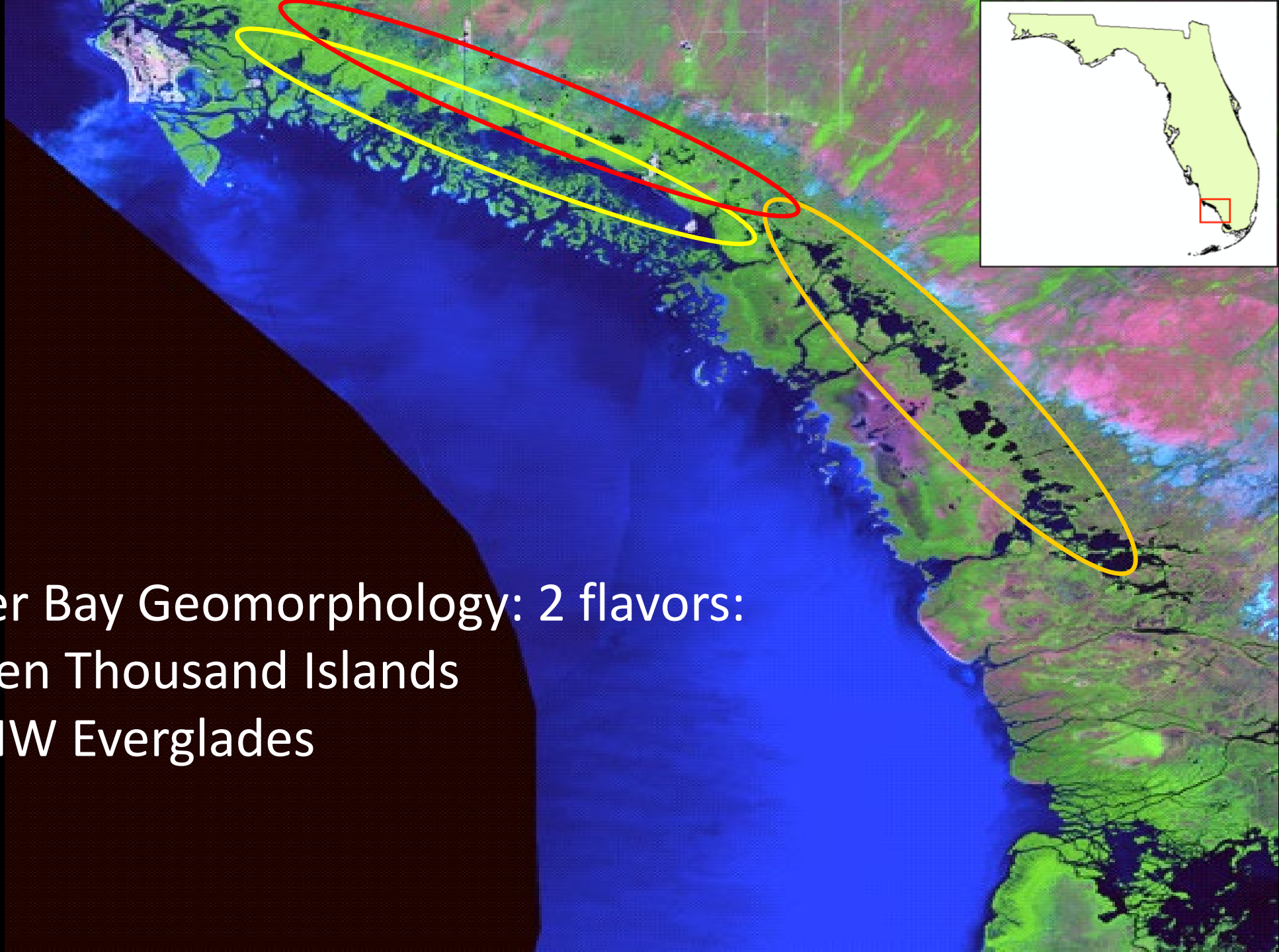


Landscape Effects of Peat Collapse: Examples From the Ten Thousand Islands NWR and Everglades NP

Kim Andres, Michael Savarese, and Brian Hoye

GEER 2019





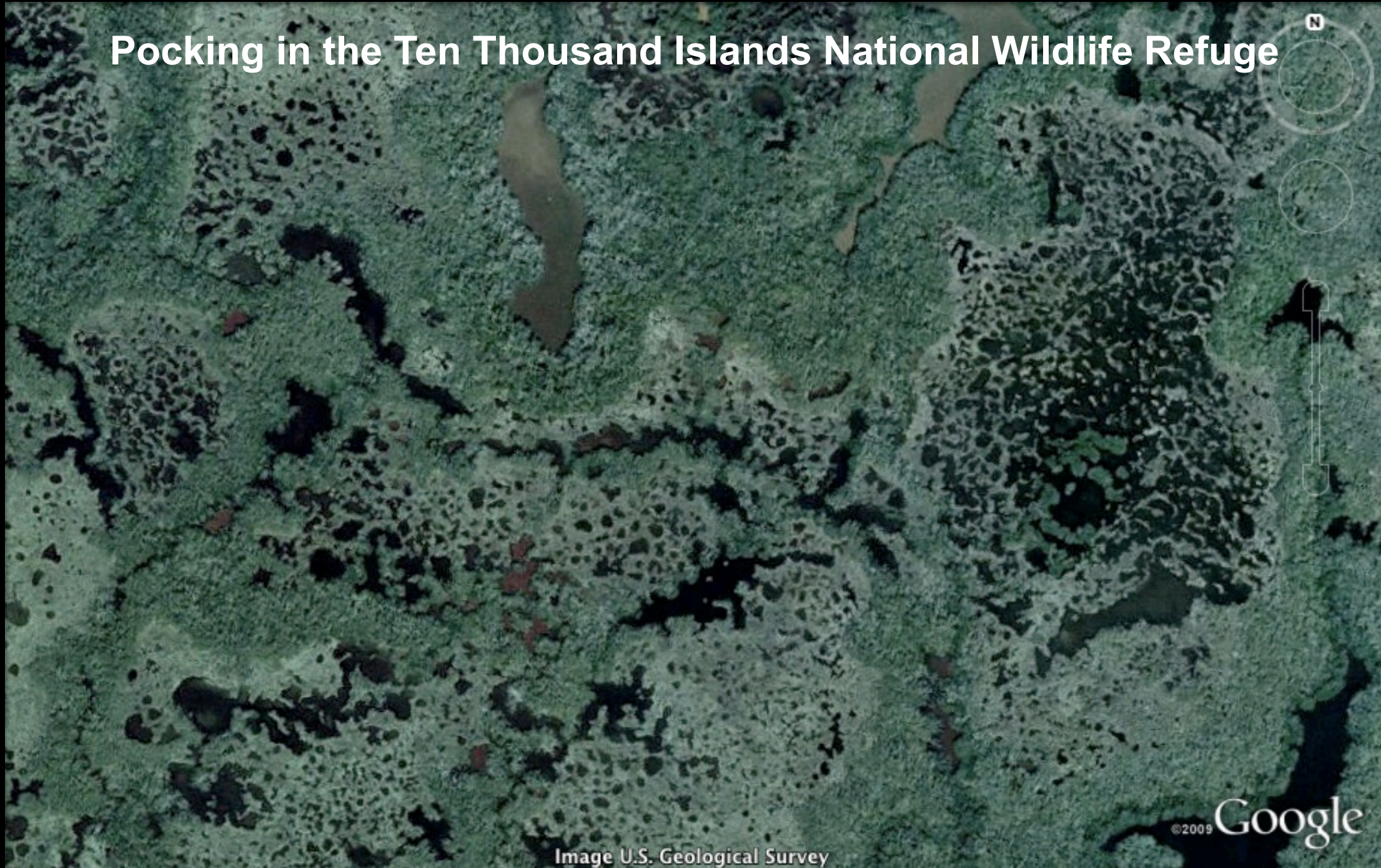
Inner Bay Geomorphology: 2 flavors:

- Ten Thousand Islands
- NW Everglades

Geomorphologic Phenomenon

- "Pocking": salt marsh grass mortality, peat collapse, drop in landscape elevation at much as 30 cm.
- Pond formation, pond enlargement, pond merger to generate large bays, inland bays with clover leaf shapes.
- Two periods: currently & middle Holocene(?)
- Not unique to South & SW FL . . . Other locales & studies:
 - Maryland (Kearney 1996; Kearney and Rogers 2010)
 - Maine (Wilson et al. 2007; Wilson et al. 2010)
 - Delaware Bay (Kearney and Riter 2011)
 - Southwest Florida (Hoye 2009)

Pocking in the Ten Thousand Islands National Wildlife Refuge



©2009 Google

Image U.S. Geological Survey

Imagery Date: Feb 1, 2006

25°57'08.53" N 81°32'57.92" W elev 0 ft

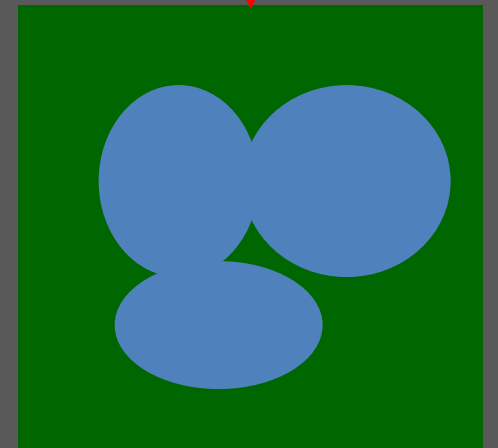
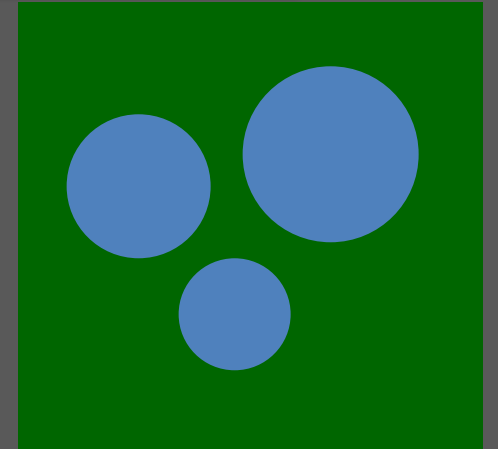
Eye alt 2851 ft



