Sea-Level Rise Rates, Projections, & Effects in Southern Florida: Connecting Science to Natural and Urban Resource Management

NCER 2018

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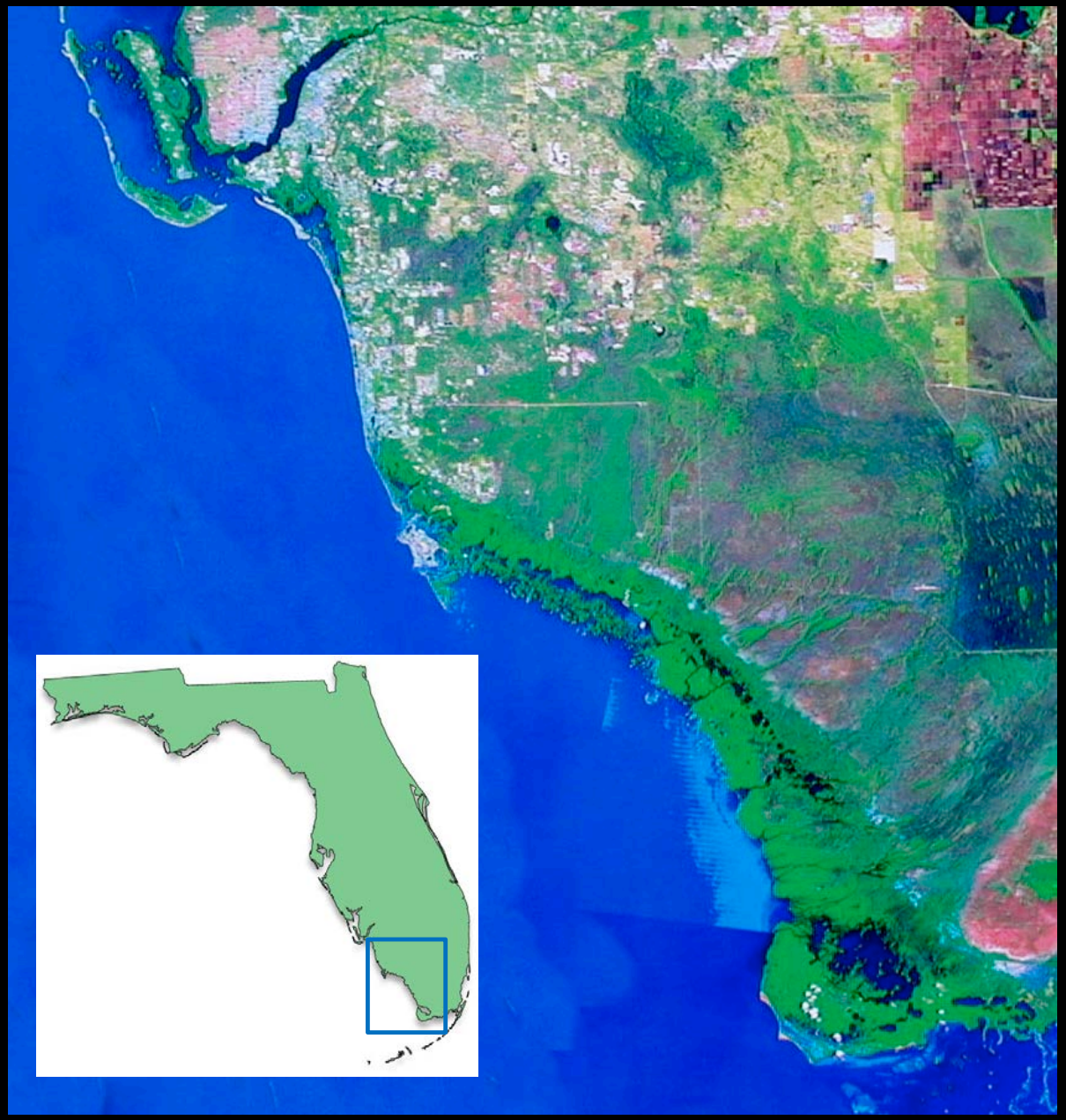
USGS science for a changing world

