Distribution of Mangrove Species on Hummingbird Cay, Bahamas

Introduction

The common name "mangrove" is used to describe a set of tropical plant species adapted to live in salt water. Mangroves are ecologically import for coastline stabilization and as a nursery habitat for commercial fish species. The goal of this study was to determine the distribution of three species of mangrove on Hummingbird Cay (HBC). *Rhizophora mangle* (red mangrove) is thought to grow at the lowest elevation, *Avicennia germinans* (black mangrove) at slightly higher elevations, followed by *Laguncularia racemosa* (white mangrove) at the highest elevations.

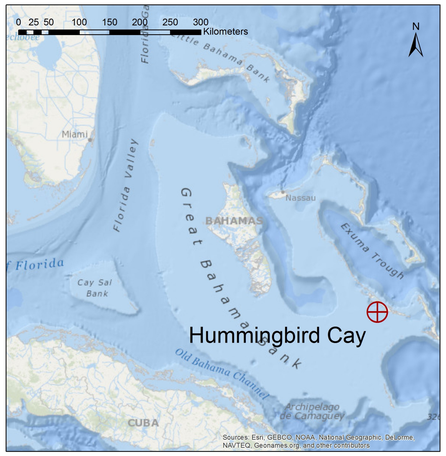
Succession is an ecological process in which the species of an ecological community change over time. There is debate over the nature of species succession in mangrove forests. Another goal of this study was to look for evidence of succession occurring in mangrove areas on HBC.

Study Species

Rhizophora mangle (red mangrove)

Avicennia germinans (black mangrove)

Laguncularia racemosa (white mangrove)

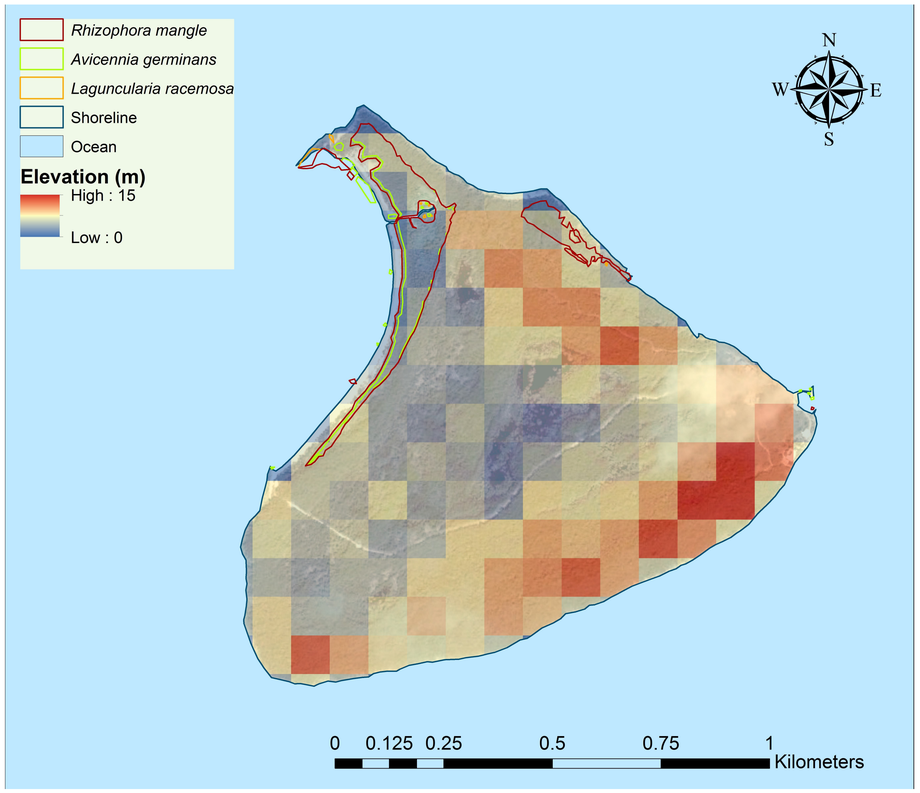


Study Area

Hummingbird Cay is a small uninhabited island west of Great Exuma Island in the Bahamas. The total area of the island is 237 acres, with mangroves covering approximately 17 acres, 7% of the island's total area.

