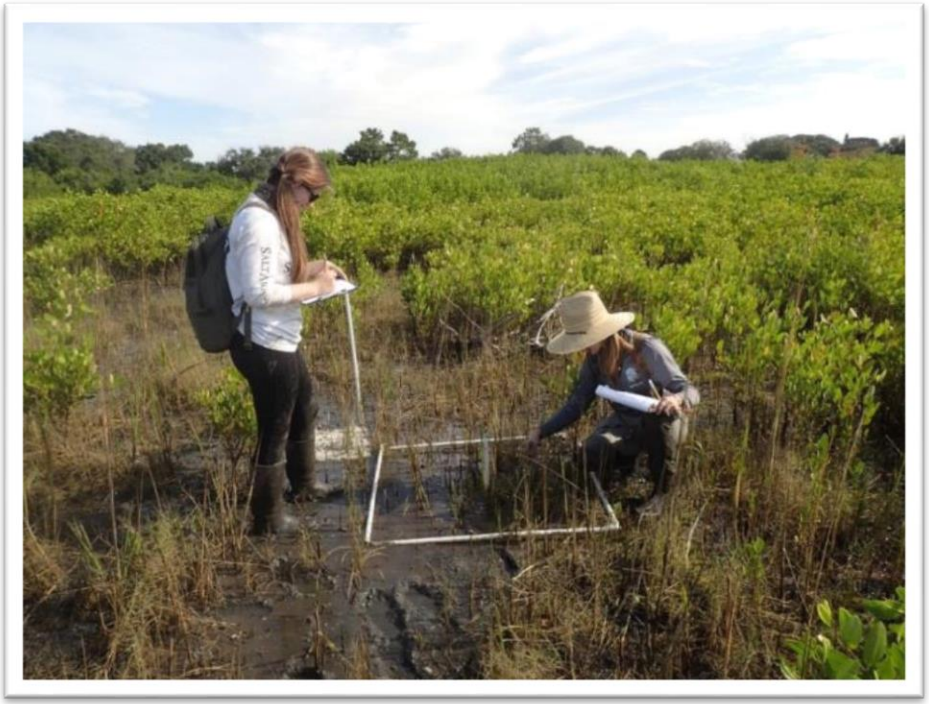
Critical Coastal Habitat Assessment

Long-term monitoring in Tampa Bay



Kara Radabaugh, Ryan Moyer, Ed Sherwood, Gary Raulerson, Amanda Chappel, Taylor Nielsen, Reba Campbell, and Emma Dontis.

Critical Coastal Habitat Assessment (CCHA)

CCHA methodology designed for long-term monitoring of coastal habitat response to sea-level rise.

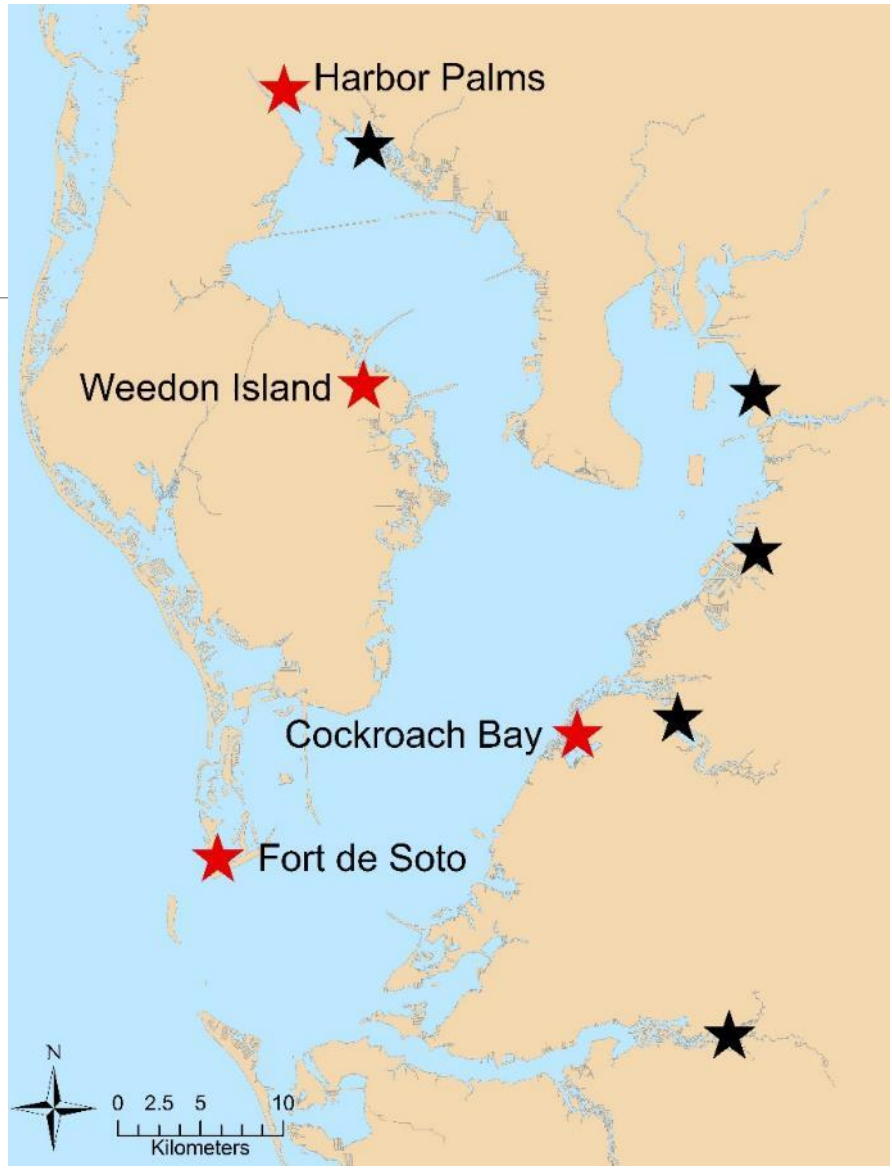
- Elevation & sediment accretion
- Flora/fauna species composition
- Porewater & sediment characteristics

Recently completed project baseline

Sites to be revisited every 3-5 years

Tampa Bay Locations

- Five sites previously completed by TBEP and Atkins
- Four additional sites with new EPA funding
  - Instructional manual and video to be released on monitoring methods



Site selection

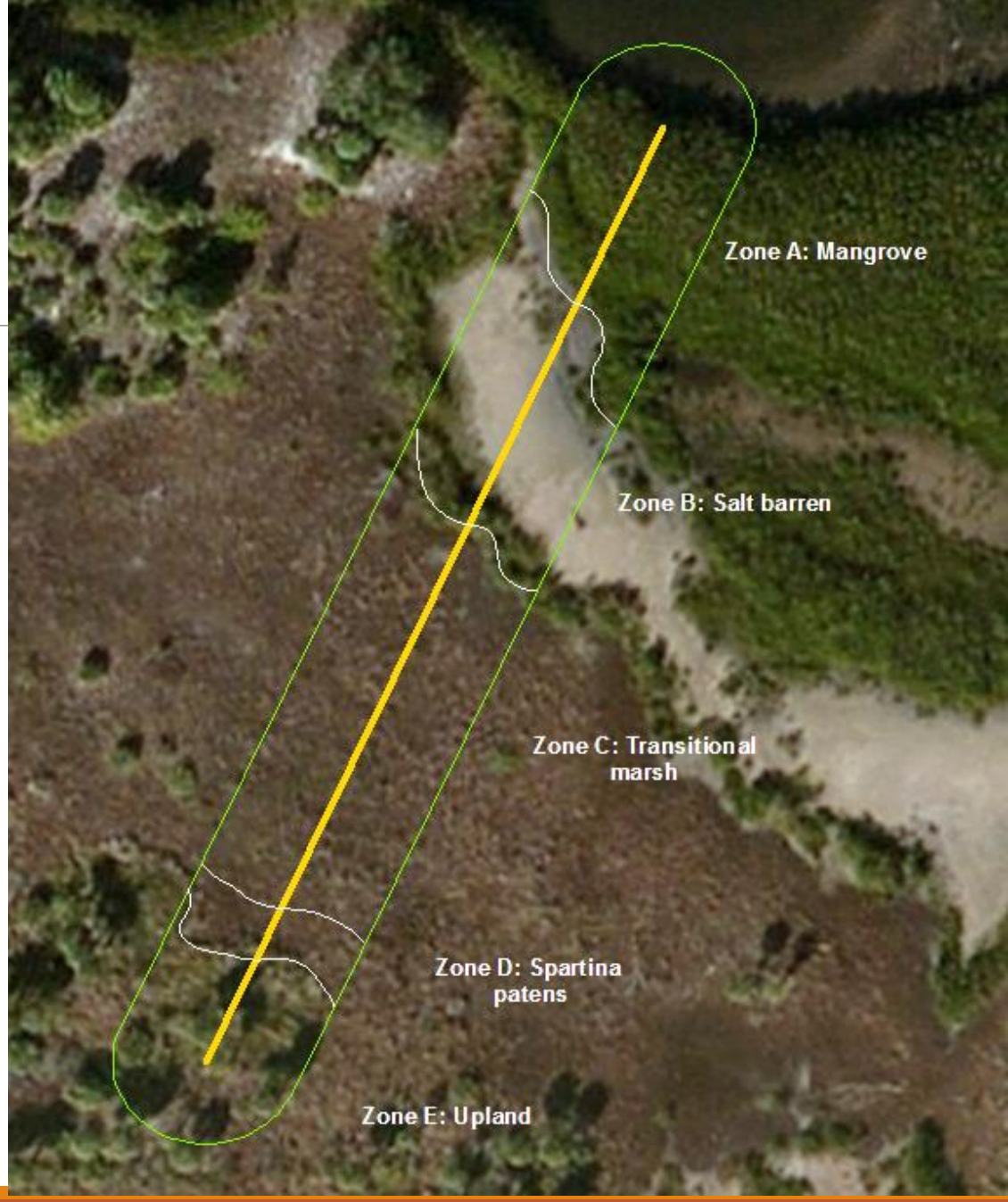
- Distributed across Tampa Bay
- Located on conservation land
- Accessible for monitoring
- Have a moderate slope that extends through 3-7 zones of vegetation within 200 m

