

Overview of my talk:

1. What are mangroves forests and salt marshes?
2. Where do they occur & some differences between them?
3. Why are mangroves and salt marshes so important?
4. How are mangroves and salt marshes being influenced by changes in climate and sea level?
5. What does history tell us?



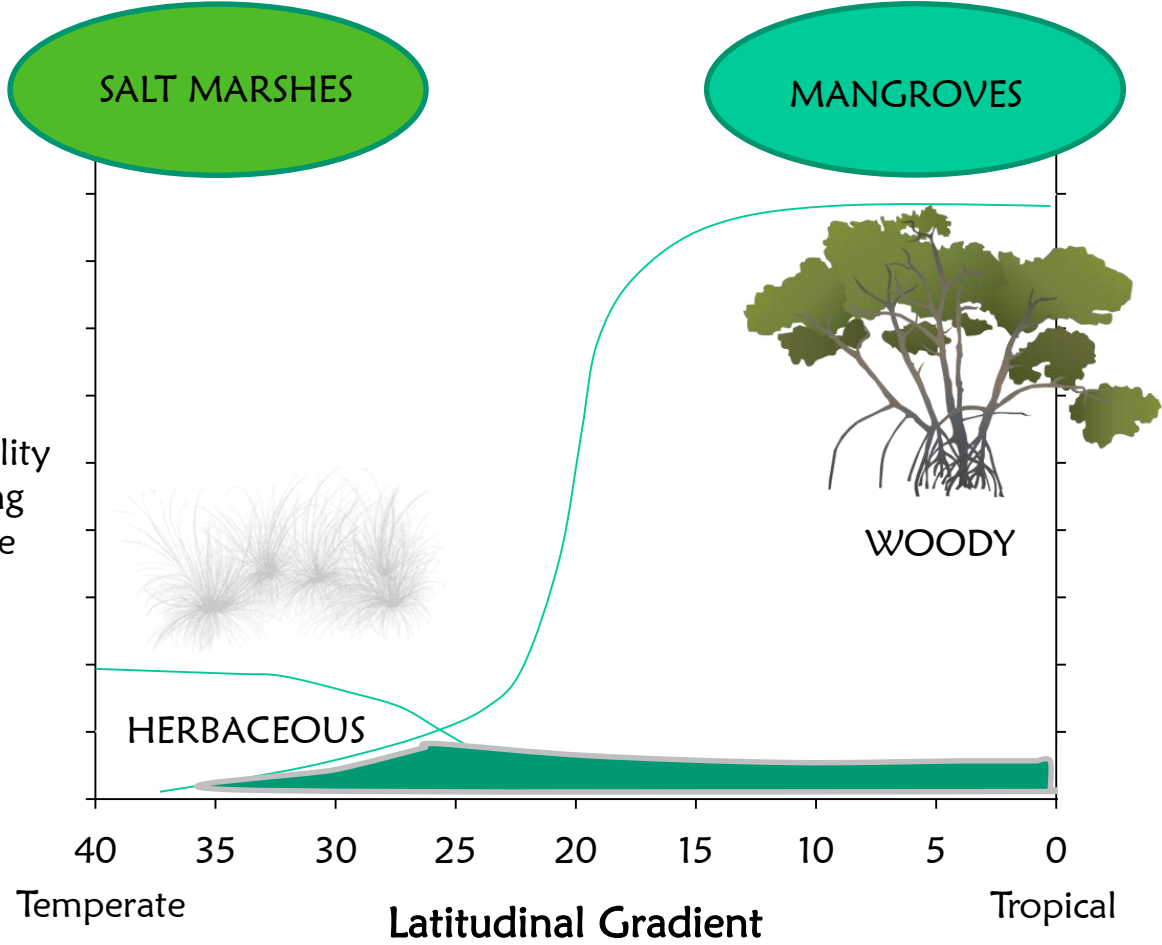
30°30' N



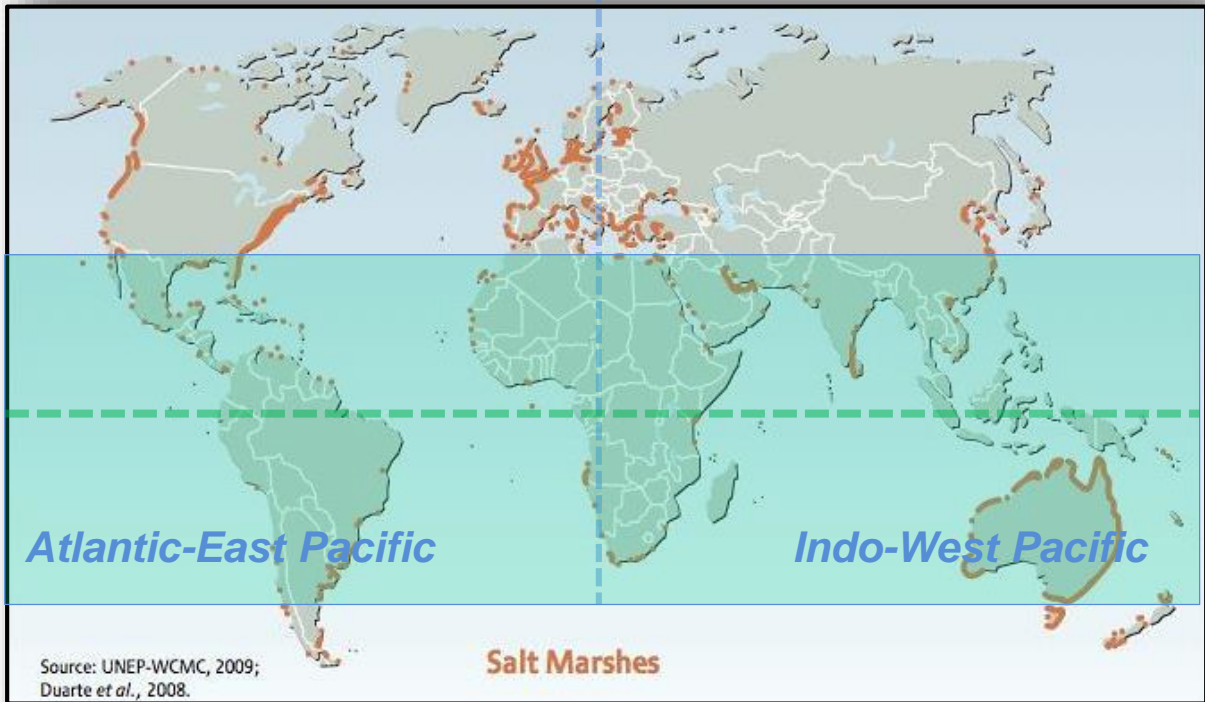
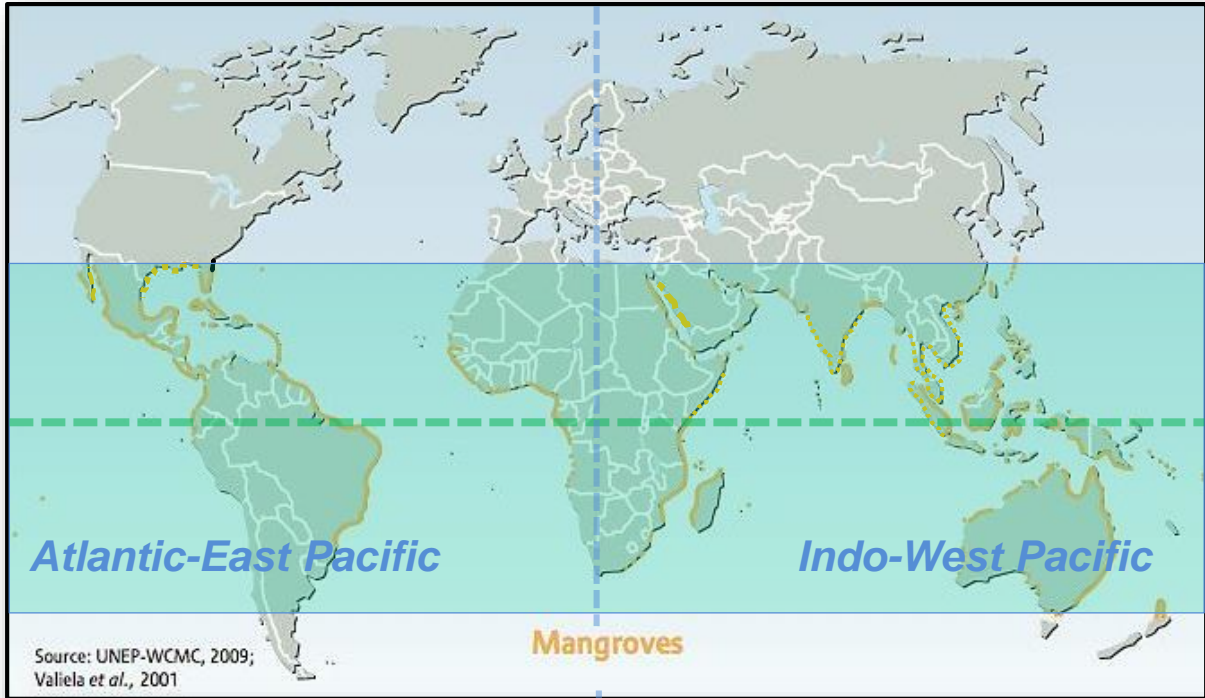
0° 30' S

