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

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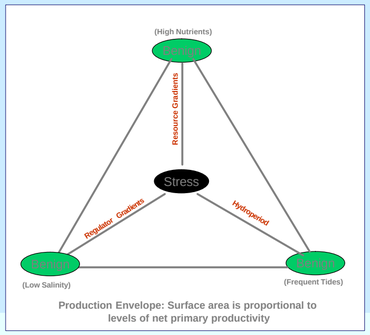
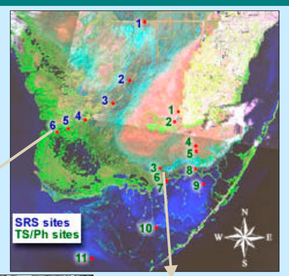
Research Problem

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 structure of the Everglades coastal mangroves.



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.

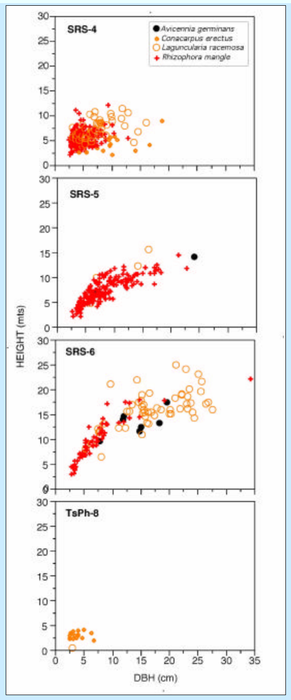
Questions

- 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?

Approach

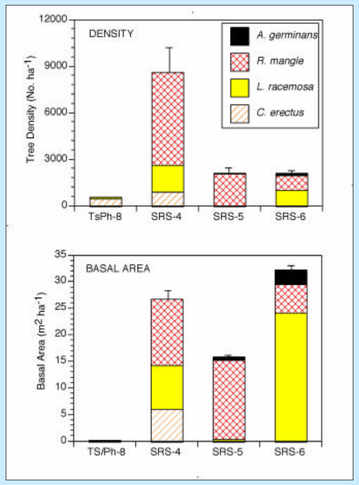
- Forest structure variables (tree height, diameter at breast height (DBH), number of species, and density) were measured in two 20 x 20 m plots and 100-150 m transects located in each site throughout 1995-2003.
- Wood production was estimated using DBH and published species-specific allometric equations.
- Annual litterfall rates were determined using monthly collections of litter fall 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.

Results



- 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.

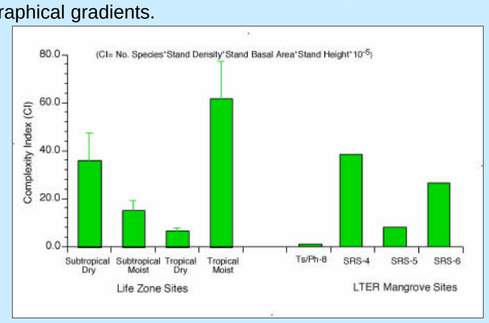
Results (cont'd)



- 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.

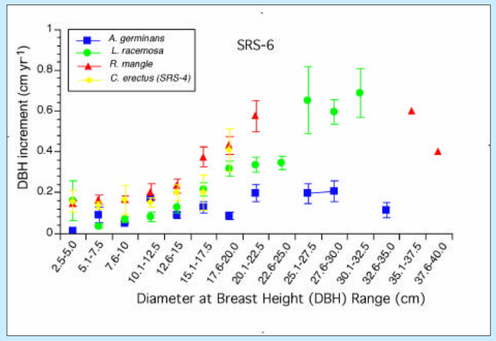
Site		TsPh-8	SRS-4	SRS-5	SRS-6
# Species		2	3	3	3
Density DBH >± 2.5 cm (# ha^{-1})	plots	25	8566.6	2112.5	2087.5
	transects	NA	4151.4	2783.1	1759.2
Total Basal Area (m^2 ha^{-1})	plots	0.7	26.7	16.0	32.2
	transects	NA	10.7	26.4	39.6
Mean DBH DBH>2.5 cm	plots	3.8	5.8	8.9	12.3
	transects	NA	6.5	9.6	14.4
Stand height (m)	plots	2.9	5.5	7.5	12.9
	transects	NA	5.8	8.2	11.0
Complexity index	plots	0.001	38.021	7.641	26.036
	transects	NA	7.713	18.150	22.989

- 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.

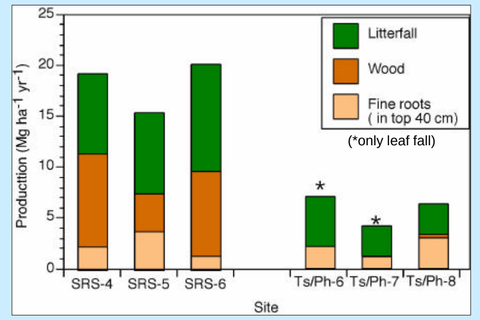


- The complexity indices (CI) measured in the Everglades compared to values observed in tropical and subtropical latitudes in the Caribbean region. CI values in TS/Ph-8 and SRS-5 are similar to values measured in tropical dry zones.

Results (cont'd)



- 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.



- 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

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