Habitat Zonation

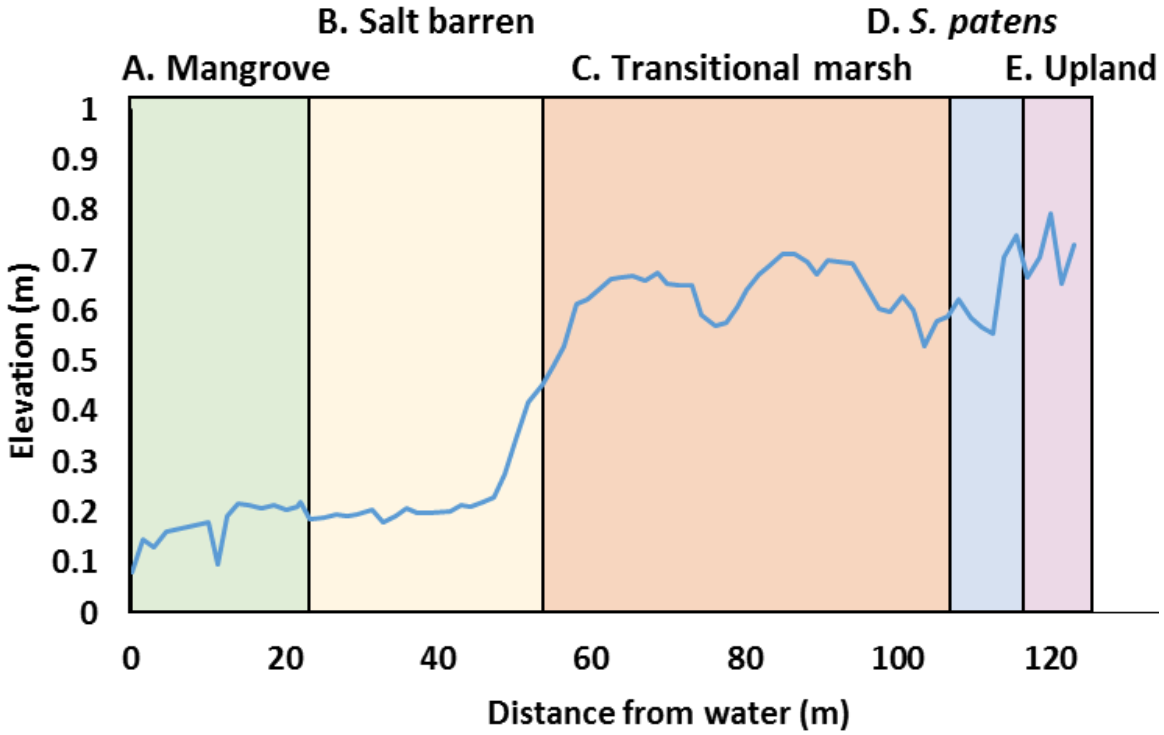
Transect extends (roughly) perpendicular from water's edge to upland habitat

Habitat transitions identified by

- Shifts in plant species
- Elevation changes



Elevation surveys



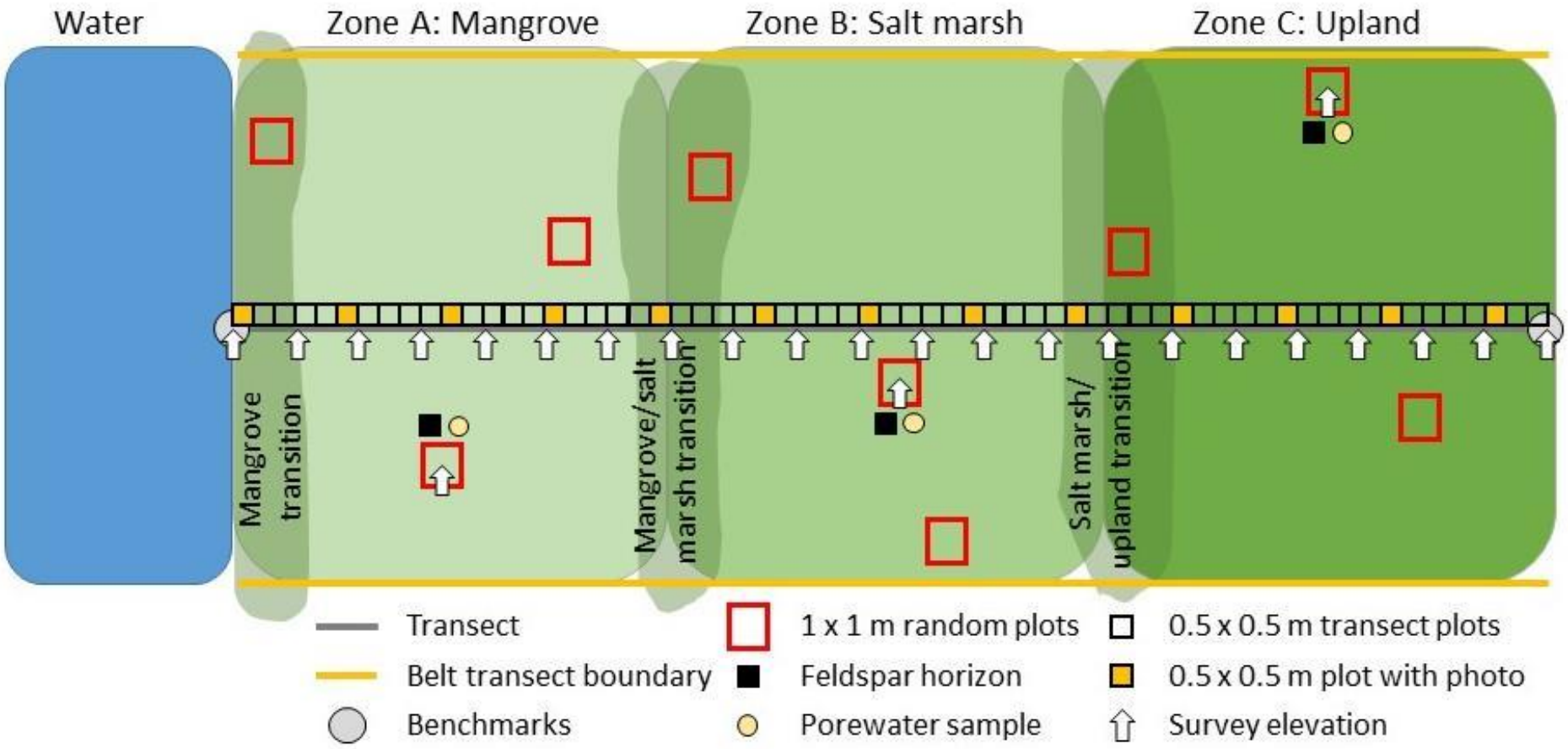
Elevation surveyed every 5 ft (1.5 m) using and RTK GPS.

Benchmarks added to beginning and end of transect.

Transect sampling

- 0.5 x 0.5 m quadrat placed along the transect
- Percent basal cover recorded for all plant species, woody debris, pneumatophores, and macroalgae
- Photo taken every 2.5 m

