Forest Structure and Productivity of Mangrove Forests in the Everglades, Florida

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Results (cont’d)

<table>
<thead>
<tr>
<th>Site</th>
<th>TS/Ph-6</th>
<th>SRS-4</th>
<th>SRS-5</th>
<th>SRS-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>DBH &gt; 2.0 cm</td>
<td>25</td>
<td>4151.4</td>
<td>3496.6</td>
<td>2783.1</td>
</tr>
<tr>
<td>(m/ha)</td>
<td>NA</td>
<td>2112.5</td>
<td>1759.2</td>
<td></td>
</tr>
<tr>
<td>Total Basal Area</td>
<td>0.7</td>
<td>26.7</td>
<td>26.4</td>
<td>39.6</td>
</tr>
<tr>
<td>(m² ha⁻¹)</td>
<td>10.7</td>
<td>26.4</td>
<td>39.6</td>
<td></td>
</tr>
<tr>
<td>Mean DBH</td>
<td>3.6</td>
<td>5.8</td>
<td>12.3</td>
<td>12.3</td>
</tr>
<tr>
<td>(cm)</td>
<td>6.5</td>
<td>9.8</td>
<td>14.4</td>
<td></td>
</tr>
<tr>
<td>Stand height (m)</td>
<td>2.9</td>
<td>5.5</td>
<td>7.5</td>
<td>12.9</td>
</tr>
<tr>
<td>(m)</td>
<td>5.9</td>
<td>8.2</td>
<td>11.0</td>
<td></td>
</tr>
<tr>
<td>Complexity</td>
<td>0.001</td>
<td>30.021</td>
<td>26.036</td>
<td>22.989</td>
</tr>
<tr>
<td>index</td>
<td>NA</td>
<td>7.713</td>
<td>18.150</td>
<td></td>
</tr>
</tbody>
</table>

• The highest tree density was observed in SRS-4 whereas the highest basal area was measured in SRS-6. The dominant species was R. mangle in all sites except in SRS-6. The high L. racemosa basal area observed in SRS-6 suggests that this area might have been subject to a disturbance (e.g., hurricane) in the past. L. racemosa is generally found in this region in sites where light availability and soil fertility is high.

• Comparison of structural variables measured in plots and transects in four sites. Differences in total basal area in SRS-4 and SRS-5 indicate the presence of different density patterns along topographical gradients.

Acknowledgments

We would like to thank the South Florida Management District (SFMD), Everglades National Park (ENP), the National Science Foundation (NSF), and the US-Geological Survey (USGS) for financial and logistical support.

Conclusions

• The dominant mangrove species were R. mangle and L. racemosa in Shark River and C. erectus and R. mangle in the Taylor Slough sites.

• The relationship DBH vs. tree height is different for the same species across sites underscoring the importance of P limitation, and probably hydroperiod, in the region.

• A. germinans had lower DBH increments than did L. racemosa; both species showed a sigmoid trend in DBH increment.

• The highest mangrove production (Mg ha⁻¹ yr⁻¹) was higher in Shark River sites than in Taylor River. Although litterfall was higher in Shark River, fine root production was similar in both regions. This suggests that large root production may play an important role in maintaining high wood production rates in Shark River.

DBH increments (cm yr⁻¹) of different species in SRS-6. A. germinans increments are the lowest and relatively constant across different DBH intervals. The highest rate was measured in L. racemosa and are similar to R. mangle values. The latter species show a sigmoid trend in DBH increment. C. erectus is present only in SRS-4, but data is included for comparisons among species.

Research Problem

Wetland processes are a function of environmental signatures that characterise a particular coastal setting. Environmental constraints on ecological processes include regulator gradients (e.g., salinity), resource gradients (e.g., nutrients), and hydroperiod, which control mangrove growth and development. The interaction of these three constraints is a surface response that defines the structure and productivity of mangrove wetlands. We propose this surface response as a conceptual model to evaluate the function and productivity of mangrove wetlands. We propose this surface response as a conceptual model to evaluate the function and structure of the Everglades coastal mangroves.

Approach

• Forest structure variables (tree height, diameter at breast height (DBH), number of species, and density) were measured in 20 x 20 m plots and 100-150 m transects located in each site throughout 1995-2003.

• Wood production was estimated using DBH and published species-specific allometric equations.

• Annual litterfall rates were determined using monthly collections of litterfall material in litter baskets.

• Leaf fall was estimated for TS/Ph 6 and TS/Ph 7 sites by tagging canopy leaves.

• Fine root production (top 40 cm) was measured using ingrowth cores.

• Wood production was estimated using DBH and published species-specific allometric equations.

Questions

• What is the structure and complexity index of mangrove forests in the Everglades and how does the index compare among sites and with other mangrove forests in other latitudes?

• What is the productivity and biomass allocation of mangrove species at the different sites in the Everglades?

• What factors are responsible for the variation in productivity and structure among sites?

Results

Study Sites

The SRS and TS/Ph sites have different hydrological regimes.

Sampling Sites:

- Shark River: SRS-4, SRS-5, SRS-6
- Taylor Slough: TS/Ph-6, TS/Ph-7, and TS/Ph-8

Results (cont’d)

• There are significant differences in the relationship between DBH and tree height per species across sites. The conspicuous patterns for R. mangle and L. racemosa along Shark River underscores the importance of fertility differences among sites, particularly when comparing R. mangle DBH and tree height between Taylor River and Shark River.

• Fine root production (top 40 cm) was measured using ingrowth cores.

• DBH increments (cm yr⁻¹) of different species in SRS-6. A. germinans increments are the lowest and relatively constant across different DBH intervals. The highest rate was measured in L. racemosa and are similar to R. mangle values. The latter species show a sigmoid trend in DBH increment. C. erectus is present only in SRS-4, but data is included for comparisons among species.

• The complexity indices (CI) measured in the Everglades compared to values observed in tropical and subtropical latitudes in the Caribbean region. CI values in TS/Ph-8 and SRS-5 are similar to values measured in tropical dry zones.

• The relationship DBH vs. tree height is different for the same species across sites underscoring the importance of P limitation, and probably hydroperiod, in the region.

• A. germinans had lower DBH increments than did L. racemosa; both species showed a sigmoid trend in DBH increment.

• The highest mangrove production (Mg ha⁻¹ yr⁻¹) was higher in Shark River sites than in Taylor River. Although litterfall was higher in Shark River, fine root production was similar in both regions. This suggests that large root production may play an important role in maintaining high wood production rates in Shark River.

Conclusions

• The dominant mangrove species were R. mangle and L. racemosa in Shark River, and C. erectus and R. mangle in the Taylor Slough sites.

• The relationship DBH vs. tree height is different for the same species across sites underscoring the importance of P limitation, and probably hydroperiod, in the region.

• A. germinans had lower DBH increments than did L. racemosa; both species showed a sigmoid trend in DBH increment.

• The highest mangrove production was measured in Shark River (15-20 Mg ha⁻¹ yr⁻¹); large root production needs to be estimated to account for the high wood production rate observed in this region.

Acknowledgments

We would like to thank the South Florida Management District (SFMD), Everglades National Park (ENP), the National Science Foundation (NSF), and the US-Geological Survey (USGS) for financial and logistical support.