi-permanently flooded marsh...

...or small circular fragments occupying rough, slightly elevated karst surfaces in peripheral seasonal marshes.
Many of the larger tree islands in the Everglades have been heavily used for thousands of years, and people have had an important role in current vegetation and substrate.
Three biological objectives for tree islands in Everglades restoration:

1. Provide critical wildlife habitat.
2. Support plant species diversity at the landscape scale.
3. Ensure net soil accretion in order to maintain these positive landforms in the marsh.

To do so, we need to...

Develop practical and economical techniques for restoring degraded islands, that emphasize the importance of re-establishing tree cover and stocking to improve tree island function.
Overstory – understory relationship

Stand Density

Developmental history

Forest Canopy (transient)

Understory character – cover, composition, regeneration
Tropical hardwood forests in:

1. Permanent plot tree islands (16 – 10 in slough, 6 in prairie)
2. Extensive tree islands (65 – 50 in ENP, 15 in WCA 3B)
3. Florida Keys forests – structure of 23 Key Largo stands, with broad range of ages, before Hurricane Andrew
1. SDI’s for unmanaged South Florida hammocks range to 1800+.
2. Tree densities range from ~40 – 2000 stems per ha.
3. Average stand diameters range from ~11-100 cm.

(SDI = \( \sum \theta (DBHi/25)^{1.6} \) Woodall et al. 2003)
1. **High density** – low ASD stands are relatively undisturbed stands on skeletal organic soils in the Keys and marl prairies.

2. **Low density** – high ASD stands are frequently disturbed, and with deep, P-rich, carbonate soils.
NMDS ordination of trees $> 10\text{cm dbh}$
(82 plots and 38 species)

**ANOSIM**

Pair-wise comparisons:

All groups differ at sig. level of $< 1\%$ except Shark Slough and Marl Prairie plots
Biological conclusions

1. As a group, many tree islands in the interior Everglades are in an enduring state of recovery from human disturbance, characterized by slow infilling around large, multi-trunked trees.

2. These hammocks differ in composition (less diverse) and site potential (more productive) from those growing on rocky substrate in the Keys.

3. The data are inconclusive regarding whether maximum stocking differs between these two broad forest groups.

4. Stocking levels in stands occupied initially by large, open-grown “wolf” trees are not easily captured.

5. Nevertheless……..
Stand density correlates – canopy cover

LAI vs. SDI for 15 permanent plots
\( r = 0.5086, \ p = 0.0628 \)
Stand density effects – forest understory
Restoration implications

1. Through its relation with canopy cover, forest site occupancy by trees affects population and biogeochemical processes in the understory at all levels of resolution.
2. In mixed stands, some of these relationships may be obscured by compositional differences and recent canopy disturbance.
3. SDI is a measure of site occupancy that can be applied to tree island communities, where it can serve as a tool for more targeted management of the many canopy-influenced aspects of tree island ecosystems.