Sampling design

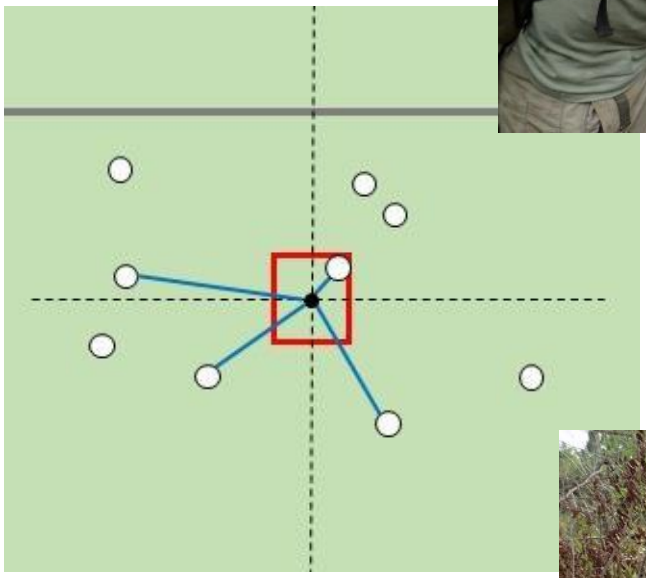


Random plots

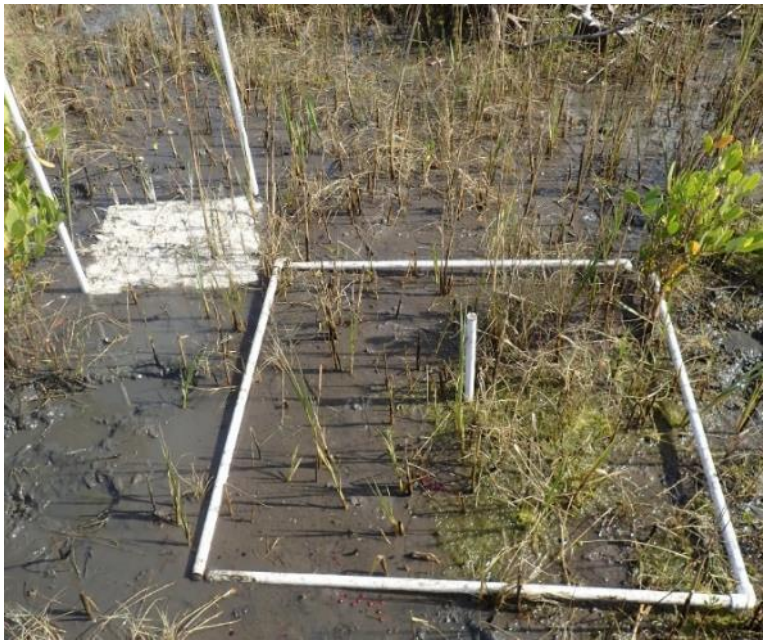
- Vegetation basal % cover
- Canopy cover
  - canopy densitometer and spherical densiometer
- *Uca* sp. burrows
- Mangrove tree crabs
- *Littorina* sp.

Point Centered Quarter (PCQ)

Measure distance to nearest tree within each of four “quarters,” record tree diameter and tree height



Calculate species-specific density (trees / hectare) or absolute cover (basal area m^2 / hectare)



Feldspar horizons

Core in 6-12 months, measure millimeters of accretion

Does not work in erosional or high-energy environments

Porewater and soil

Determine porewater salinity and depth

Save soil sample of top 5 cm

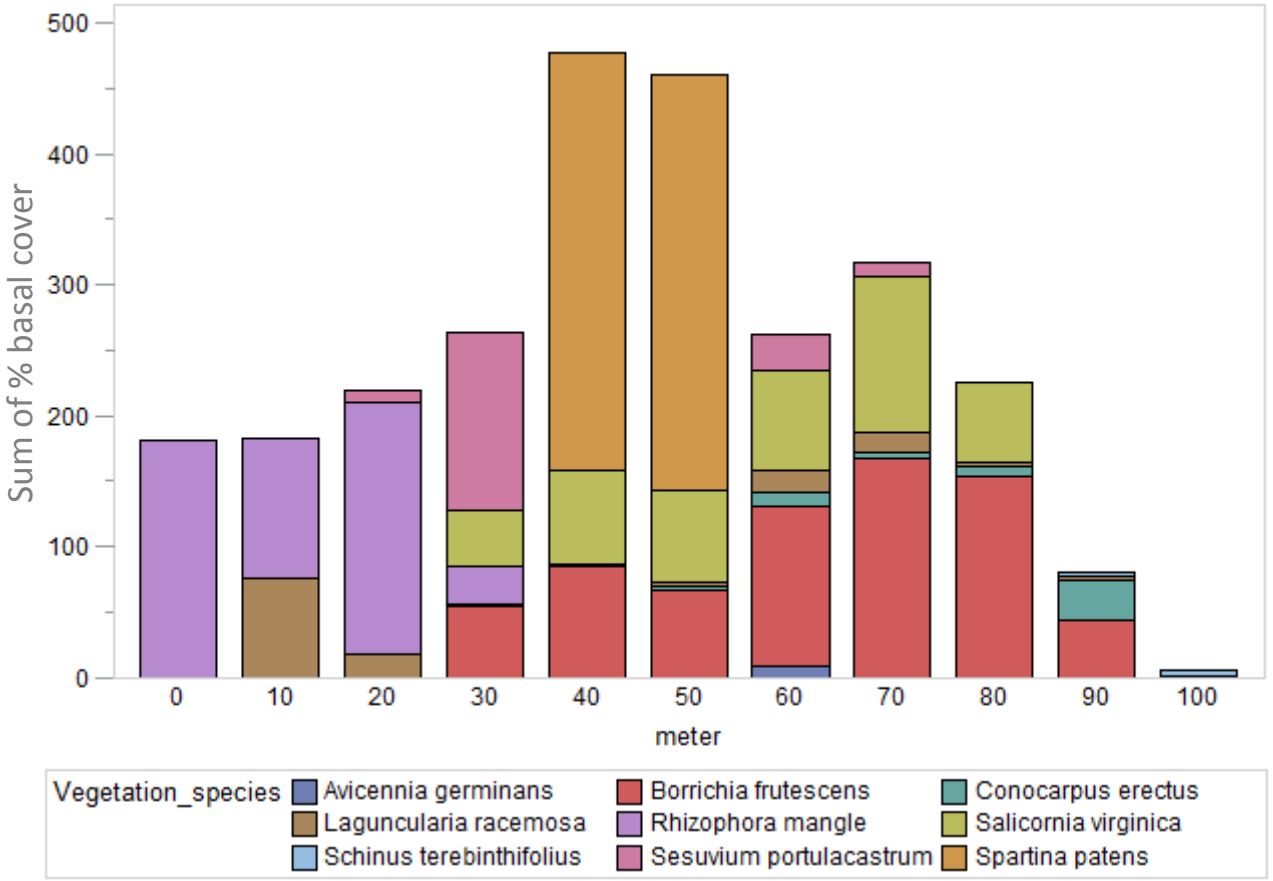
Soil analysis

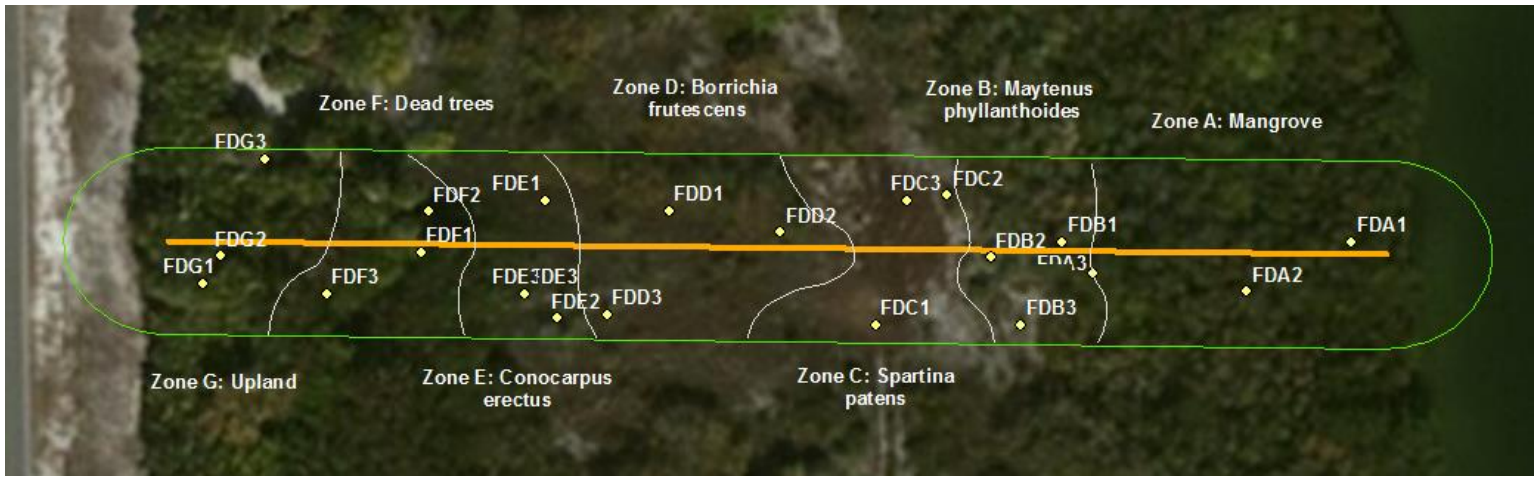
Organic matter content determined by loss on ignition procedures

Grain size determined through sieve analysis

Veg. Results

Transect shows range of each species with respect to elevation and distance from water.