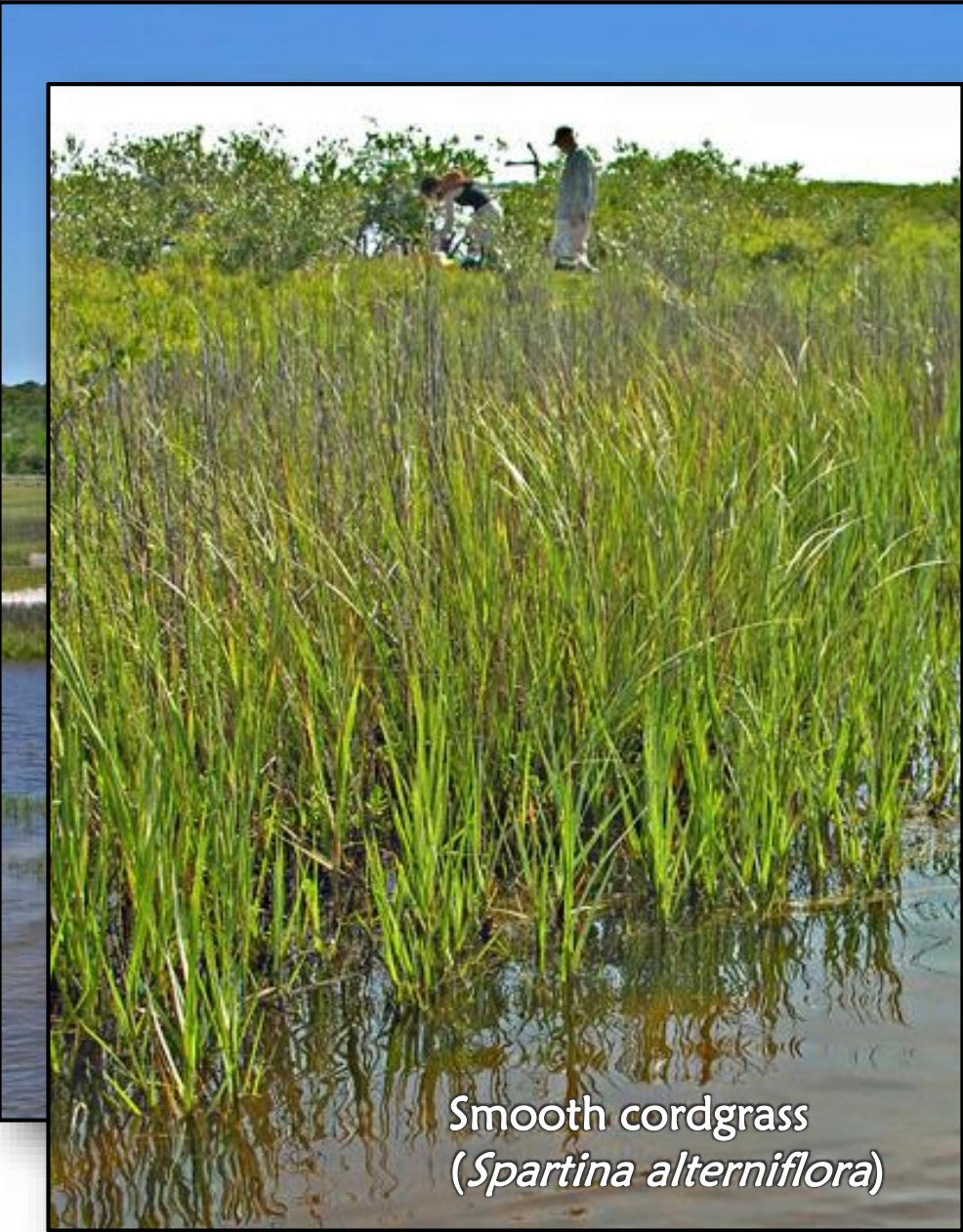


← Factor 1 (e.g., temperature)
→ Factor 2 (e.g., competition, disturbance, herbivory)