Pocking of *Spartina* Marshes



Implications: Tidal Pond Formation



Evidence of initiation, growth, and merger of ponds

Implications of SLR: Tidal Pond Evolution

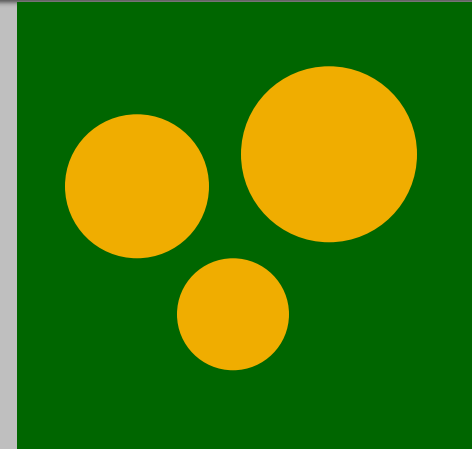


Hoye, 2008



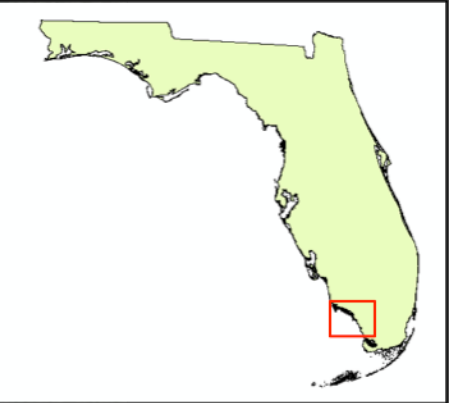
Southwest
Everglades

- Evidence of initiation, growth, and merger of ponds at different scales



Recent Pocking in Ten Thousand Islands NWR

Andres et al., in press. Estuaries & Coasts

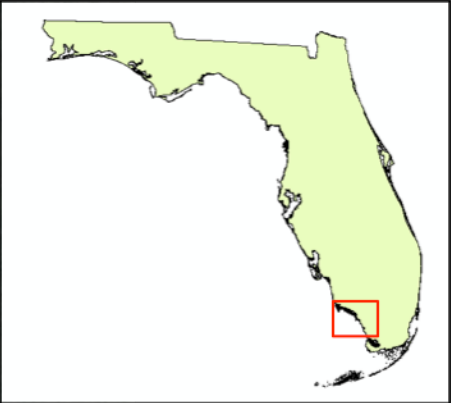


Ten Thousand Islands



Faka Union Canal