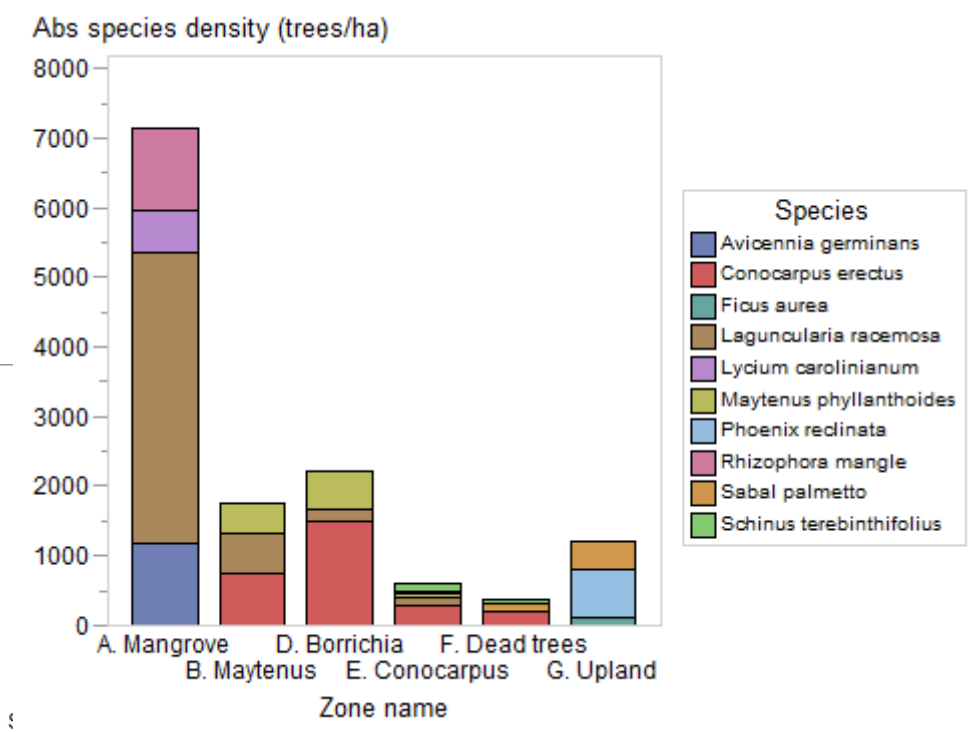


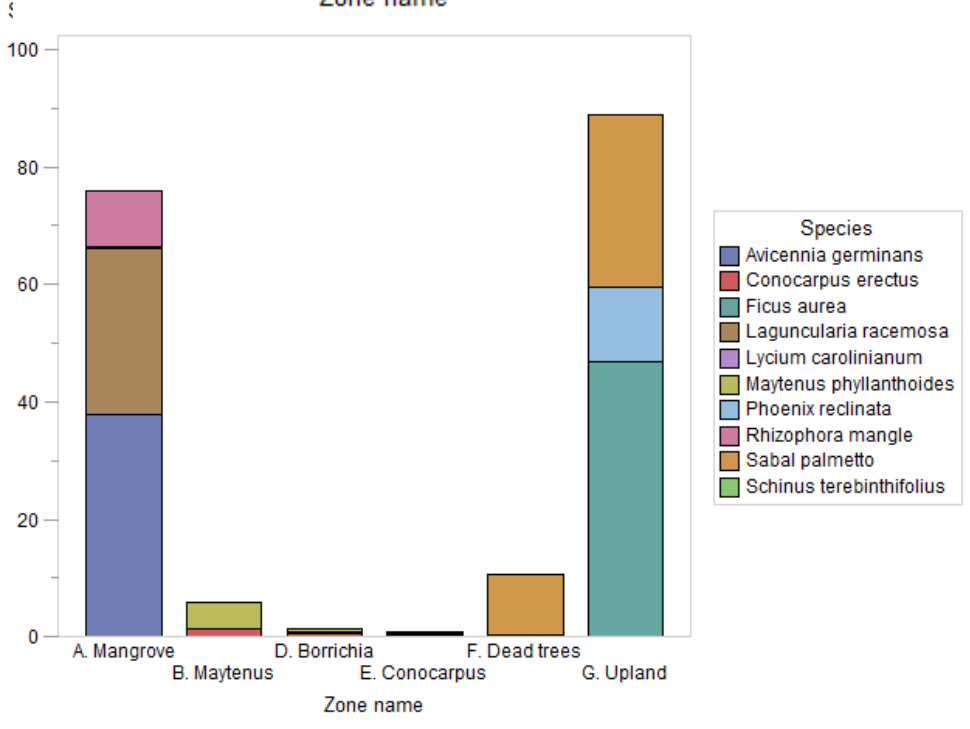


Veg. Results

PCQ sampling provides metrics of tree abundance and diversity

- Species-specific density (trees / hectare)
- Species-specific absolute cover (basal area m^2 / hectare)

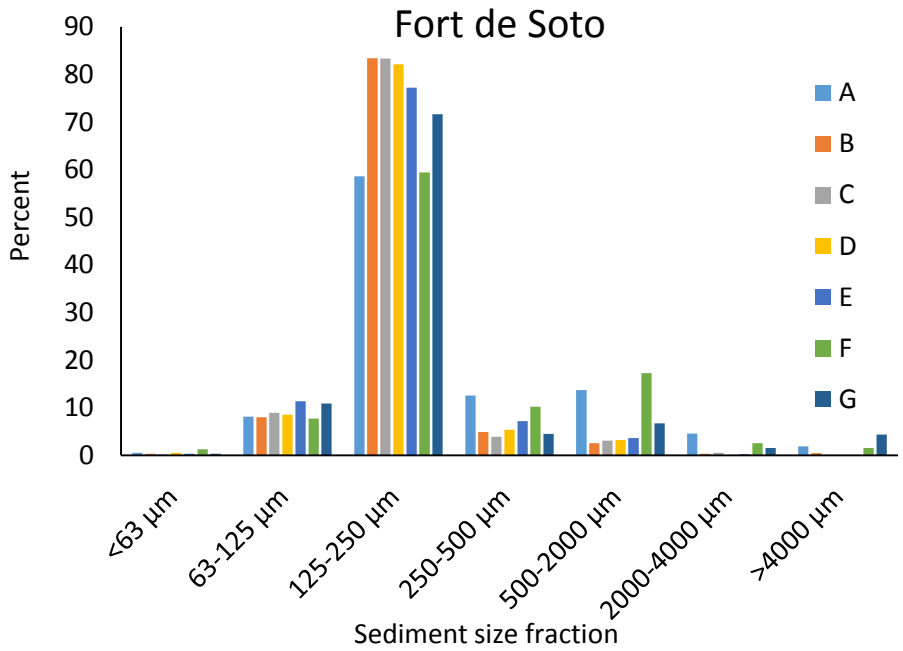


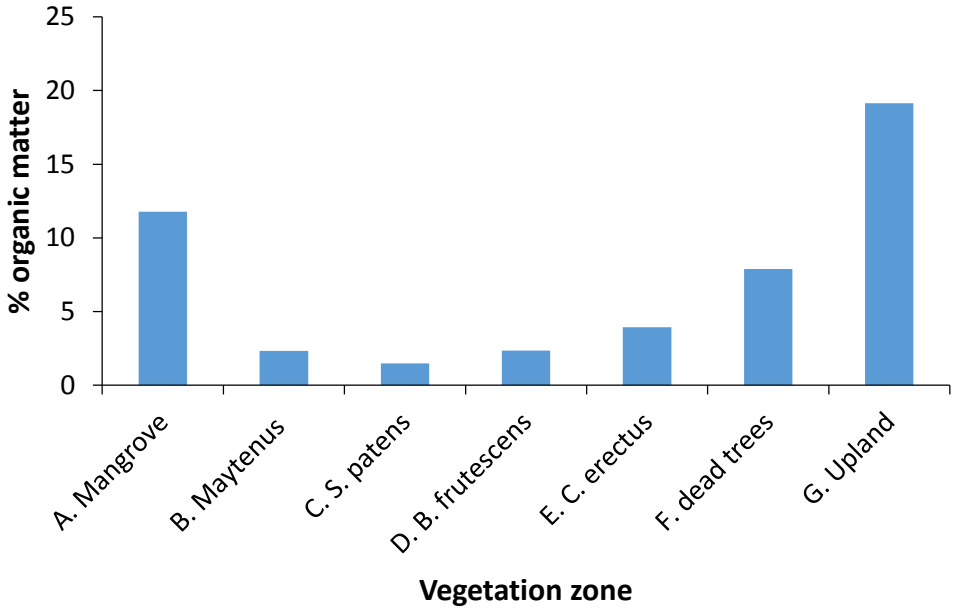


Sediment

Majority of sediment fine sand (125-250 µm)