- Biomass
- Diversity
- Shoreline stability
- Nutrient cycling
- Carbon storage

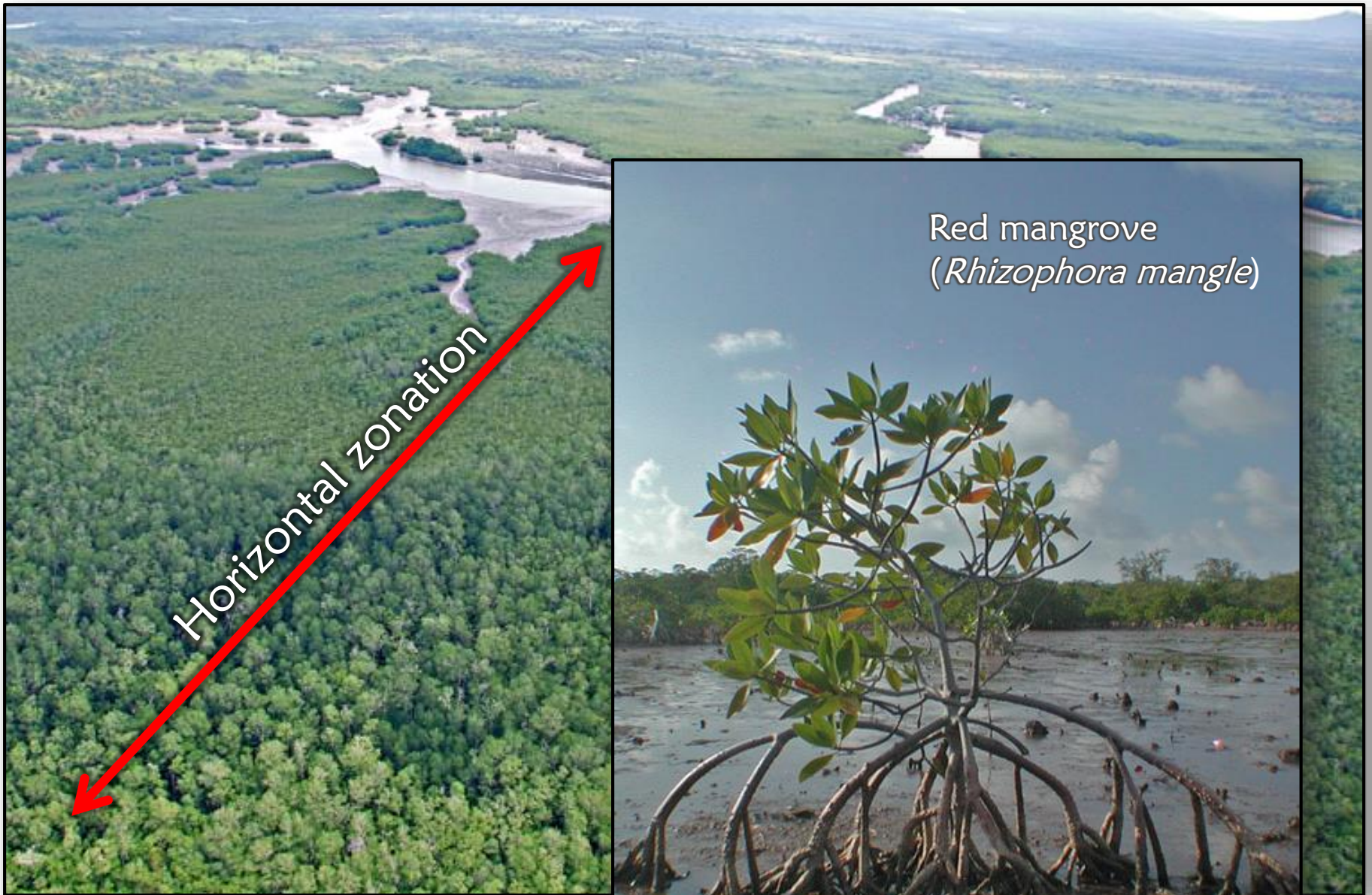




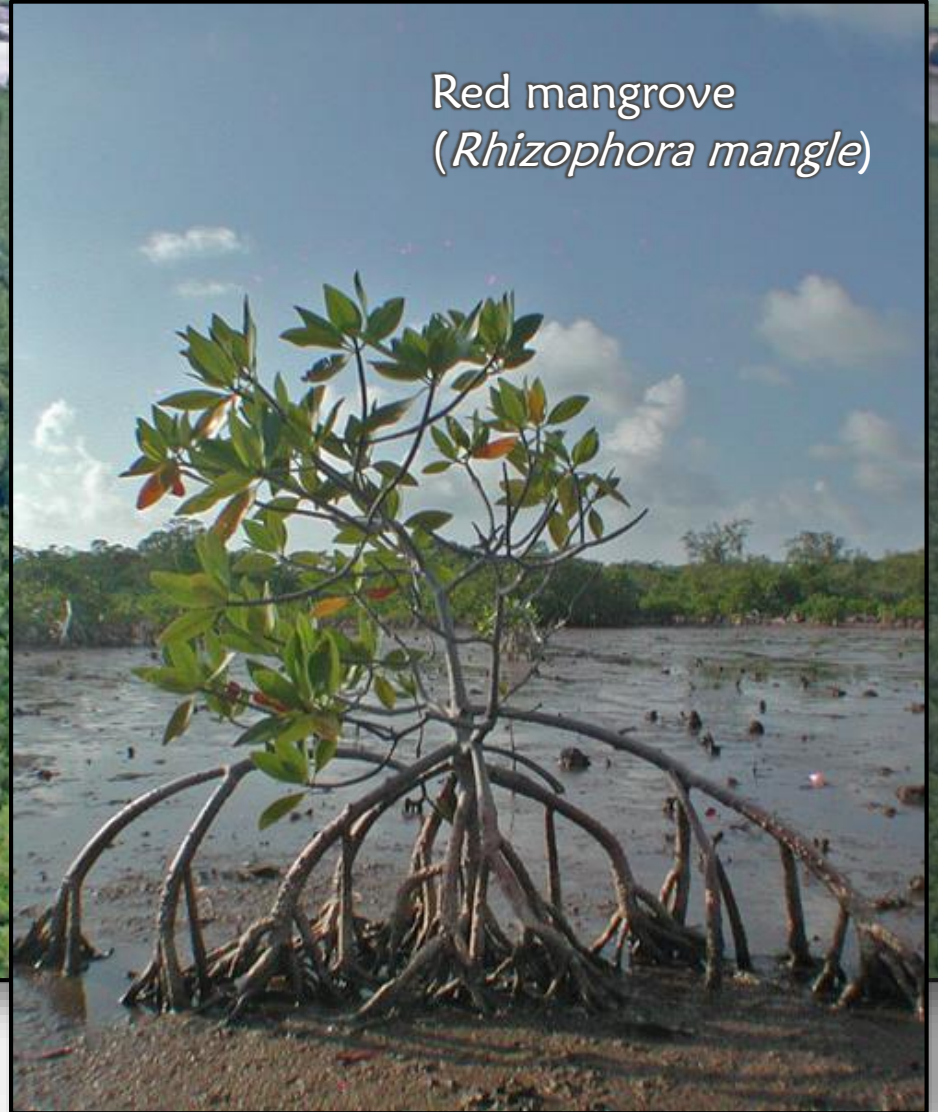
Smooth cordgrass
(*Spartina alterniflora*)



