Investigating the Relationship Between Leaf Spectral Indices and Leaf Traits in Recovering Black Mangrove Forest



Erin Cushing

cushinge@hawks.rockhurst.edu Rockhurst University Mentor: Dr. Danielle Ogurcak

BACKGROUND

- Combined effects of road construction and hurricanes have resulted in mangrove die-off zones in Rookery Bay National Estuarine Research Reserve (RBNERR).
- The goal of this project was to gain a better understanding of the relationships between leaf reflectance-derived spectral indices and leaf traits associated with mangrove leaf structure and function across a hydrologic stress gradient in a recovering basin mangrove forest.
- Quantifying these relationships is a crucial first step in developing remote sensing tools useful in forest management for early detection of plant stress.
- The Fruit Farm Creek die-off zone, in Rookery Bay NERR is attributed to construction of San Marco Rd (Figure 2). A partial restoration of tidal flow was constructed in 2012, and in 2017, Hurricane Irma caused significant damage to the forest likely impacting recovery.



Figure 2: Study sites located along 2 transects, in Rookery Bay NERR, near Naples, Fl. Location of constructed tidal creek shown adjacent to road.

	Dead Zone		Transitional		Canopy	
Transect	% DO	SAL	% DO	SAL	% DO	SAL
T1	32.03	3.1	48.54	3.4	45.41	3.9
T2	27.71	3.7	35.7	3.2	30.96	4.6

Table 1: Dissolved oxygen (%DO) and salinity (SAL ppt) of porewater at each site, taken on 7/1/2021 (T1) and 7/8/2021 (T2) with YSI EXO sonde.

METHODS



in mangrove leaf traits in dieoff zone.



across 3 canopy cover zones in 2 transects in Fruit Farm Creek die-off area.



Proximity to constructed tidal creek may explain variations

Figure 1: Normalized difference vegetation index (NDVI) of black mangrove leaves from trees and saplings

FIU Coastal Ecosystems REU Site

RESULTS

It was predicted that the leaf reflectance, measured by the vegetation indices would vary across the 3 zones in the gradient. However, a relationship was observed between the distance to the constructed tidal creek and mangrove leaf reflectance. Other leaf traits reflect physiological differences between trees and saplings growing in the 3 canopy cover zones.



Figure 3: The specific leaf area was found to be higher in saplings than trees across all gradients. From dead zone to canopy, there is an increasing trend in SLA. Lower SLA tends to correspond with increased leaf defenses. Saplings were generally not observed in the dead zone.



Figure 4: Leaf dry matter content is shown to be higher in trees than in saplings across both transects, indicating that the tree leaves have higher density than saplings. Leaves higher in LDMC are usually more resistant to damage.



Figure 5: The relationship between the average SLA, and two vegetation indices (NDVI and ChIRE). ChIRE appears to better predict SLA than NDVI across both transects.

Future Research

Mechanisms responsible for relationships observed in this study may be further quantified by measuring leaf stomatal conductance, chlorophyll fluorescence, and nutrient content.

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