More organic matter in surface soil of mangroves and upland zones





Sediment

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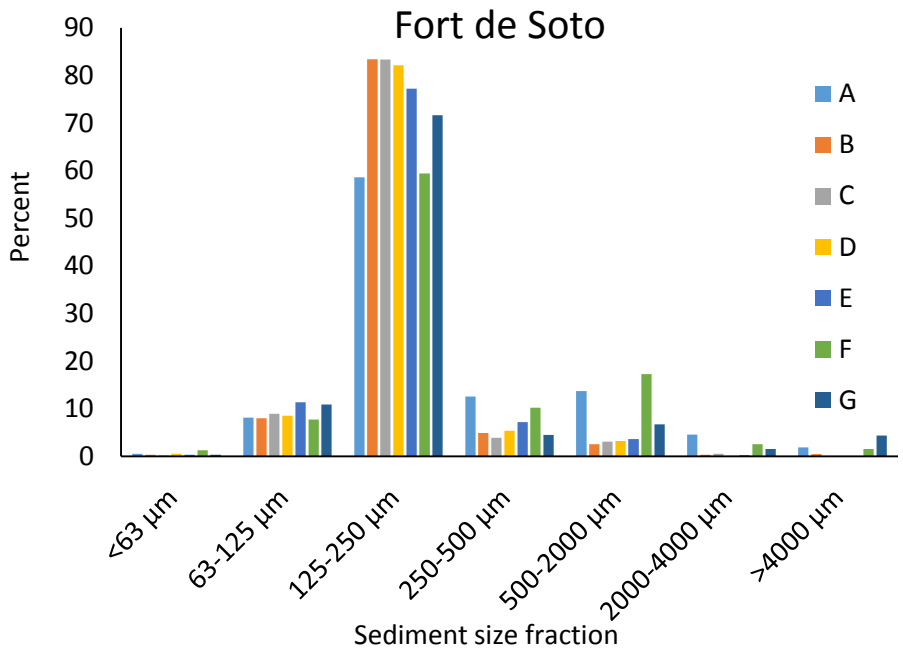
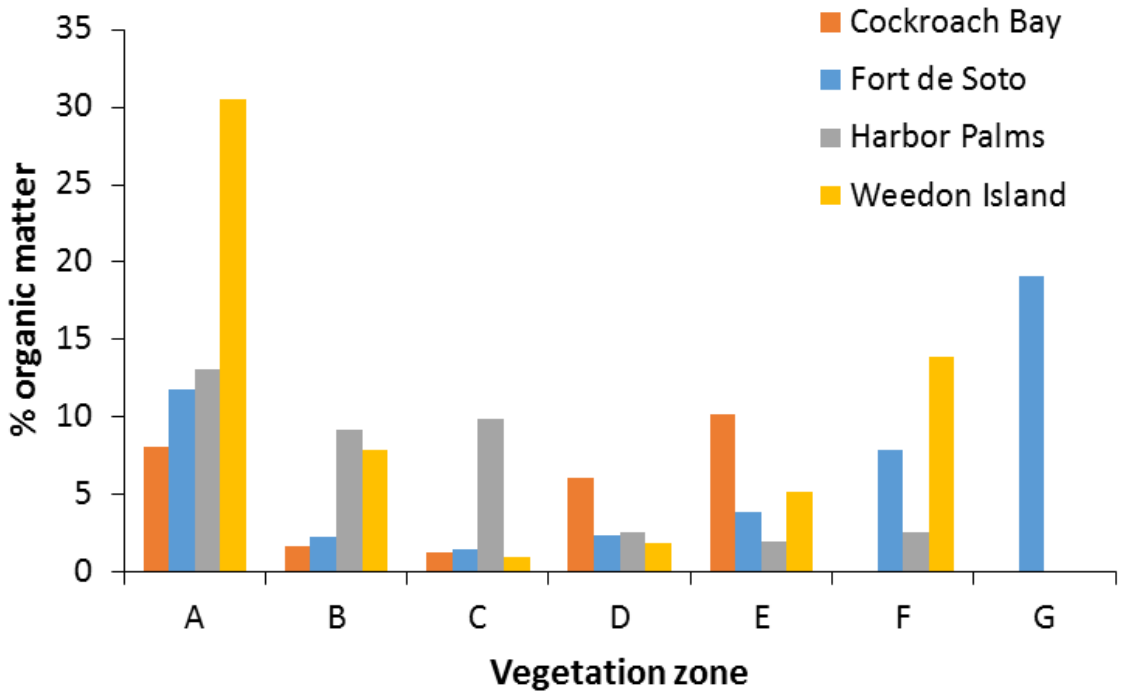


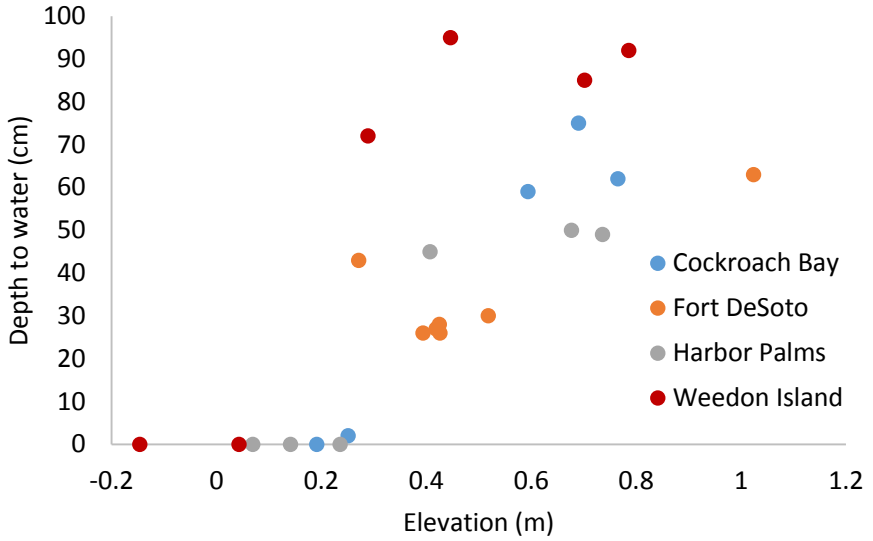
More organic matter in surface soil of mangroves and upland zones

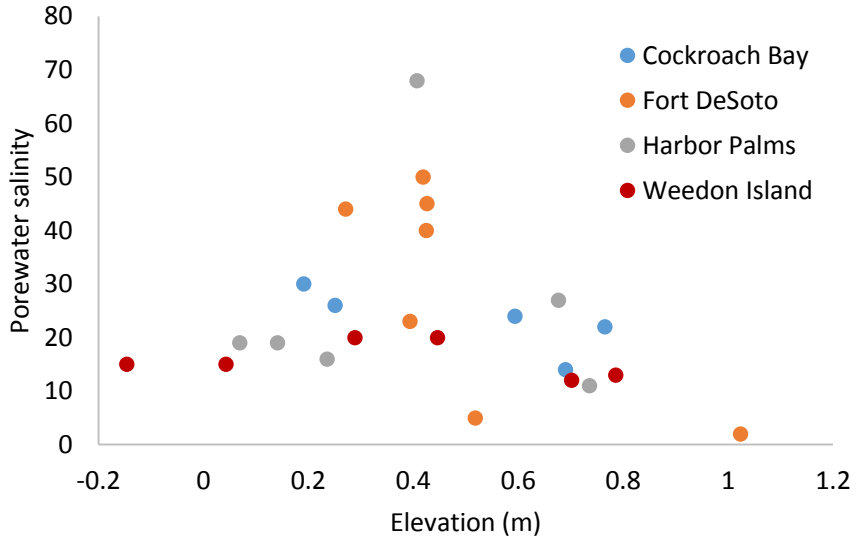


Porewater results

Elevation correlated with depth of water table ($p<0.0001$, $r = 0.7499$)

Porewater salinity not correlated with elevation ($p = 0.32$)





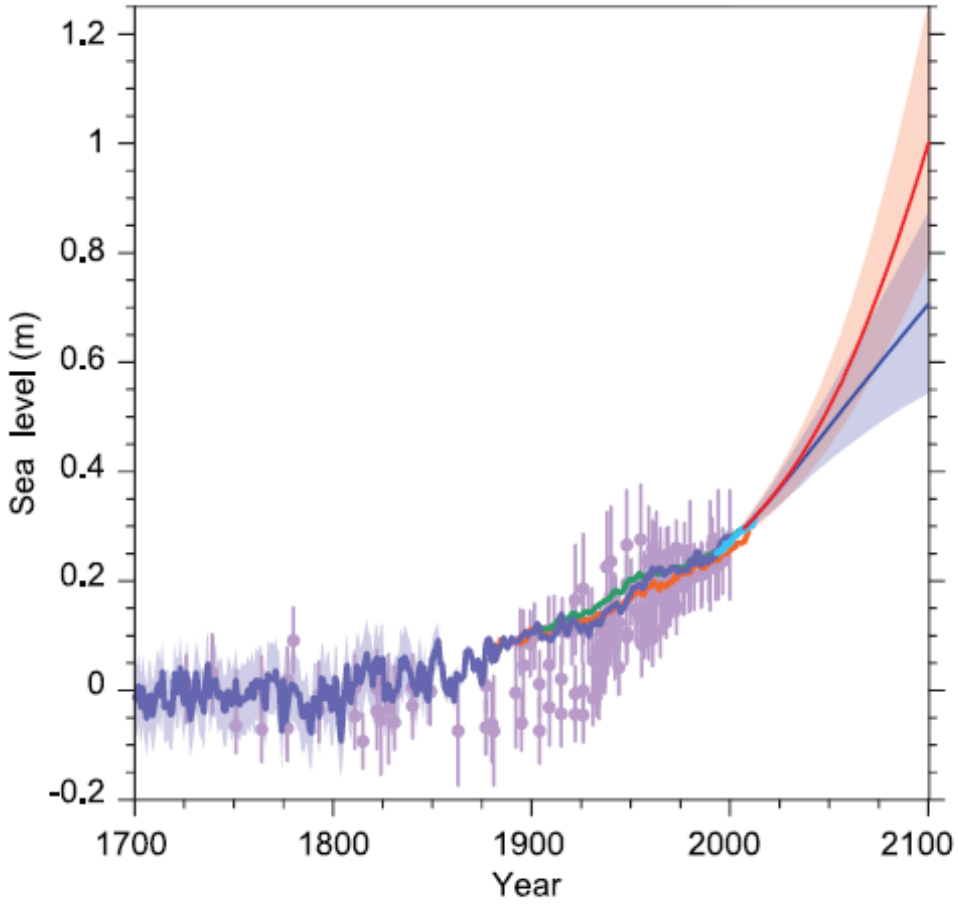


Figure 13.27 | Compilation of paleo sea level data, tide gauge data, altimeter data (from Figure 13.3), and central estimates and *likely* ranges for projections of global mean sea level rise for RCP2.6 (blue) and RCP8.5 (red) scenarios (Section 13.5.1), all relative to pre-industrial values.