Temperate coastal wetlands

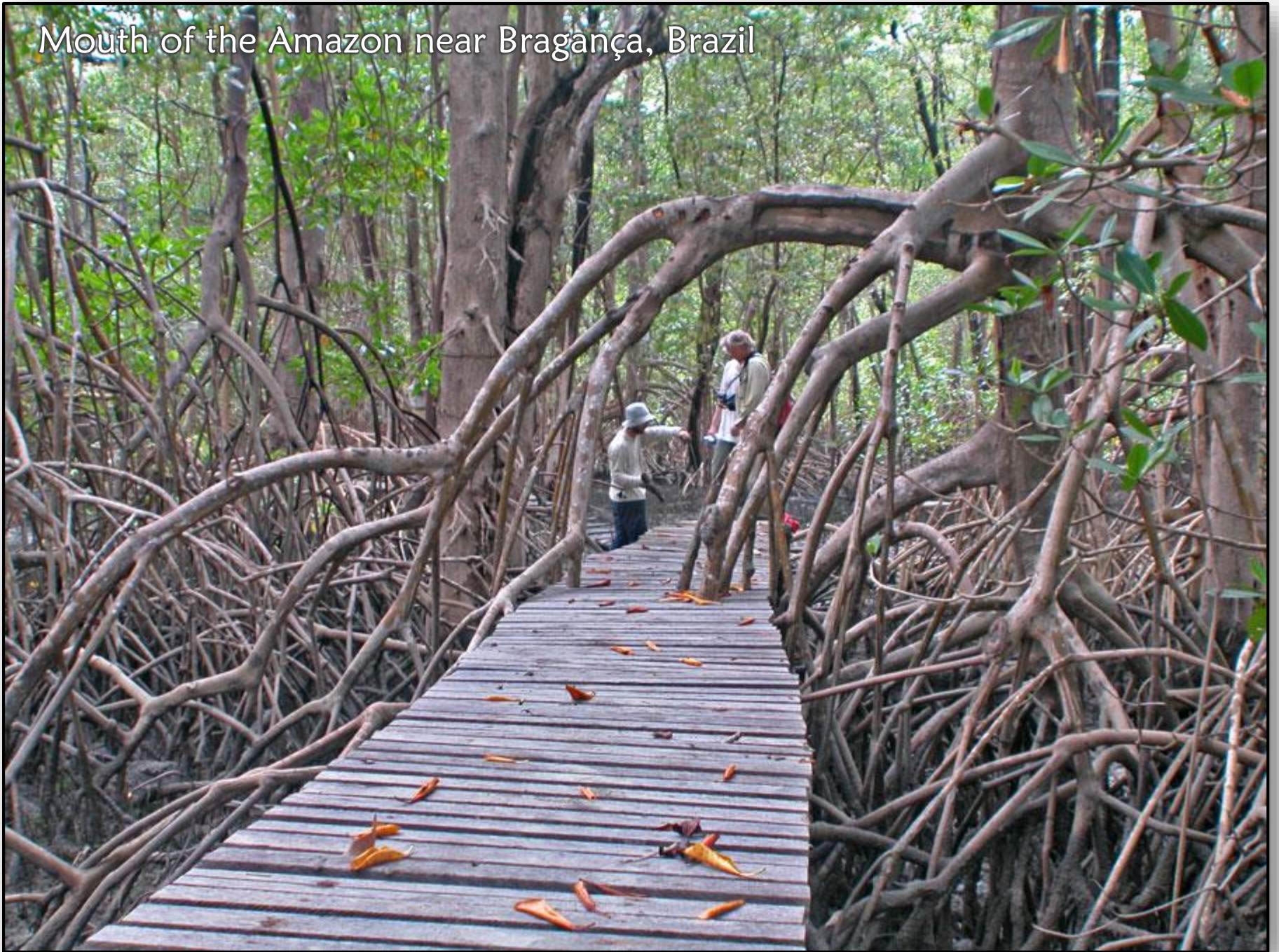


Red mangrove
(*Rhizophora mangle*)