Data collection

The data sets used in this study were collected on Hummingbird Cay using a Garmin GPSmap 60CSx GPS unit. The island perimeter and mangrove areas were marked by circumnavigating these areas and periodically recording waypoints. Polygon layers were created from the field data. Zonal statistics were run on the mangrove areas to obtain elevation statistics for each species. Elevation was modeled using NASA's SRTM DEM. GPS data is accurate to within 4m.



Results

R. Mangle occupied the greatest area of all the mangrove species, covering an area of more than 14 acres (Figure 1). *A. germinans* and *L. racemosa* covered far less area; ~3 acres and ~0.3 acres respectively. (Figure 1). The average elevation of the three species was the inverse of what was expected. *R. mangle* grows at the highest average elevation, *A. germinans* slighty lower, then *L. racemosa* at the lowest average elevation (Figure 2). Despite the trend in average values, the range of *R. mangle* extends to the lowest elevation, at 0m. The lower limit of *A. germinans* range was 1m and that of *L. racemosa* was the highest at 2m. This result was consistent with expected elevation range.

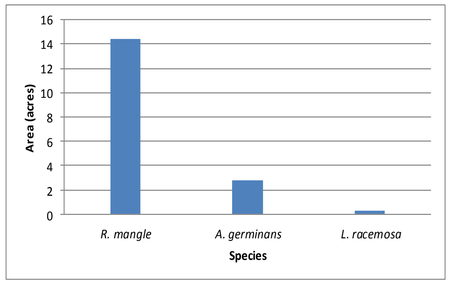


Figure 1 Area populated by *R. mangle, A. germinans,* and *L. racemosa* on Hummingbird Cay, Great Exuma Island, Bahamas.

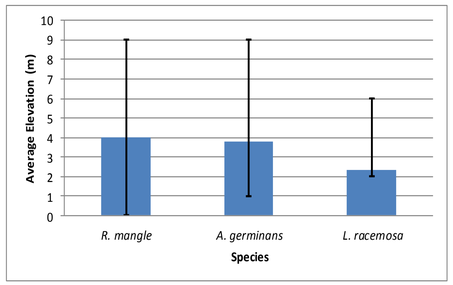


Figure 2 Average elevation of *R. mangle, A. germinans,* and *L. racemosa* on Hummingbird Cay, Great Exuma Island, Bahamas. Bars represent range of elevation data.

Discussion

R. mangle is the dominant mangrove species on Hummingbird Cay. It's range covers most of the two major tidal inlets, with a total coverage area of more than 14 acres. In comparison, *Avicennia* and *Laguncularia* are not as prolific, covering areas of ~3 acres and ~0.3 acres respectivly (Figure 1).

In 1986, the lagoon along the western edge was described as "fringed with mixed stands of *R. mangle* and *A. germinans* and unvegetated in the center" (Thibodeau and Nickerson, 1986). This description is evidenced by the large *A. germinans* trees which can be found along the edge of the lagoon. Over the past 26 years, *R. mangle* has populated the unvegetated center of the lagoon and has transformed the area into dense mangrove swamp.

One reason for the success of *R. mangle* may be that is better able to grow in deep water. While *R. mangle* grows at the highest average elevation, it range extends the lowest (Figure 2). *R. mangle* is especially well adapted to growing in relatively deep water, because it is elevated above the water by its prop roots. In contrast, *A. germninans* and *L. racemosa* have pnuematophores that need to extend into the open air, restricting there range to the land or shallow water. Together these factors give *R. mangle* a competitive advantage in deep water.

With a deep water advantage, *R. mangle* is able to pioneer into areas inaccessible to *A. germinans* and *L. racemosa,* and is therefore the first established species in the succession process of mangrove forests.

Cartographer: Christopher Watson

Date: 4/26/13
Data Sources: Tufts Mangroves Project, NASA SRTM
Projection: WGS 1984 UTM Zone 18N
Scale: 1:4,500