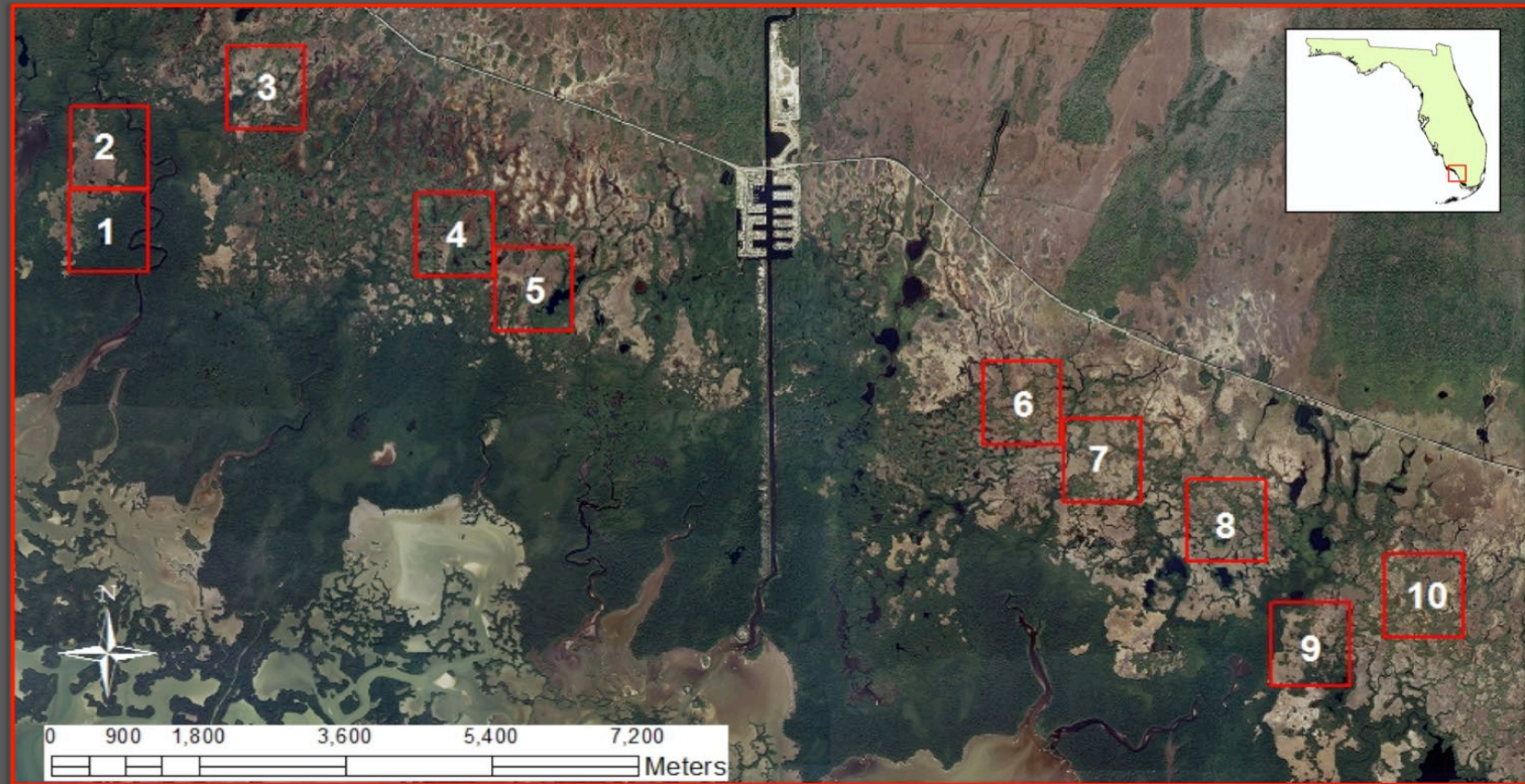
Ten Thousand Islands



Experimental Design



Sediment coring

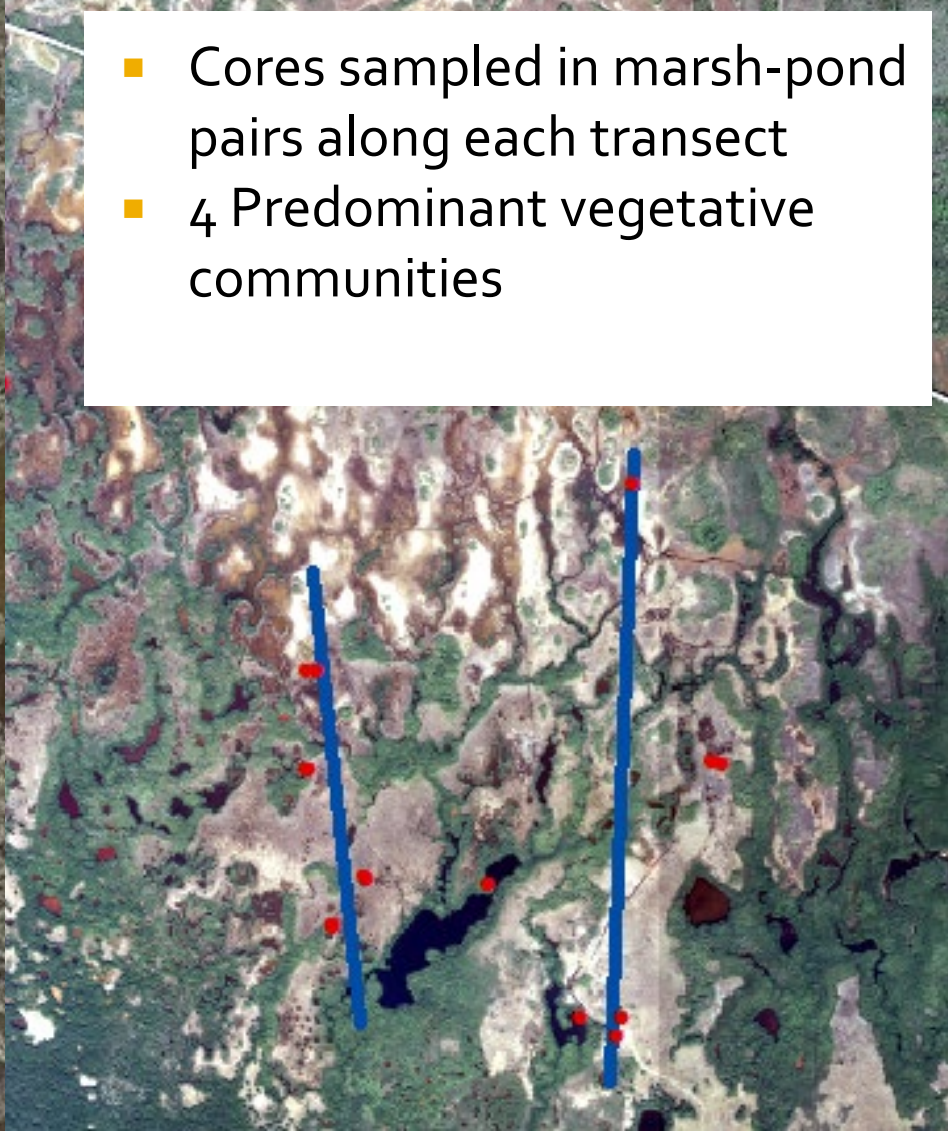


Time Series Spatial Analysis

Sediment Coring

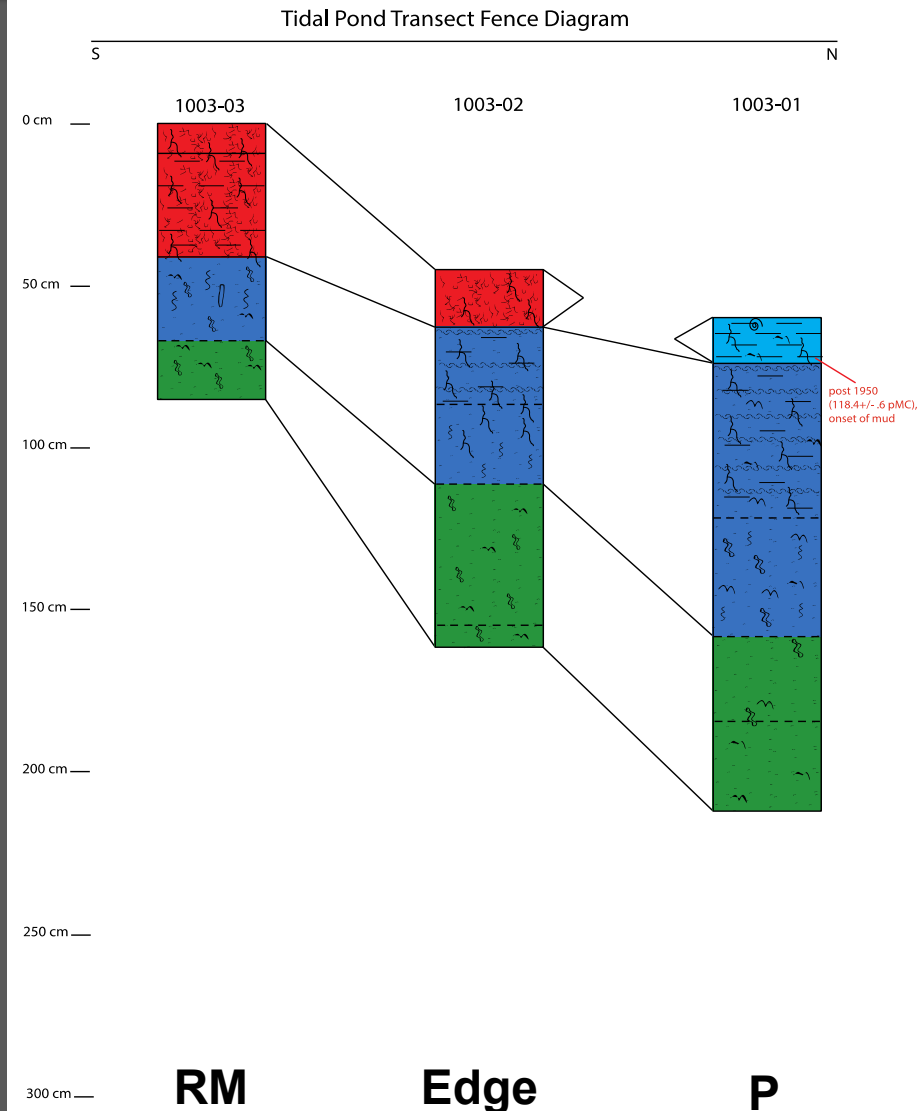
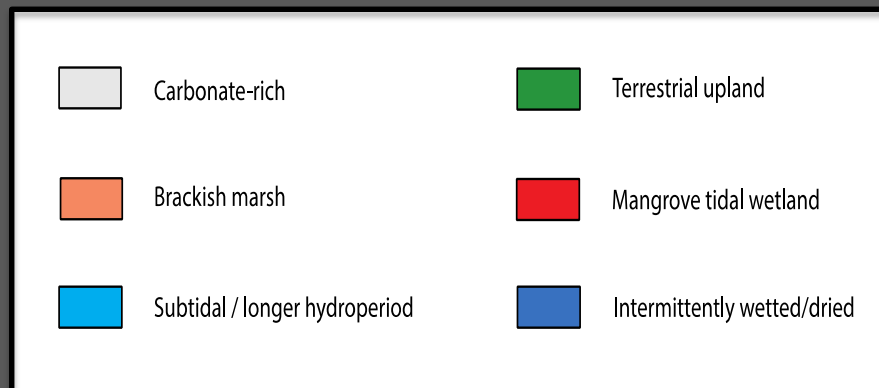


- Cores sampled in marsh-pond pairs along each transect
- 4 Predominant vegetative communities



Identifying Precursor Habitats

- Pond cores largely lack peat
 - Comparatively less peats in pond vs. partner marsh cores
 - 11 of 16 pond cores contain no peat development