IPCC AR5 (Church et al. 2013)

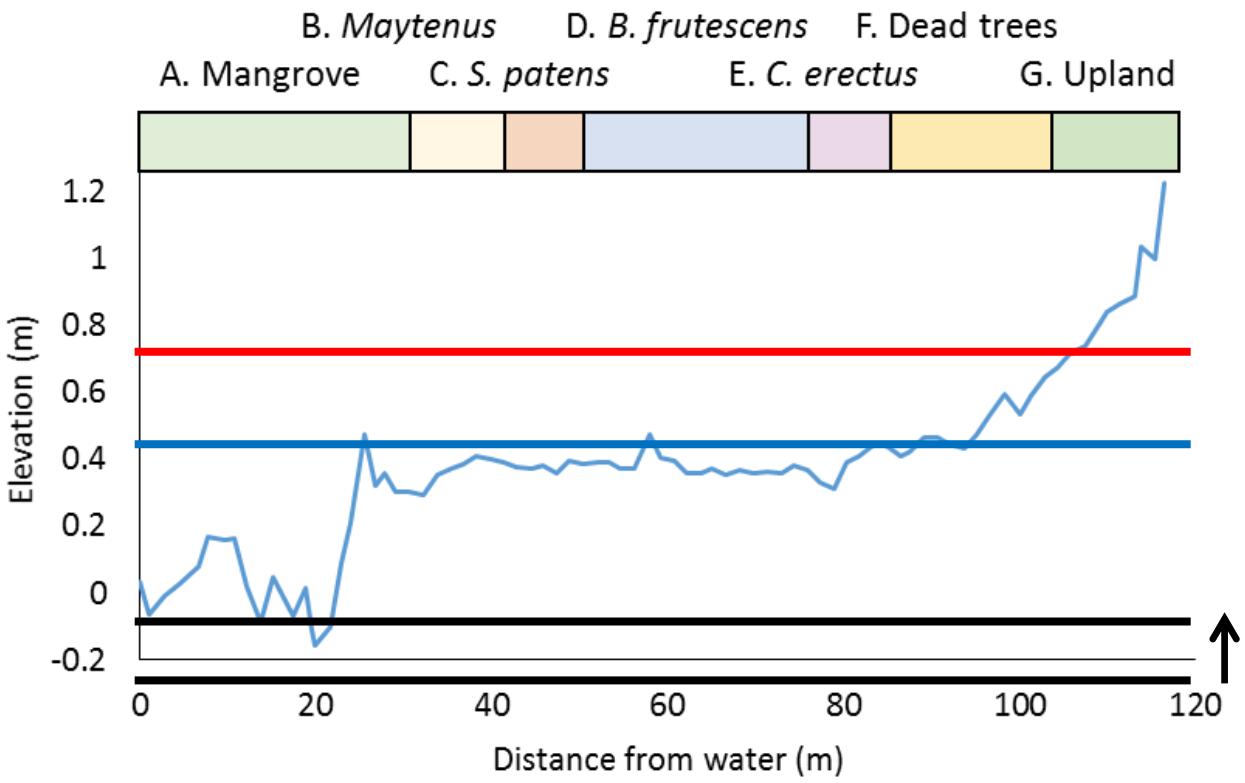
Sea-level rise

19 cm avg global SLR since 1901 (IPCC AR5)

Low emission scenario (RCP2.6, shown in blue) predicts ~50 cm additional SLR by 2100 (~70 cm total)

High emission scenario (RCP8.5, shown in red) predicts ~80 cm additional SLR by 2100 (~1 m total)

Fort de Soto

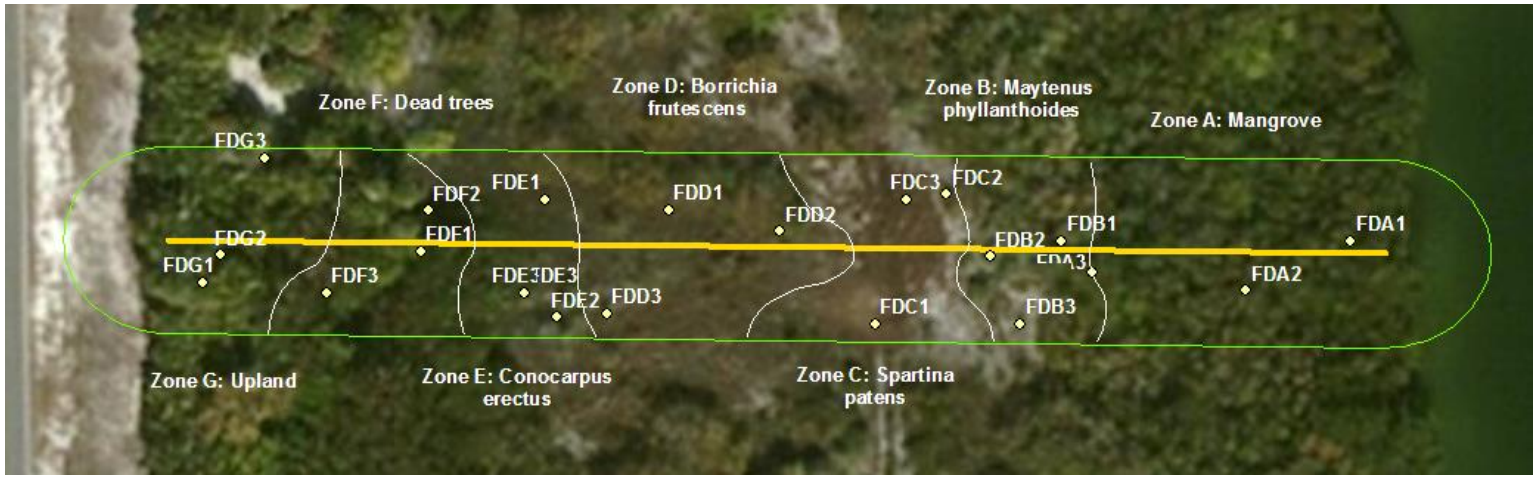


High emissions SLR 2100 (1 m)

Low emissions SLR 2100 (70 cm)

Existing SLR (19 cm)