Tropical coastal wetlands

Mouth of the Amazon near Bragança, Brazil



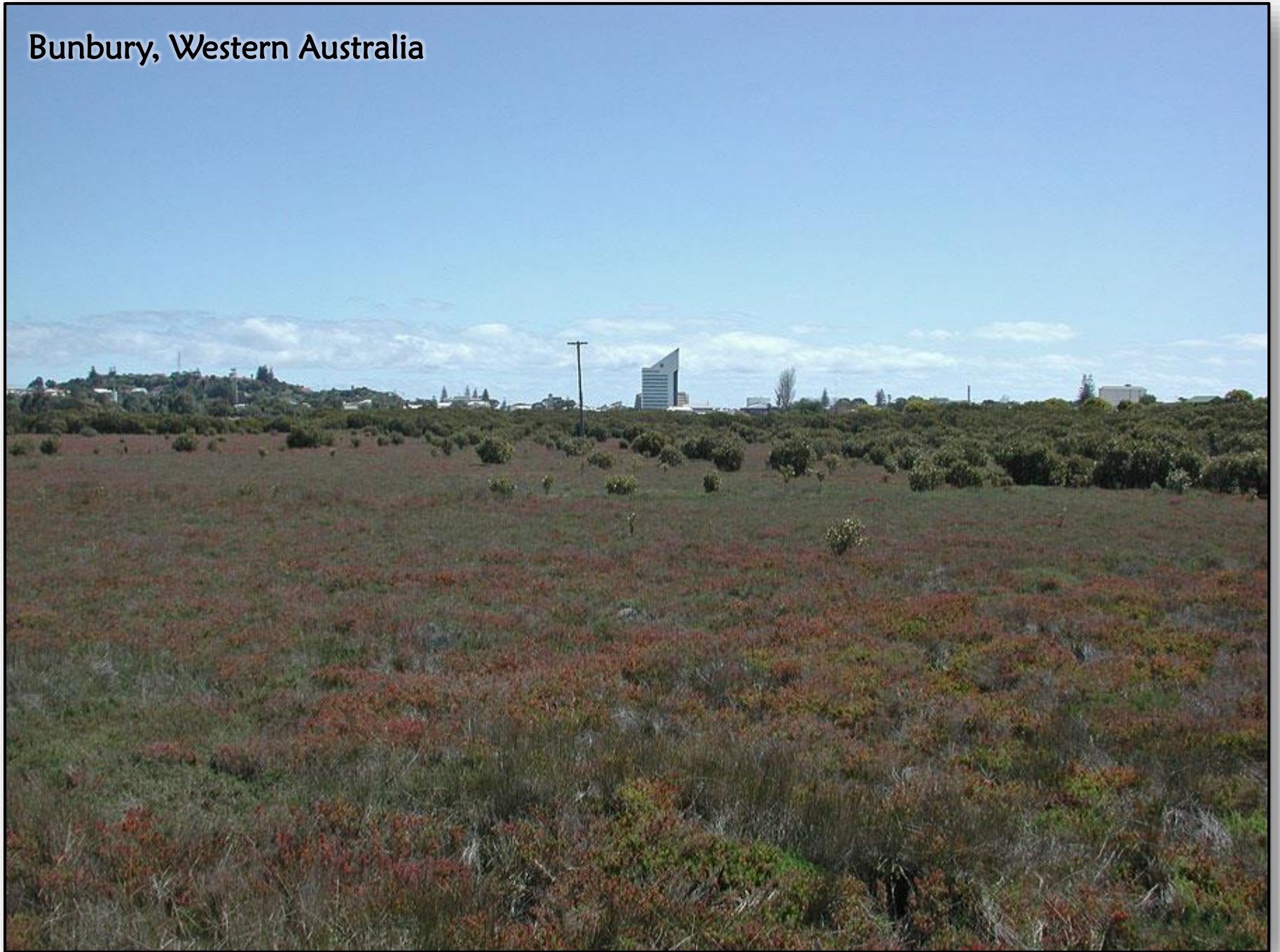
Belize, mainland, Toledo District



Tinchi Tamba Wetlands, near Brisbane, Queensland



Bunbury, Western Australia



Waikopua Estuary, near Auckland, New Zealand



Ecological and economic importance of mangroves and salt marshes

- Buffer for nutrients and sediment runoff
- Shoreline protection



Habitat

- nursery for fisheries
- wildlife

Mangrove and salt marsh fauna

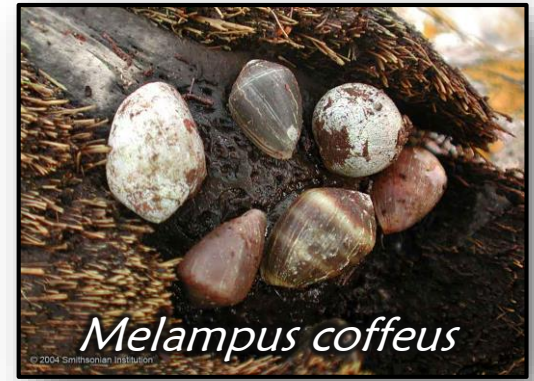
Fishes



Birds



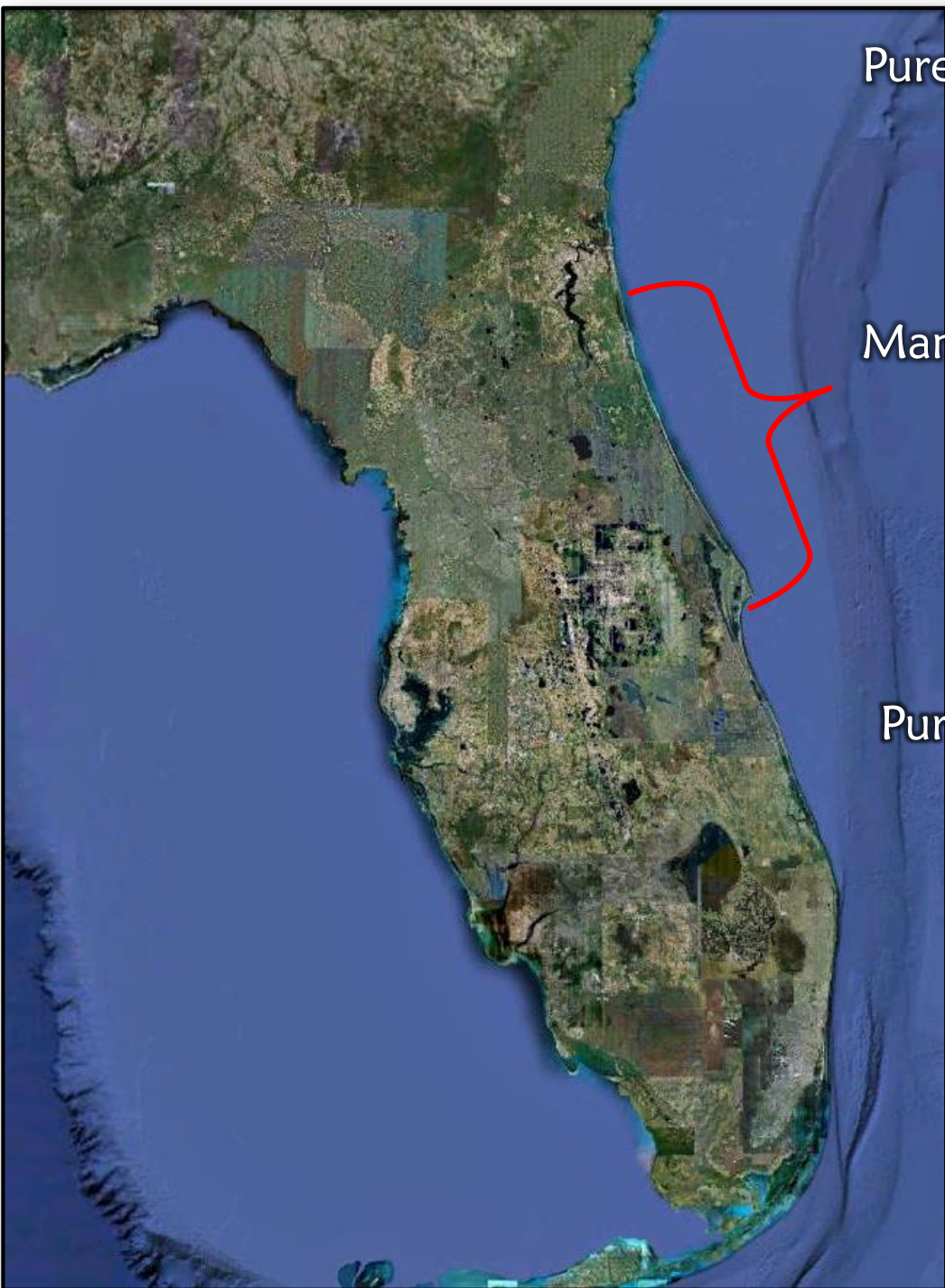
Marine Invertebrates



Threats to mangroves and salt marshes

- 💧 >50% of the world's mangroves have been destroyed; ~35% destroyed just in the last 2 decades
- 💧 Current rate of loss is expected to continue until ca 2020 at which point ~15% will remain
- 💧 One study predicted mangrove extinction in 100 years
- 💧 Most damage/loss has been caused by conversion to shrimp farms, development, tourism
- 💧 >70% of the salt marshes along the coast of North America have been destroyed... agricultural practices, land development, overharvesting, invasive species
- 💧 Pollution... nutrient over-enrichment is one of the major global threats to coastal ecosystems

Consequences of changes in climate and sea level



Pure Saltmarsh



Mangrove-Saltmarsh Ecotone



Pure Mangrove



...28°40' N, Merritt Island National Wildlife Refuge



Along the coast of Florida, where are the north temperate limits...??