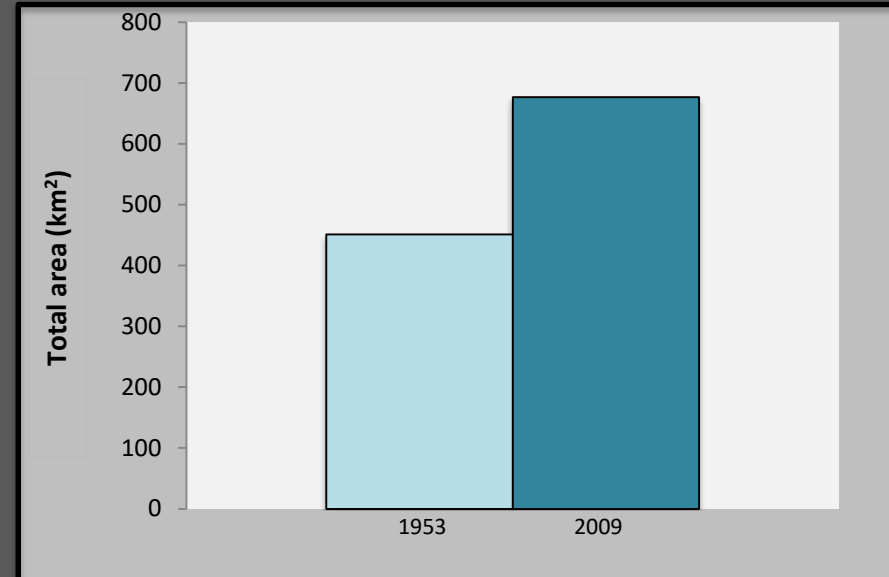
GIS Pond Analysis



- ESRI ArcMap (10.1, 10.2.1) software
- 10 randomly-selected 1 km² marsh locations
- Compare 1953 & 2009

Identifying Pond Changes Over Time

- Pond Area:
 - Total combined pond area increase of 226km²
 - Marsh ponds: +276km²
 - Mangrove ponds: -50km²

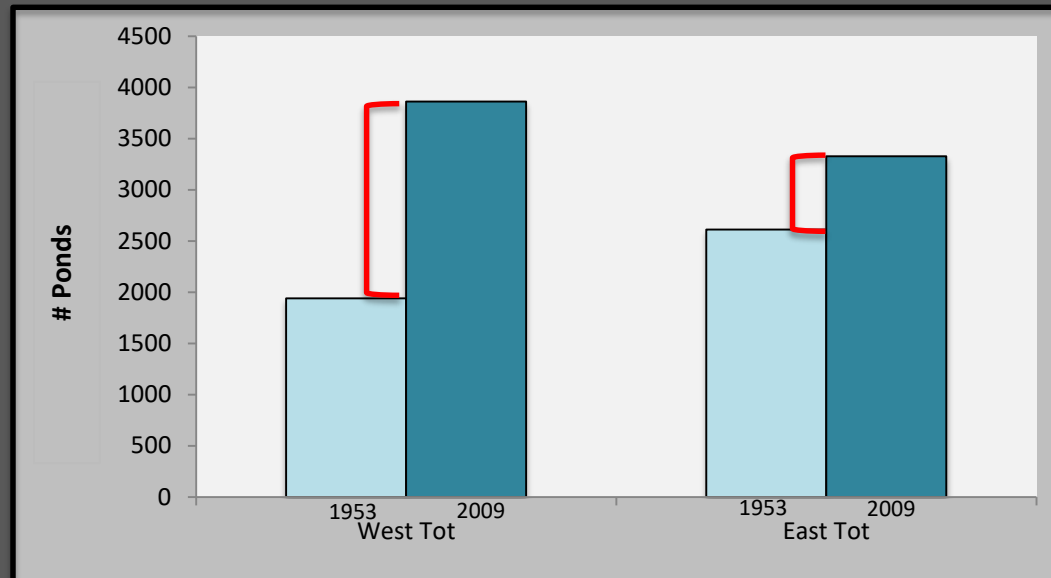


TOTAL POND AREA			
(m ²)	WEST	EAST	TOTAL
1953	2.22E+05	2.29E+05	4.51E+05
2009	3.84E+05	2.93E+05	6.77E+05
TOT CHANGE	1.62E+05	6.32E+04	2.26E+05
% CHANGE	73%	28%	50%
RATE OF CHANGE (m ² /y)	2847.92	1108.80	3956.72

Identifying Pond Changes Over Time

- Pond Count:
 - Increased at 3x the rate in western sites (1-5) than eastern sites (6-10)