Elevation surveyed using NAVD 88



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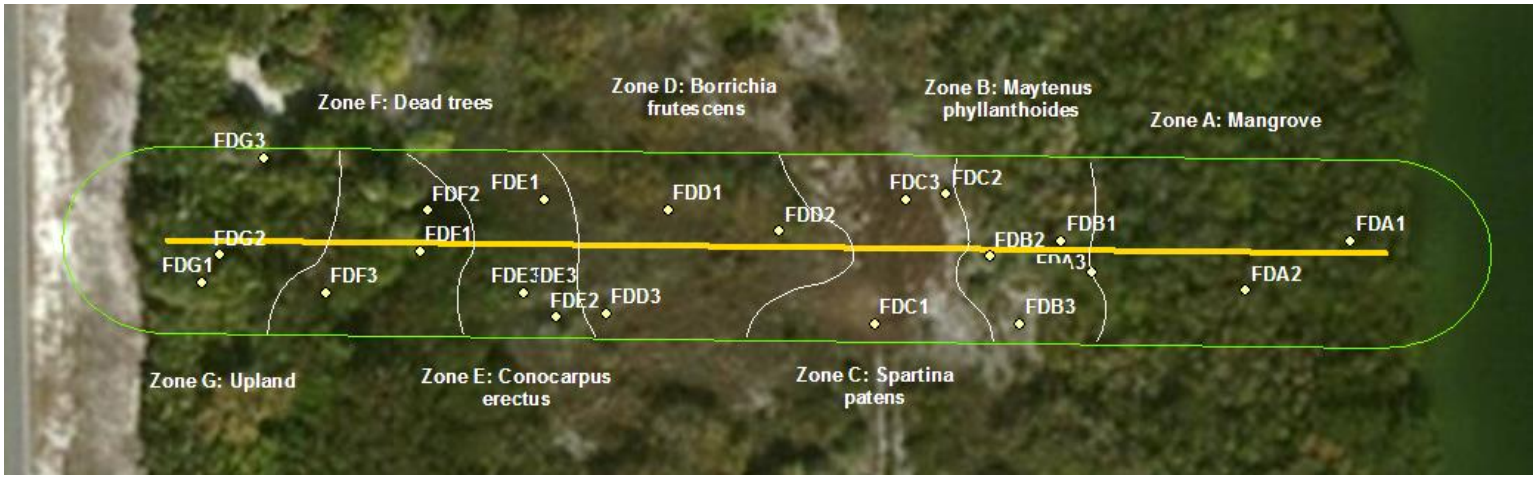
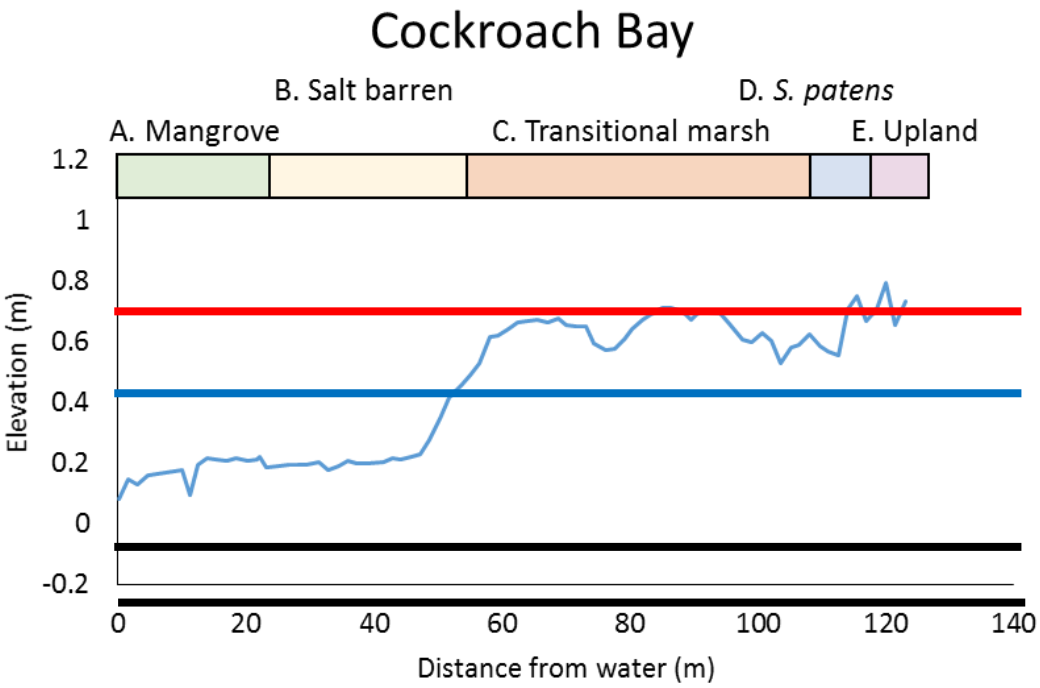
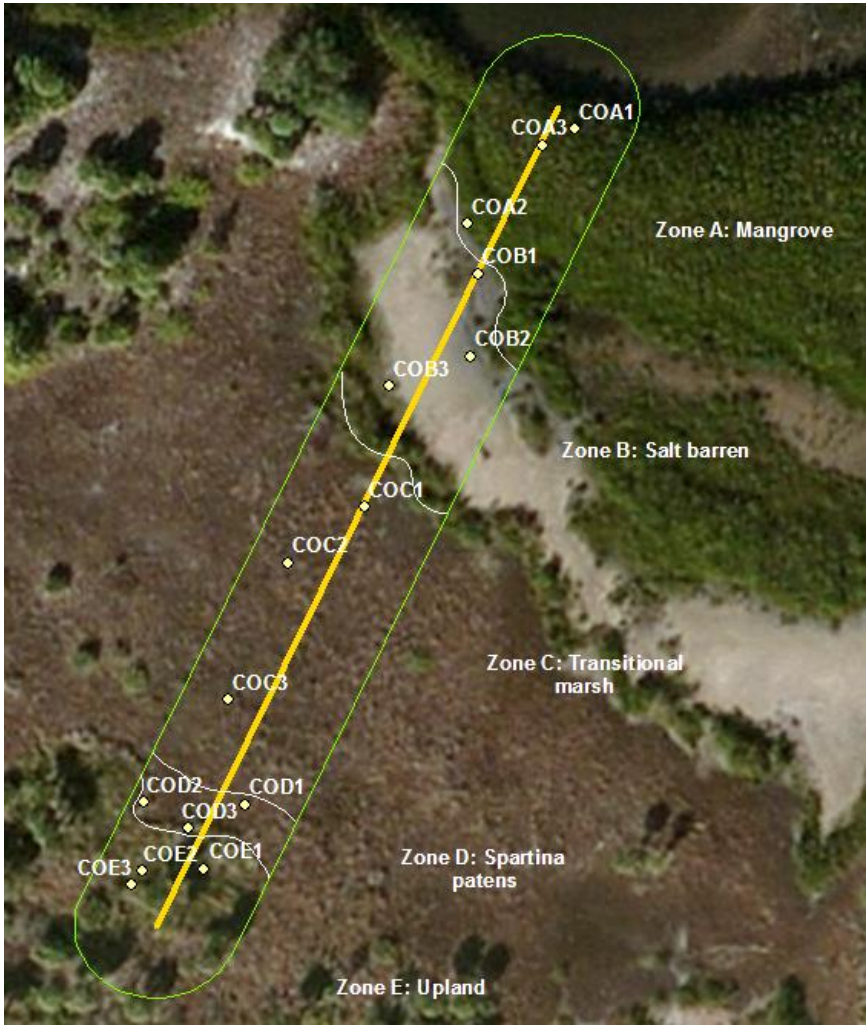
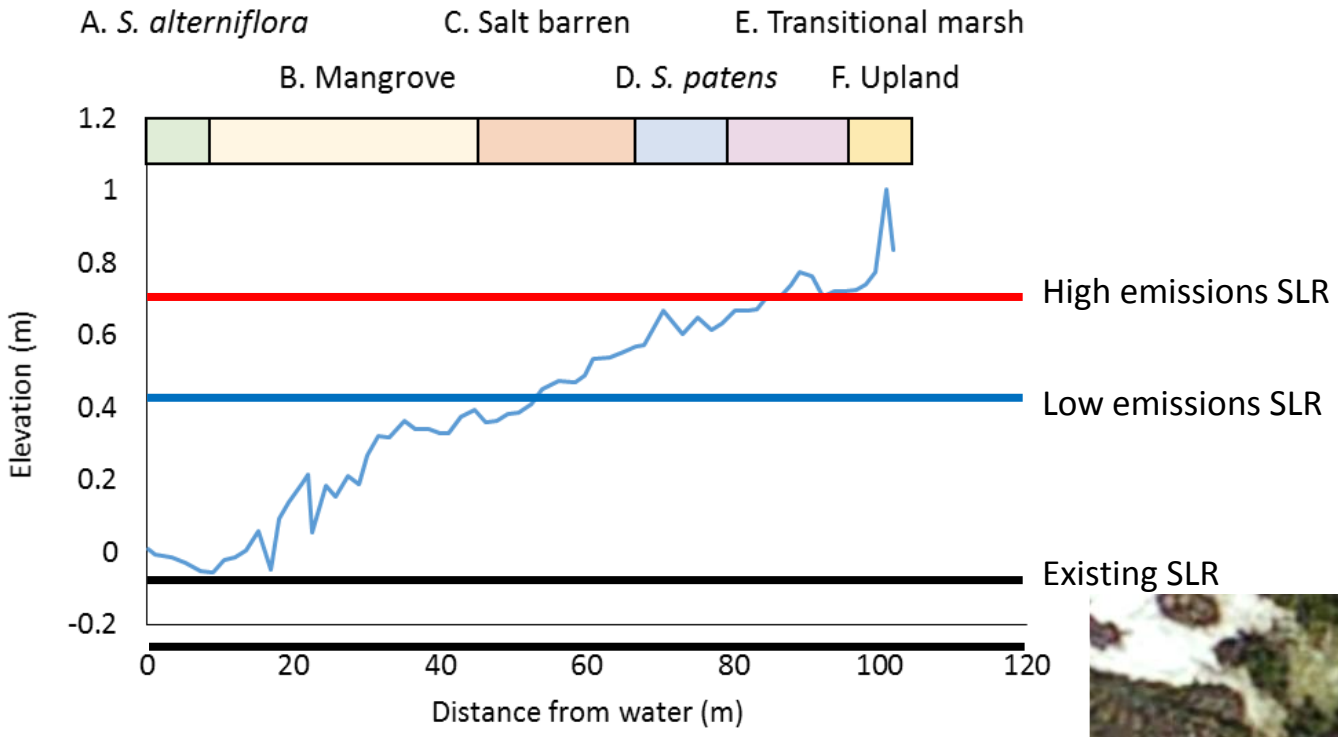

Zone F: Dead trees
Zone D: Borrichia frutescens
Zone B: Maytenus phyllanthoides
Zone A: Mangrove
FDG3
FDF2
FDE1
FDD1
FDC3
FDC2
FDB1
FDA1
FDG2
FDF1
FDD2
FDB2
FDG1
FDF3
FDE3
FDE2
FDD3
FDA3
FDA2
FDC1
FDB3
Zone G: Upland
Zone E: Conocarpus erectus
Zone C: Spartina patens