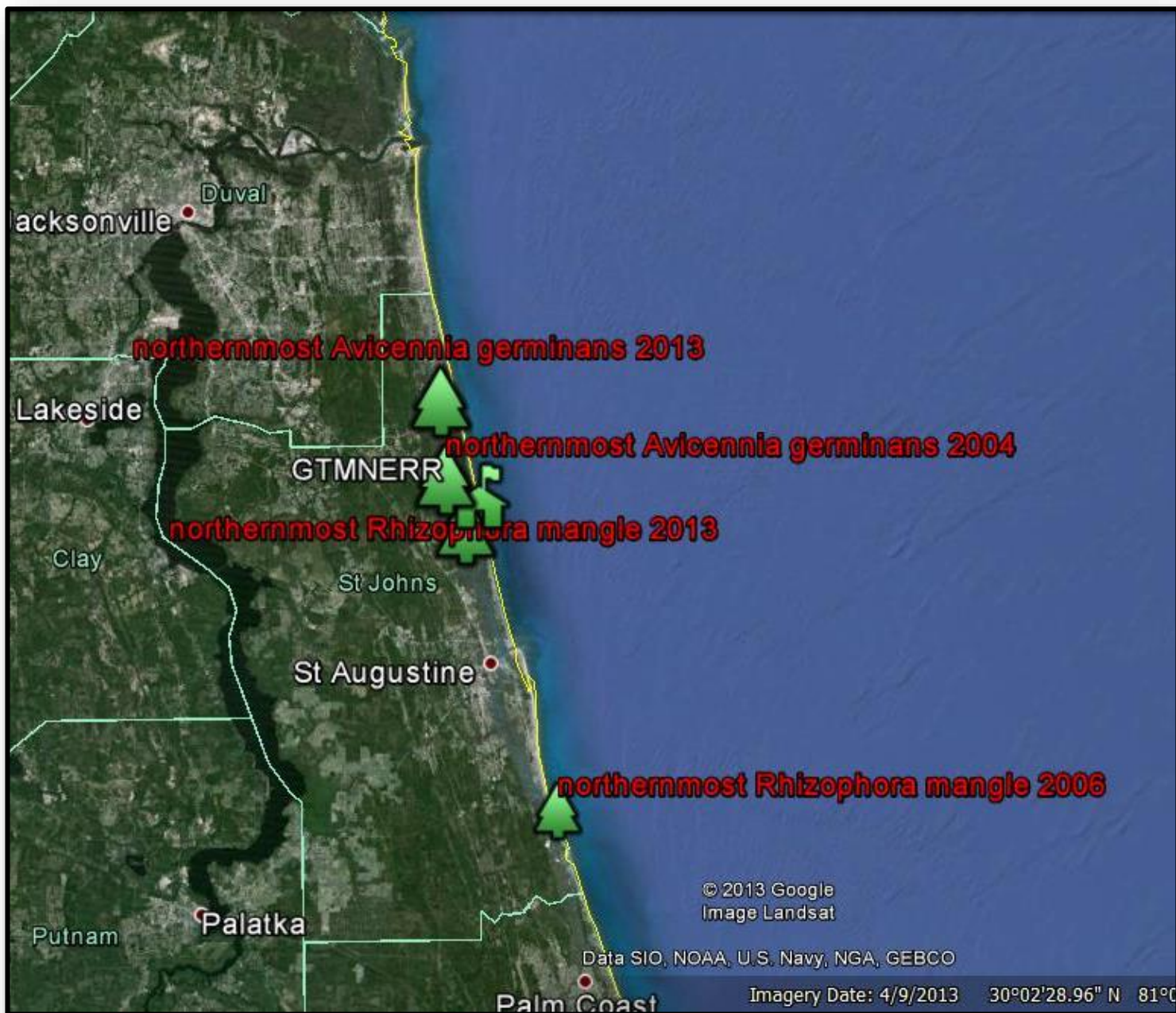
Rhizophora mangle 29°97' N
...in 2010

Avicennia germinans 30°11' N



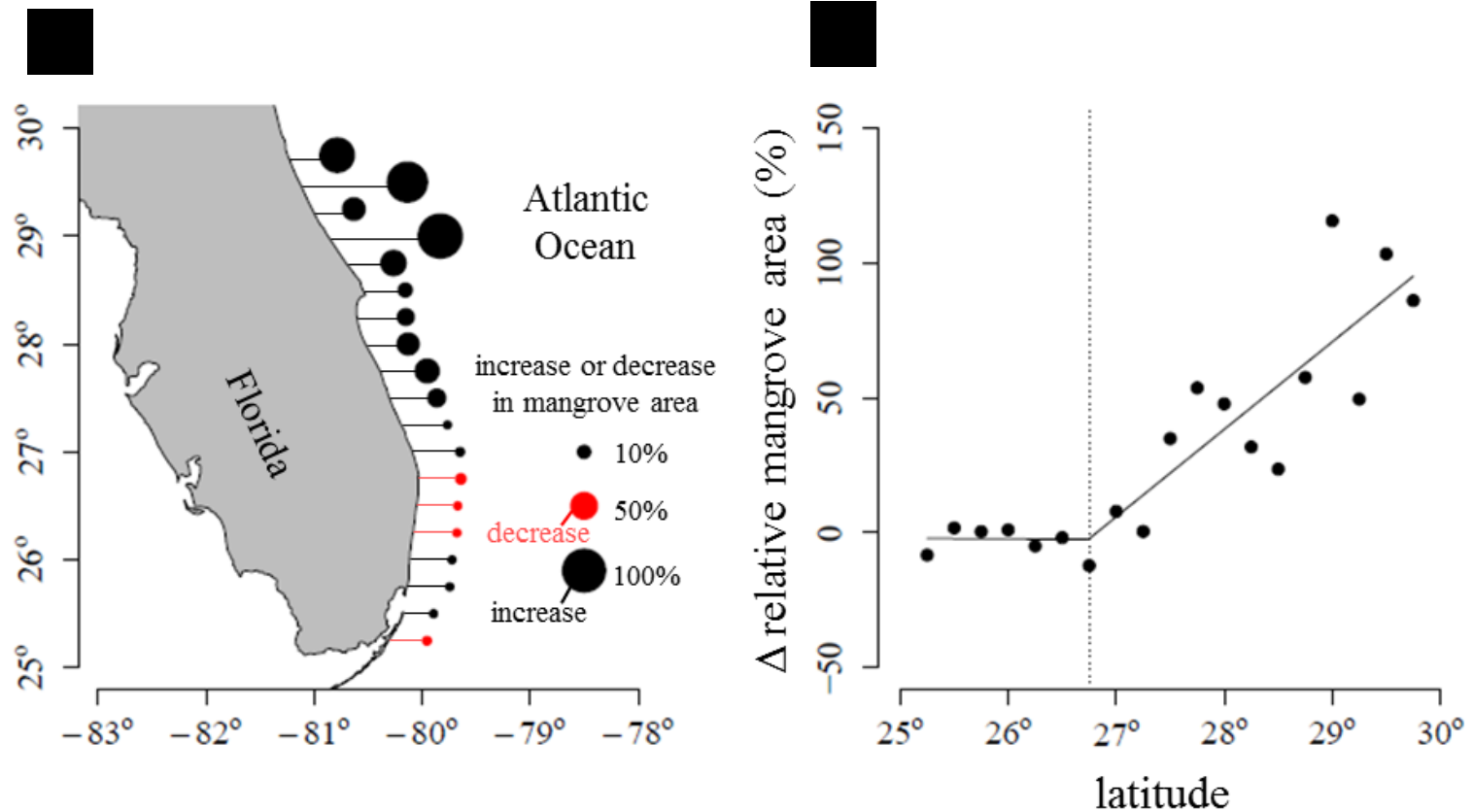
...in 2004



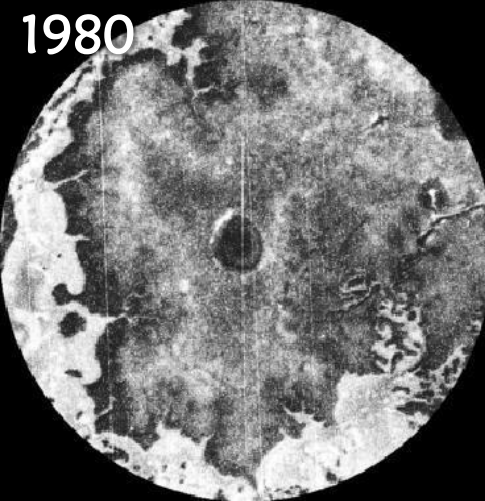
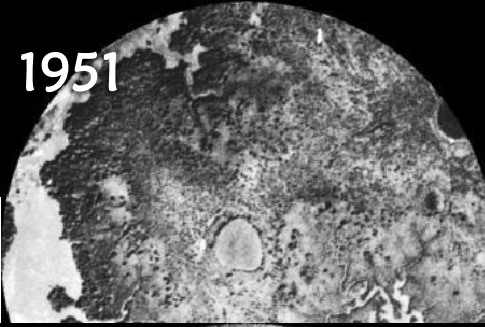


...more recently

There is a strong relationship between latitude and the magnitude of increase in mangrove cover