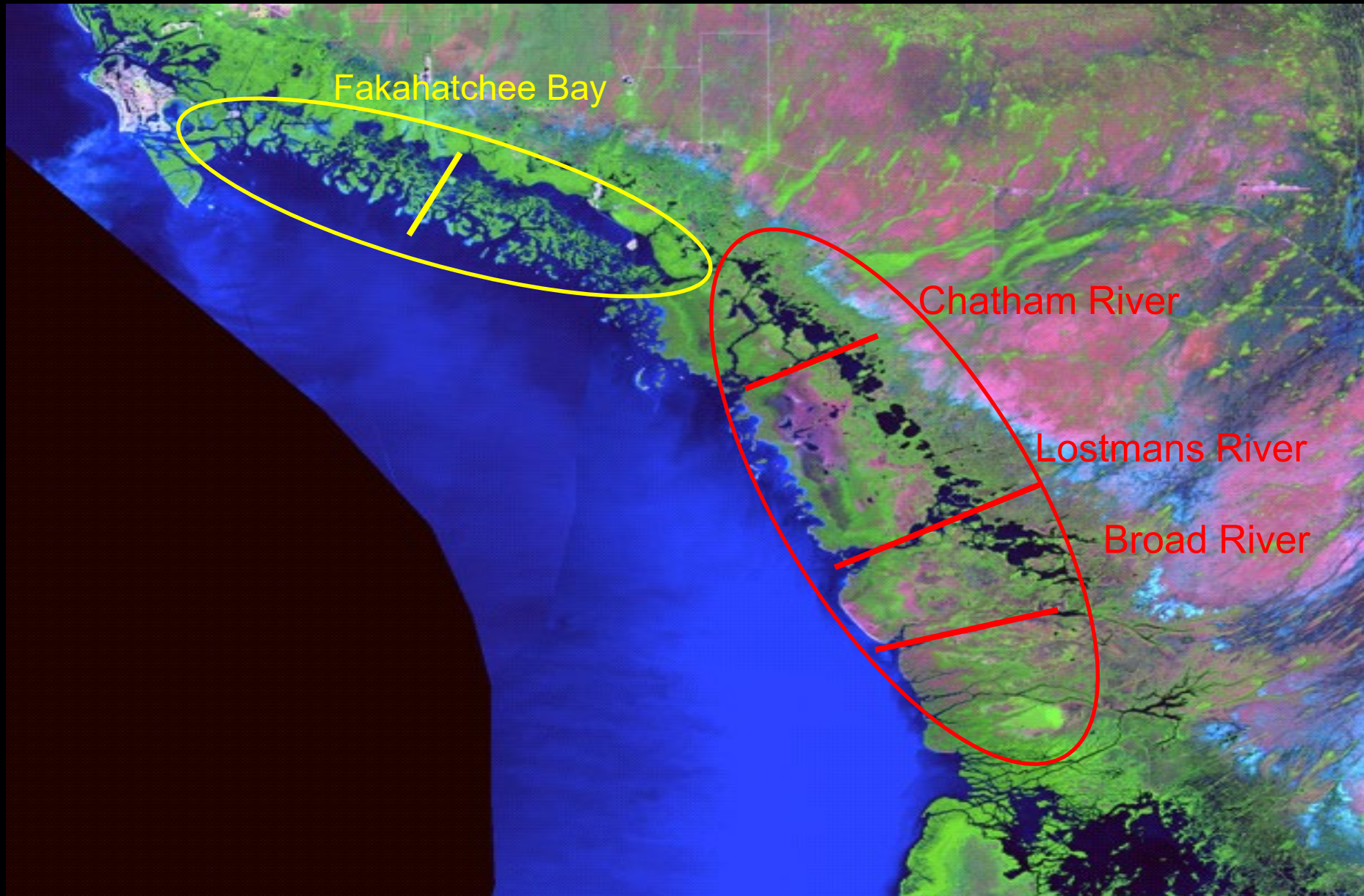
TOT COUNT			
MARSH PONDS	WEST	EAST	TOTAL
1953	1942	2613	4555
2009	3863	3328	7191
TOT CHANGE	1921	715	2636
% CHANGE	98.92	27.36	57.87
RATE OF CHANGE (#/y)	33.70	12.54	46.24



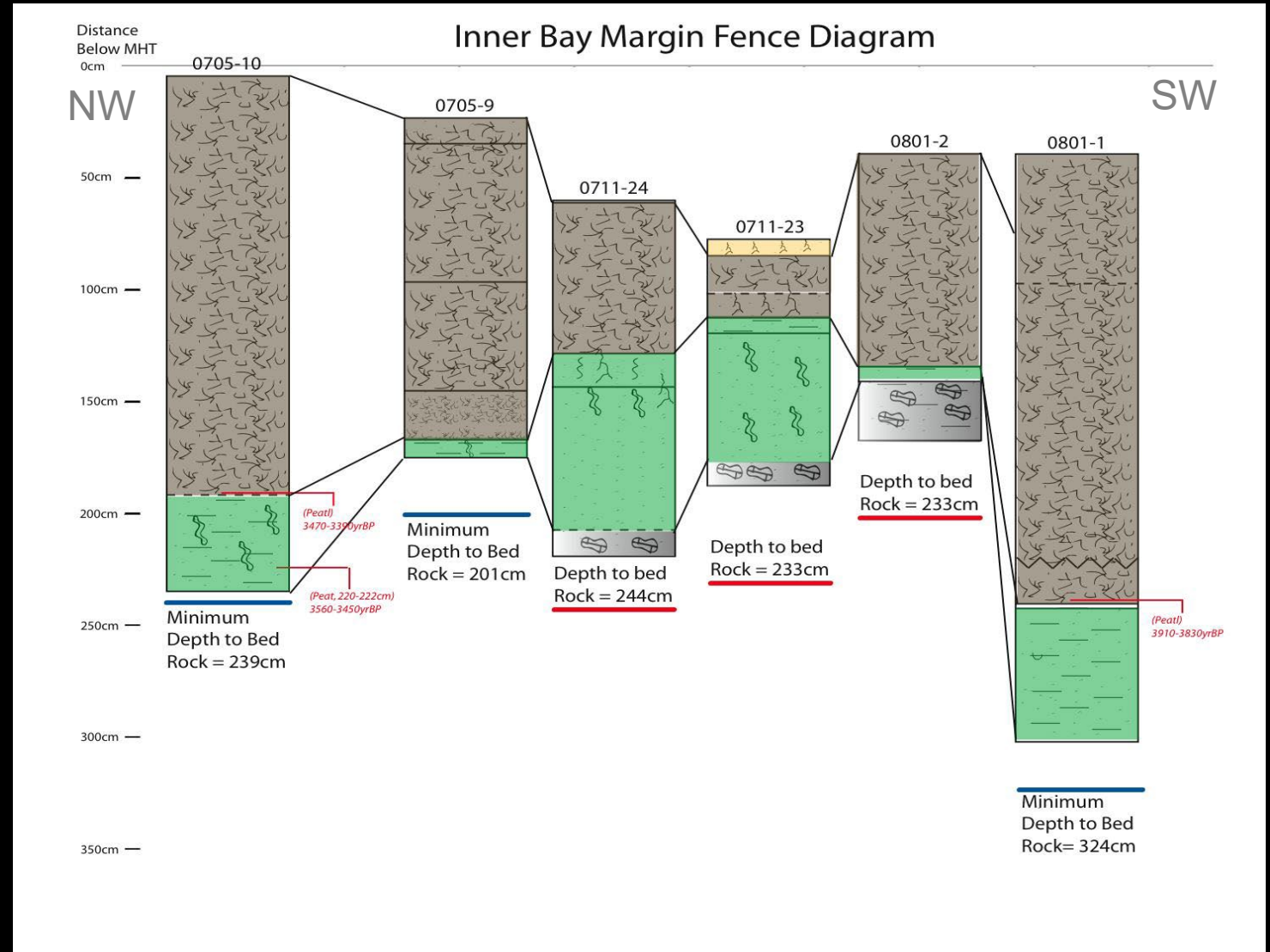
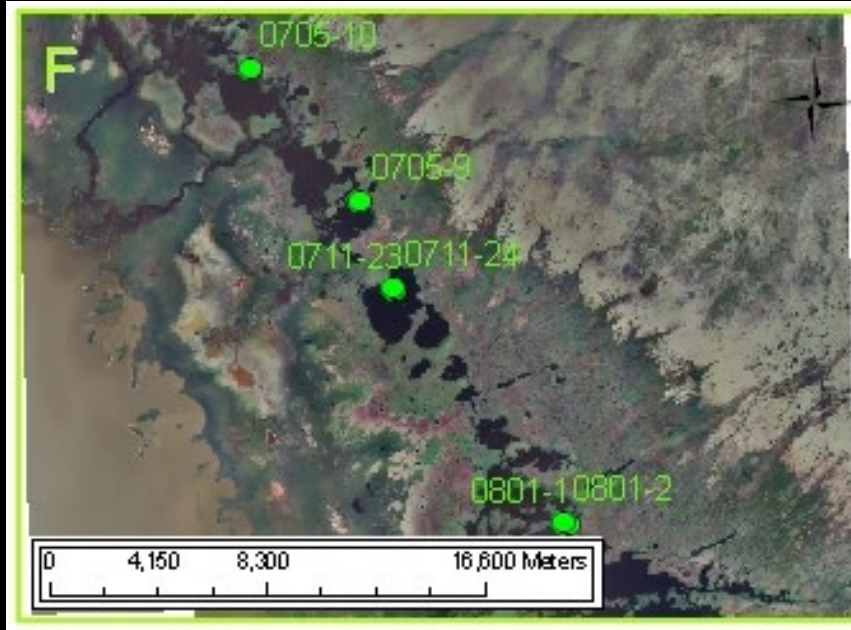
Middle to Late Holocene Pocking in Everglades NP