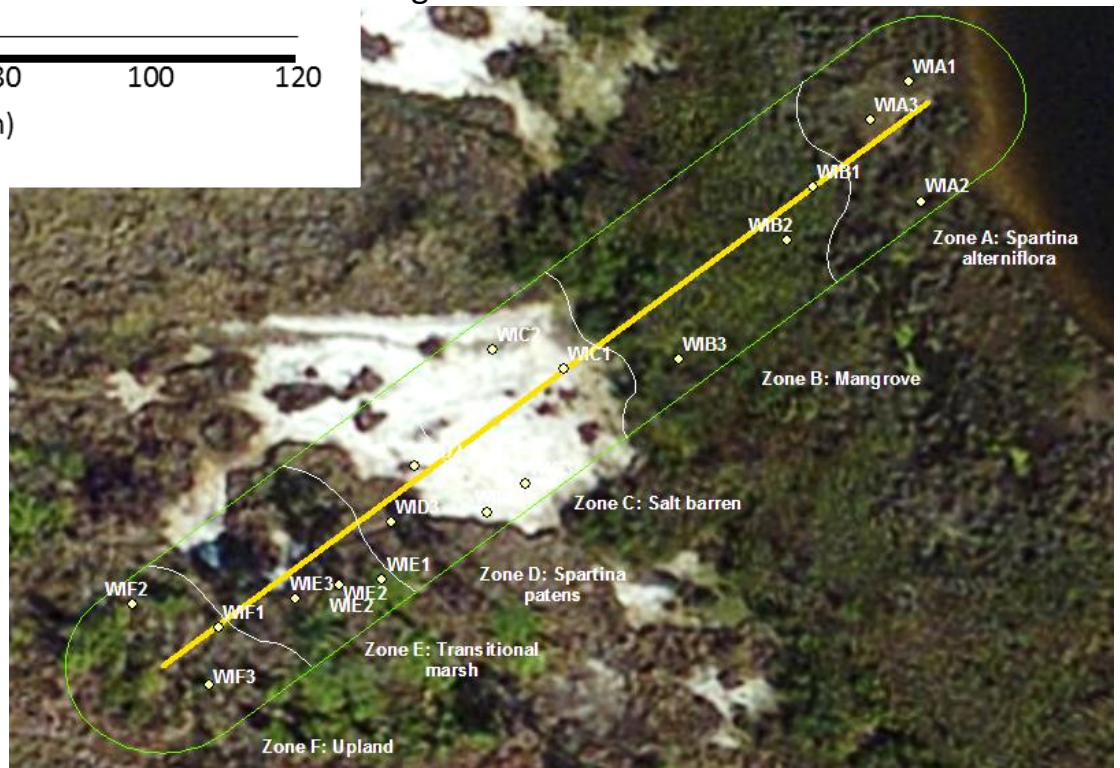

Cockroach Bay
B. Salt barren
D. S. patens
A. Mangrove
C. Transitional marsh
E. Upland
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
Elevation (m)
0
20
40
60
80
100
120
140
Distance from water (m)


COA1
COA3
COA2
Zone A: Mangrove
COB1
COB2
COB3
Zone B: Salt barren
COC1
COC2
COC3
Zone C: Transitional marsh
COD2
COD1
COD3
COE2
COE1
COE3
Zone D: Spartina patens
Zone E: Upland

Cockroach Bay

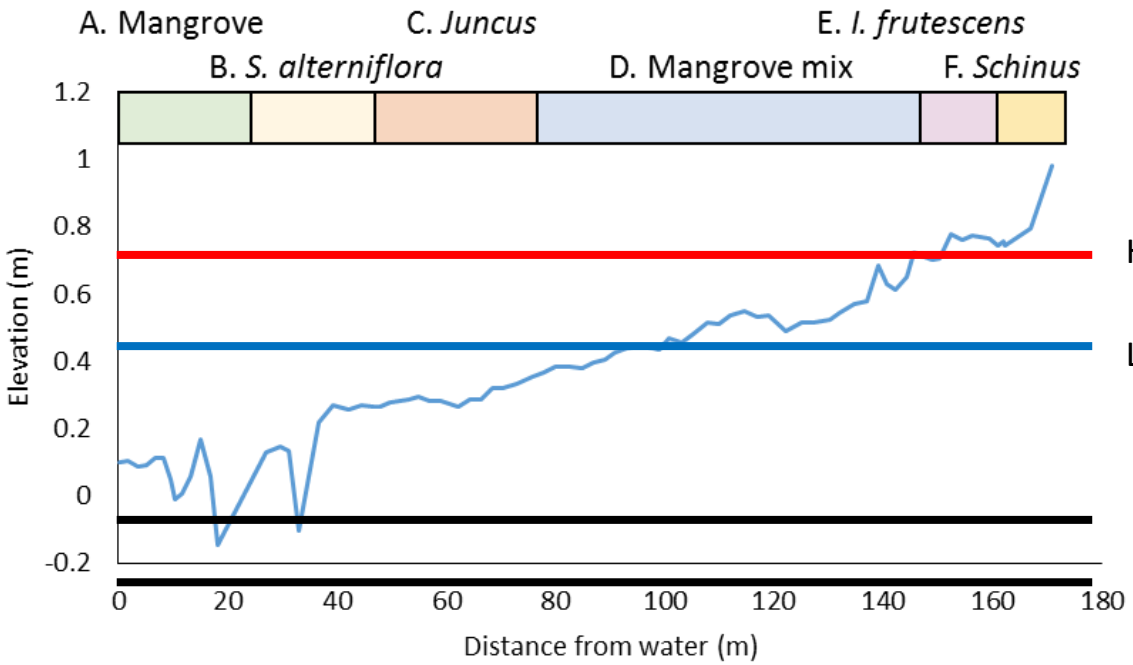
Weedon Island





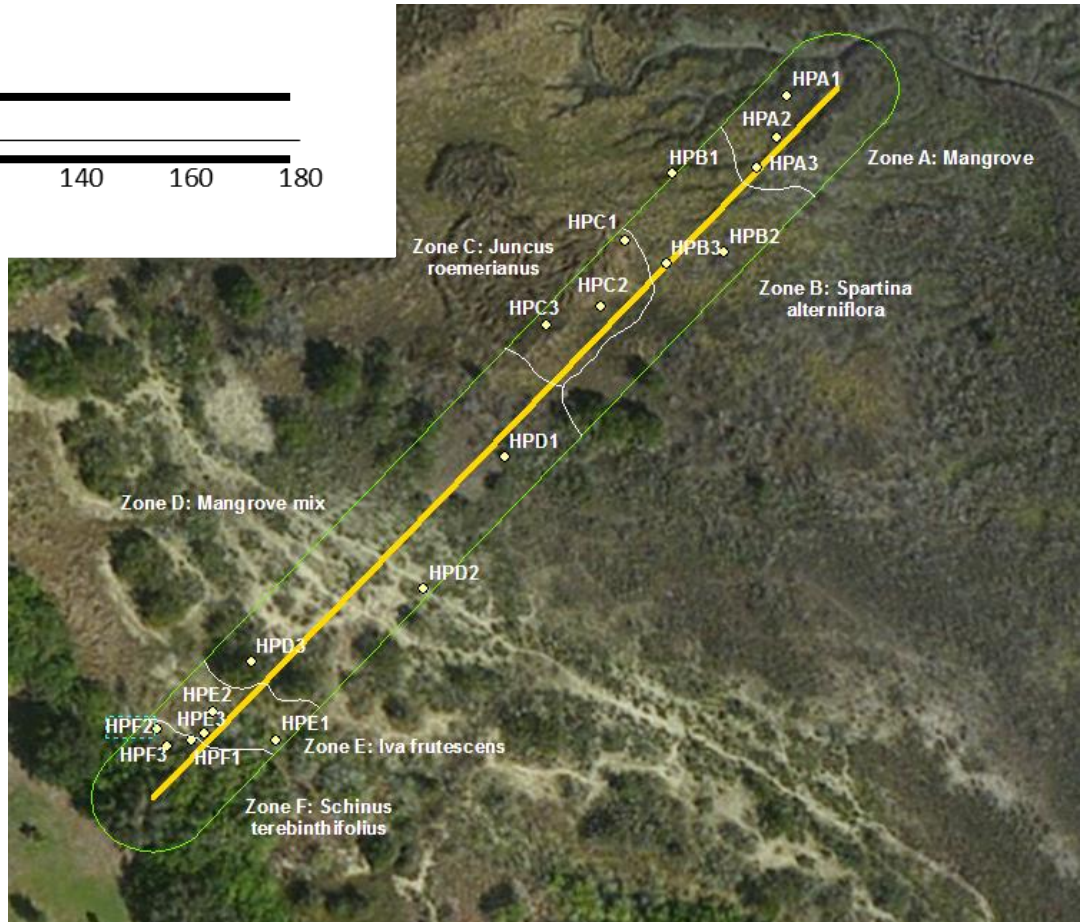
Weedon Island

Harbor Palms



High emissions SLR

Low emissions SLR



Harbor Palms

Conclusions

- Methodology enables long-term study of abiotic conditions and flora/fauna response to sea-level rise.
  - Written and video training manuals
- SLR scenarios (omitting coastal wetland accretion rates)
  - Low emissions scenario: MSL at elevation of existing salt barrens by 2100
  - High emissions scenario: MSL at elevation of upland or transitional high marsh by 2100
- Landward migration restricted by urban development, roadways, elevation
  - Existing conservation lands with natural buffer vitally important

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Methodology originally developed by
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- Pamela Latham, Research Planning Inc.
- Lindsay Cross, Tampa Bay Estuary Program
- David Loy, Atkins North America

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Church, J.A., P.U. Clark, A. Cazenave, and others 2013: Sea Level Change. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., and others (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.