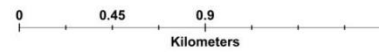
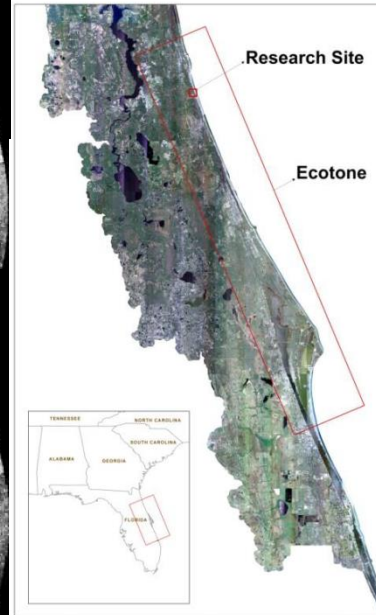
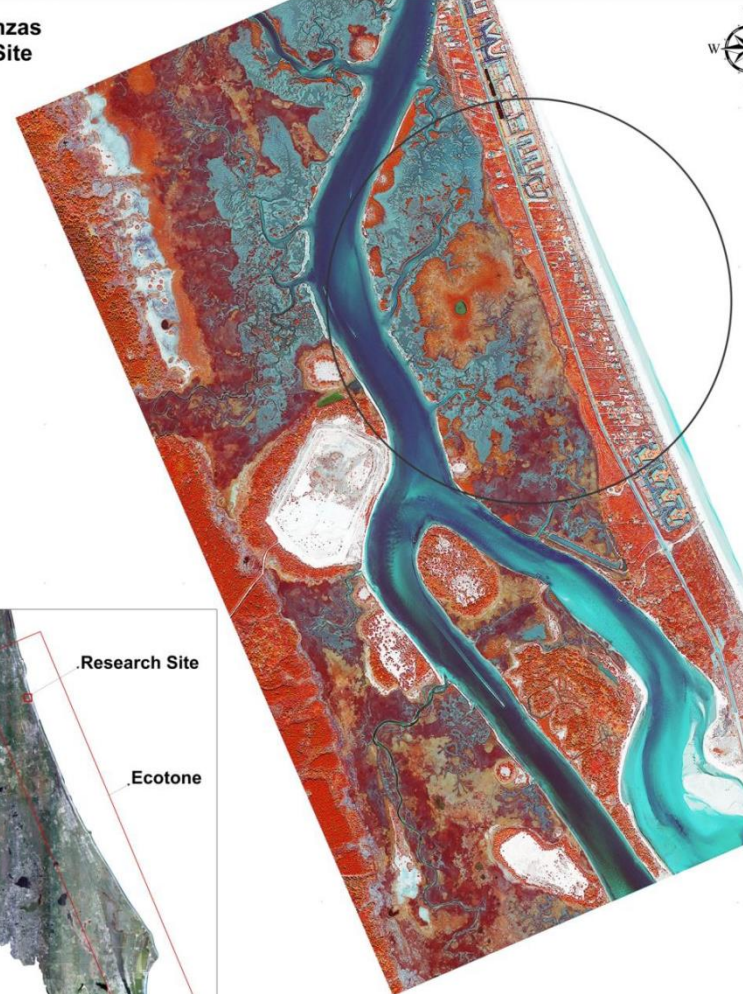


Cavanaugh et al. (2014, PNAS)



81°16'15"W 81°15'50"W 81°15'25"W 81°15'0"W 81°14'35"W 81°14'10"W 81°13'45"W

North Matanzas Research Site

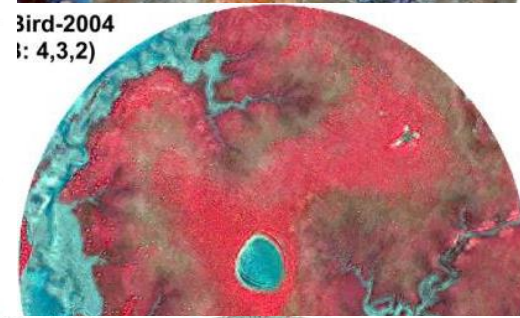


WorldView-2 (RGB: 7,3,2)
Projection: UTM, Zone 17
Datum: WGS84
Pixel size: 0.50 m
Acquisition Date: Mar 05, 2013

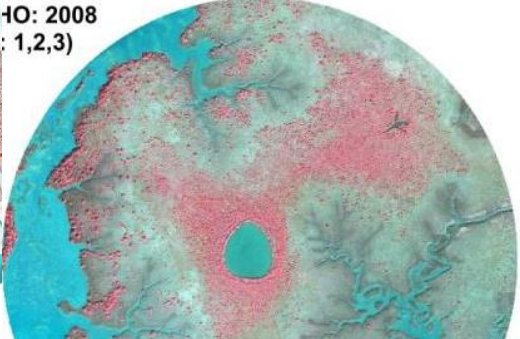
O: 1995
1,2,3)



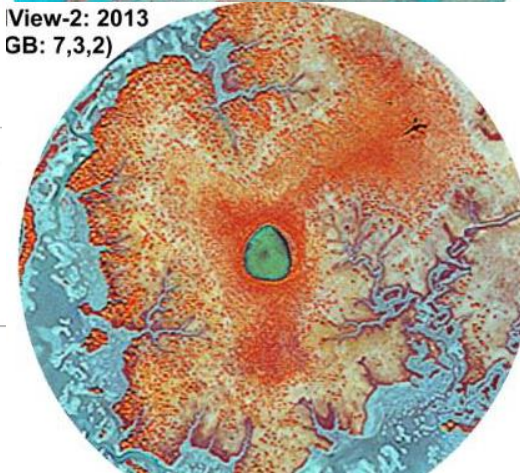
Bird-2004
i: 4,3,2)



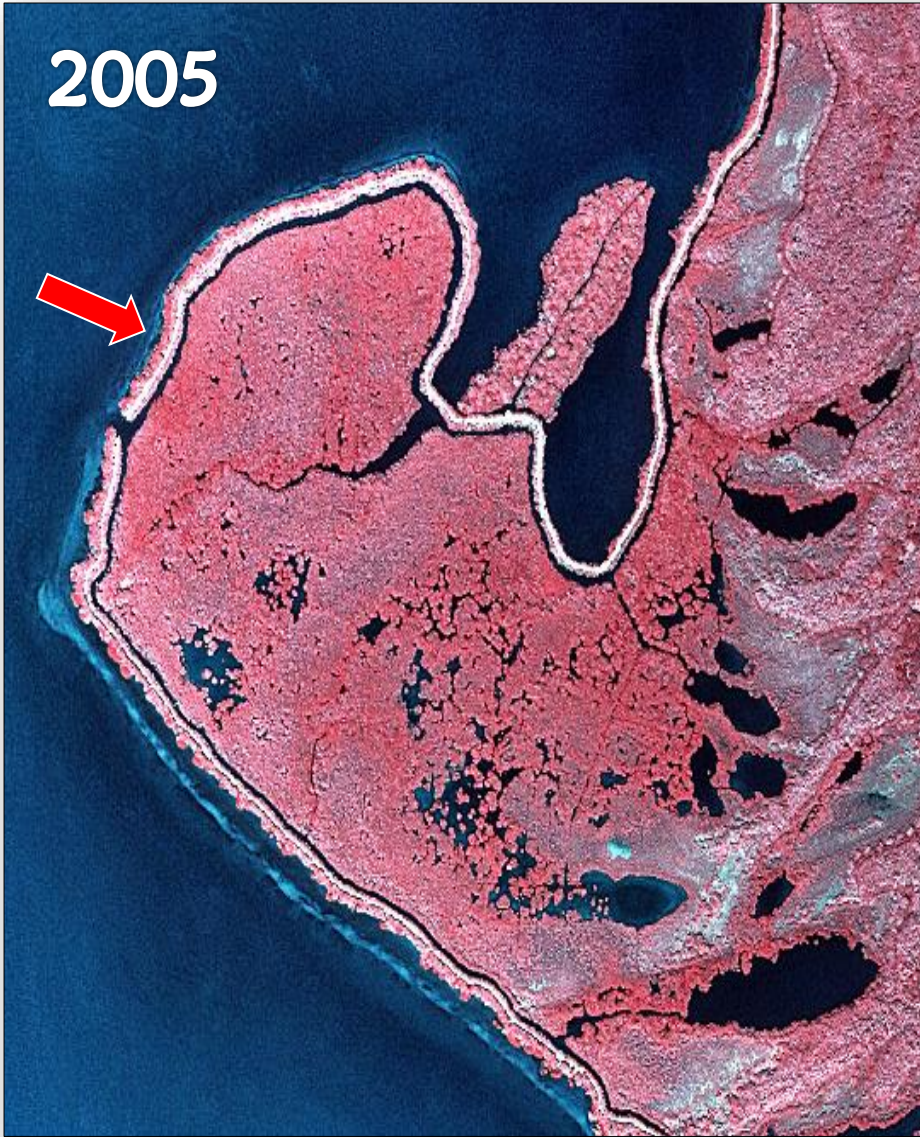
HO: 2008
: 1,2,3)