Hoye, 2009. MS Thesis, FGCU

Geomorphologic change along the southwest coast



Inner Bay Transect



Intertidal oyster reef

Subtidal bay

Intertidal wetland peat

Subaerial soil

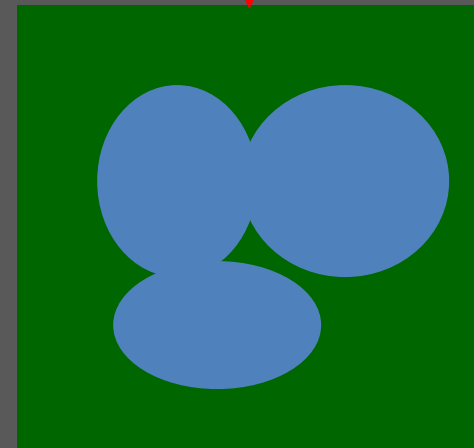
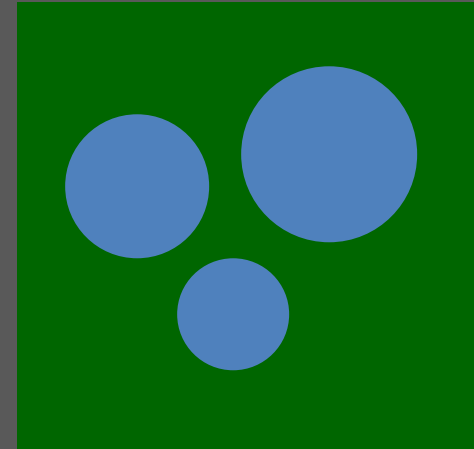
Geomorphologic Implications

Similar phenomenon in earlier
Holocene resulting in this . . .

Major landscape
transformation!

An earlier Holocene SL high
stand?

Northwest coastal
Everglades



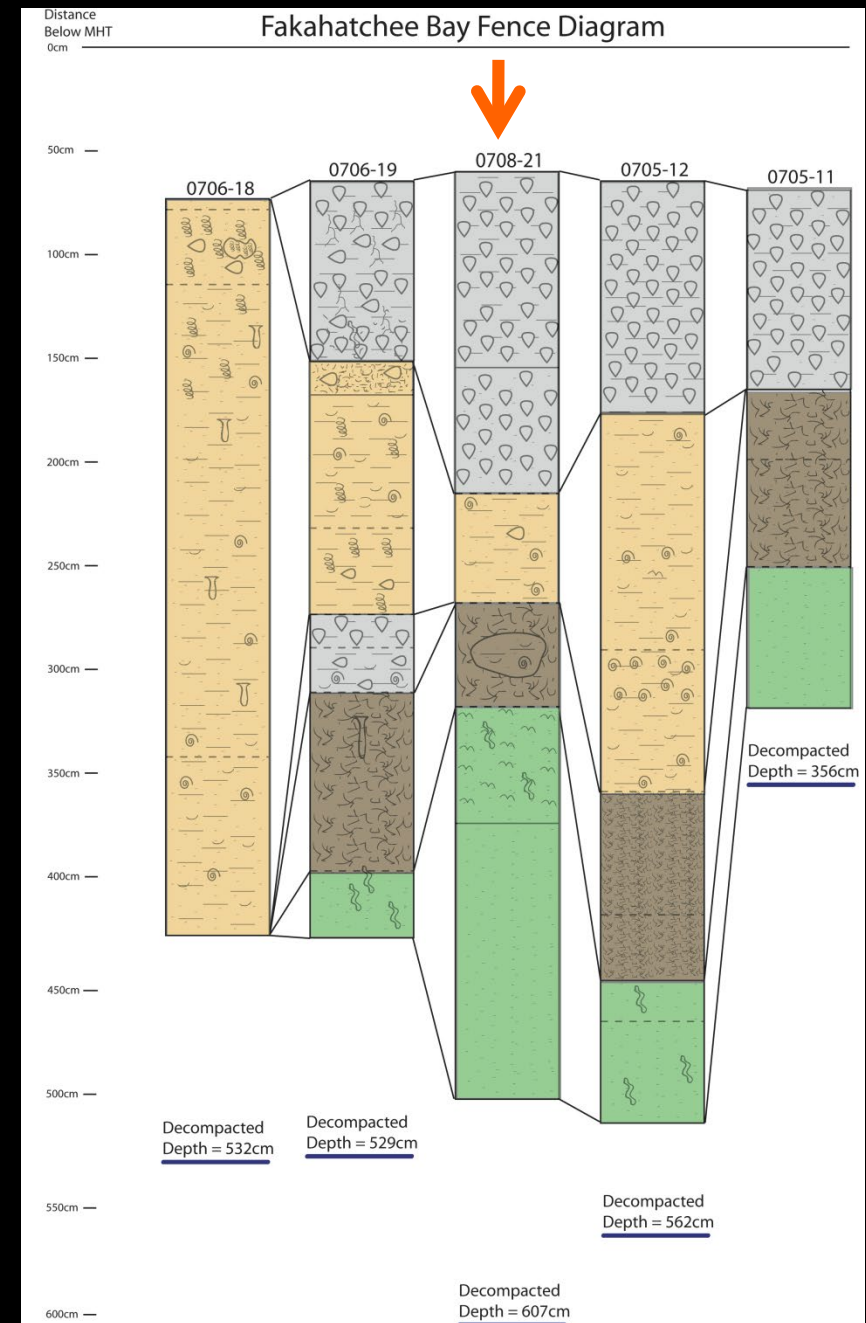
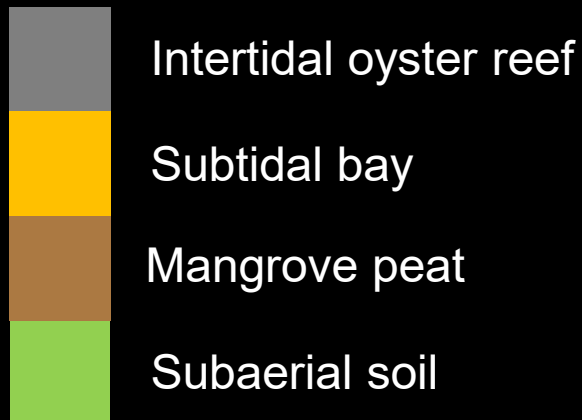
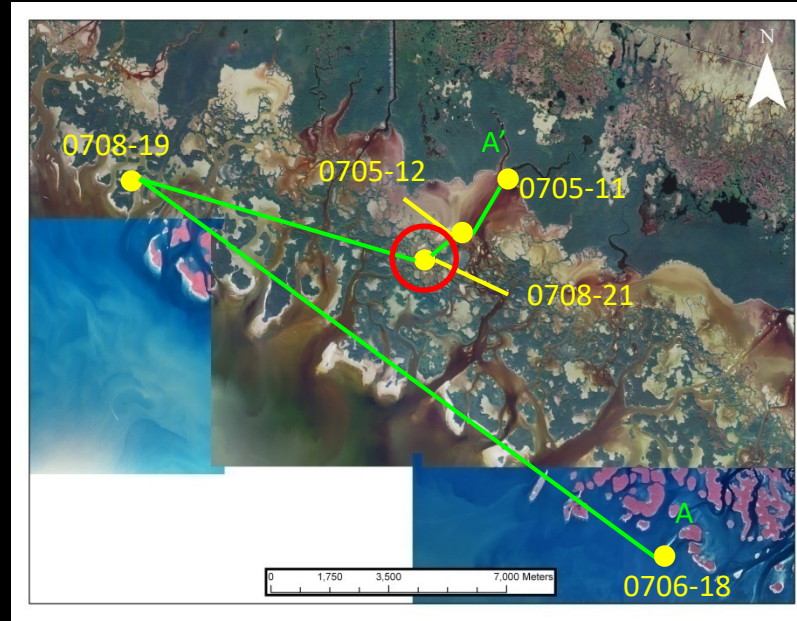
Conclusions

- Pocking (peat collapse) can transform the wetland landscape.
- Expect such a response during times of accelerated SLR.
- Creates a management difficulty: How do you prevent pocking and make the landscape more receptive to mangrove migration?
- Restoring freshwater hydrology can slow or avert the process.

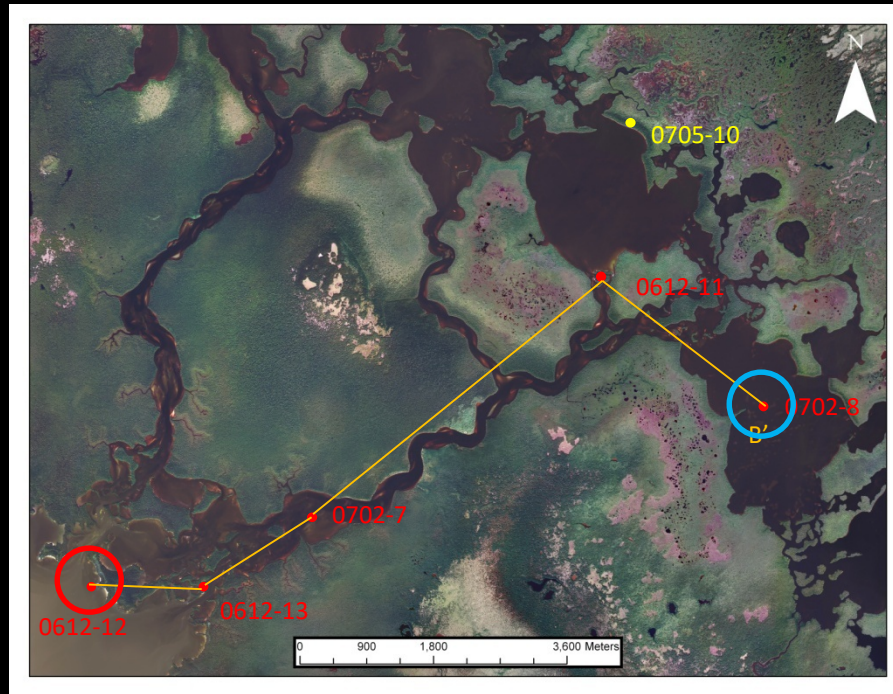
Acknowledgements

- South Florida Water Management District, Ten Thousand Islands National Wildlife Refuge, Fakahatchee Strand Preserve State Park, and Everglades National Park.
- Larry Richardson, Ken Krauss, Rebecca Howard, Andy From, Mike Barry, Jill Schmid, Tim Howard, and Ananta Nath.
- Faculty, staff, and students from Florida Gulf Coast University and its Coastal Watershed Institute.

Fakahatchee Bay Transect



Chatham River Transect



Intertidal oyster reef

Subtidal bay

Mangrove peat

Subaerial soil

- Same phenomena in Broad & Lostman's Rivers.
- Interior bays are degradational.