View-2: 2013
GB: 7,3,2)

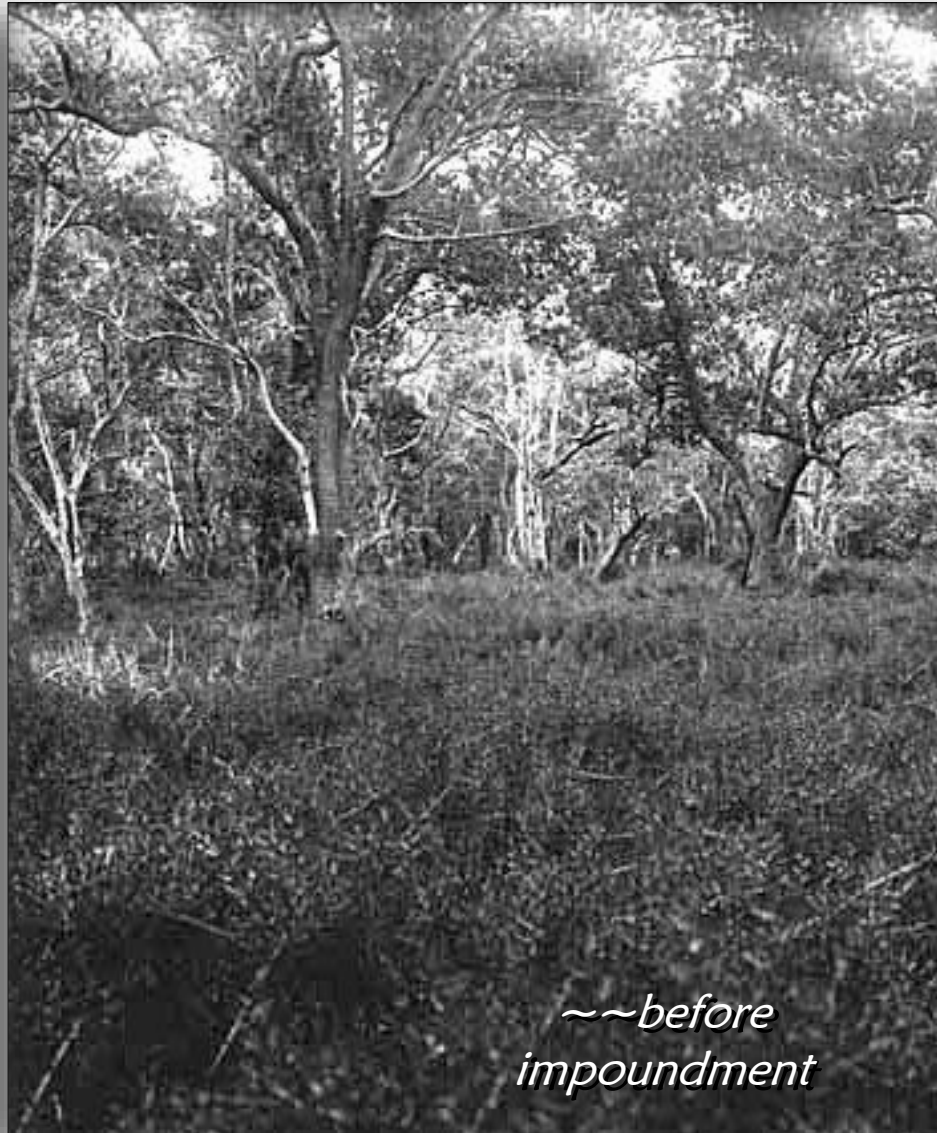


2005



$27^{\circ}32'34''\text{N}$, $80^{\circ}19'52''\text{W}$

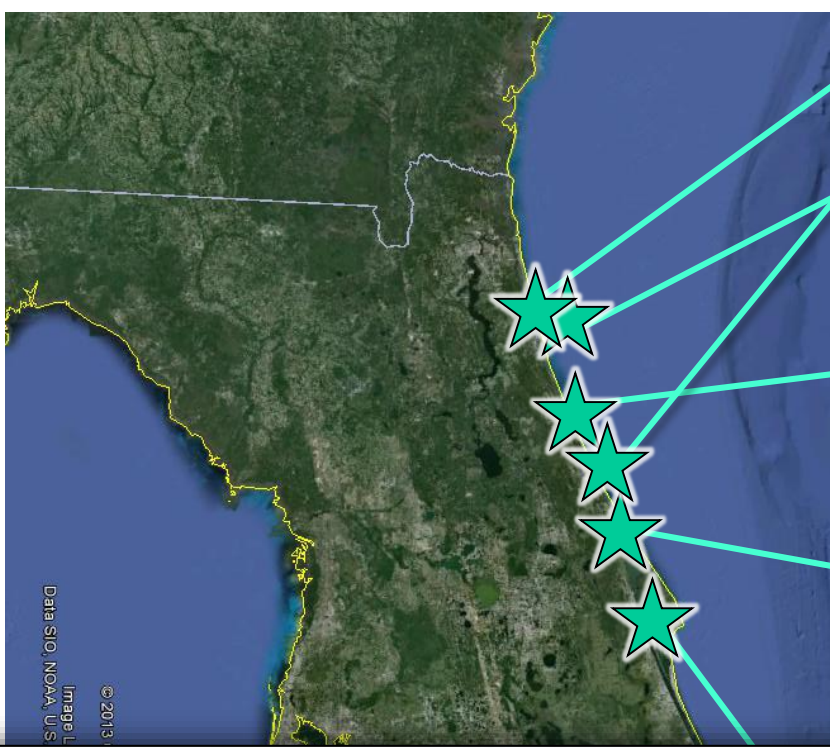
Avalon State Park, North Hutchinson Island, IRL, FL



27°32'34"N, 80°19'52"W

Avalon State Park, North Hutchinson Island, IRL, FL

mangrove distribution



- Bartram 1765-66, reported *Avicennia germinans* at Anastasia Island
- Michaux 1788, reported *Avicennia germinans* and *Rhizophora mangle* at Anastasia Island and Turtle Mound
- Audubon 1835, spent a very cold night aground... on a “mangrove island” , New Smyrna in search of a brown pelican specimen;
- Dr J R Motte 1836-38, Army surgeon; Fort Ann, Merritt Island; reported lush *tangle mangrove forest* killed by severe winter of 1835 from New Smyrna to Haulover Channel.



Nicholson 1928 (*The Wilson Bulletin*) reported finding Macgillivray Seaside Sparrows nesting in small mangrove trees on Merritt Island; photo shows salt marsh with big dead *Avicennia germinans* tree in foreground

Current research:

Objectives:

- to understand the effects of climate change and nutrient enrichment on the expansion of mangrove trees into temperate salt marshes
- to predict the consequences of this invasion for the functionality and biodiversity of coastal habitats.

Approach:

- relate the *regional* mangrove invasion front to climate patterns
- examine the role of land use and especially its impact on nutrient and sediment flow; *document mangrove population* expansion into previously salt marshes
- investigate interactions between *mangrove and salt marsh plants, including their distinct and shared food webs.*