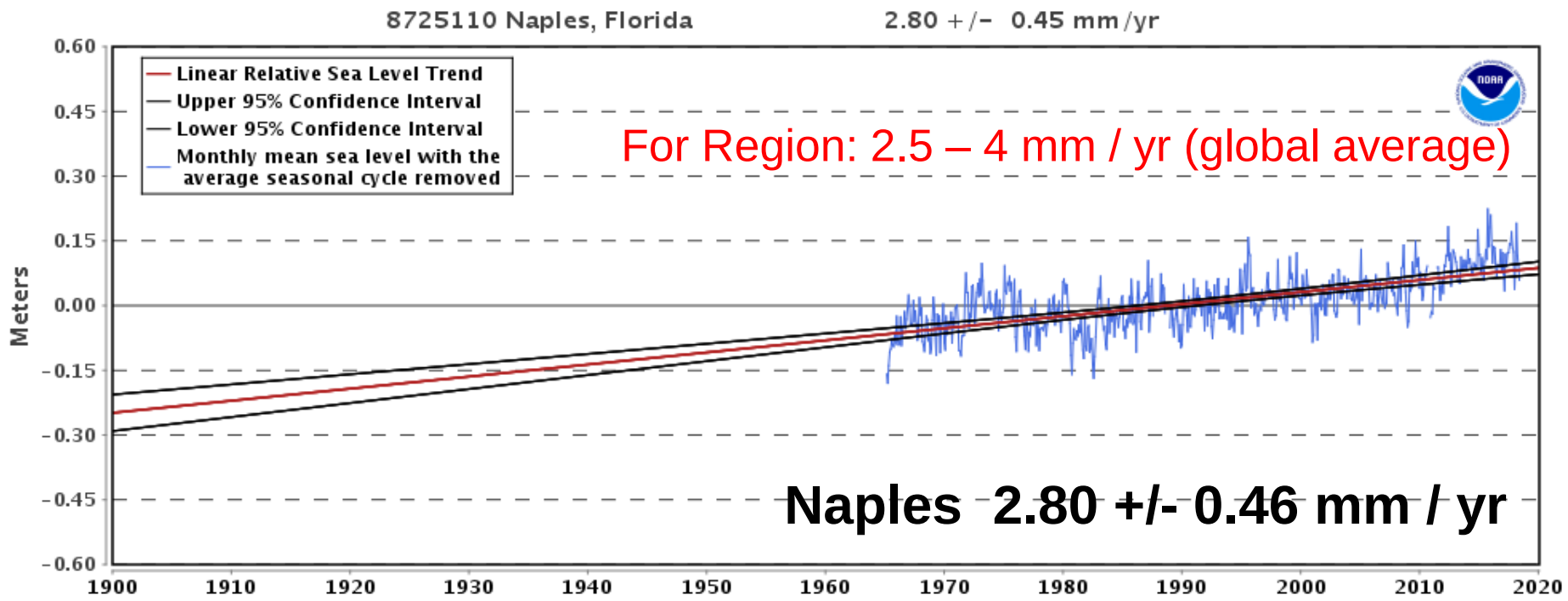
Outline

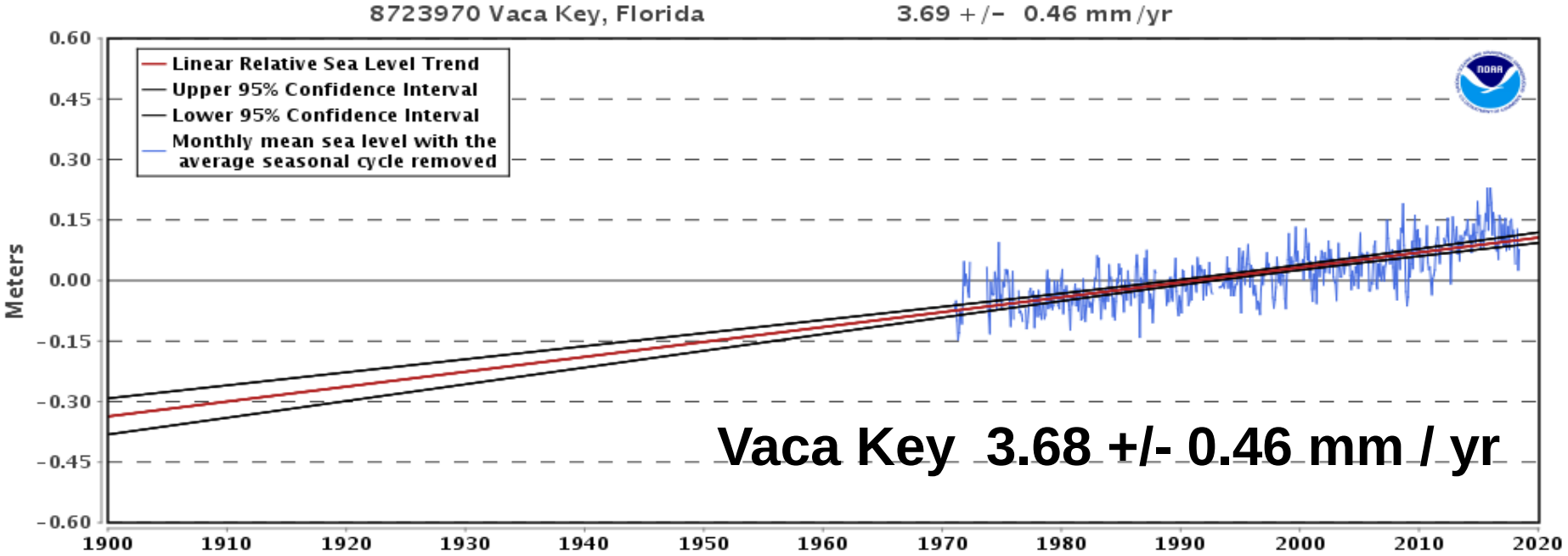
1. SLR impacts to natural & urban landscapes
2. Future projections
3. Science to management in South FL
4. Challenges

Part 1: Impacts in Southwest FL



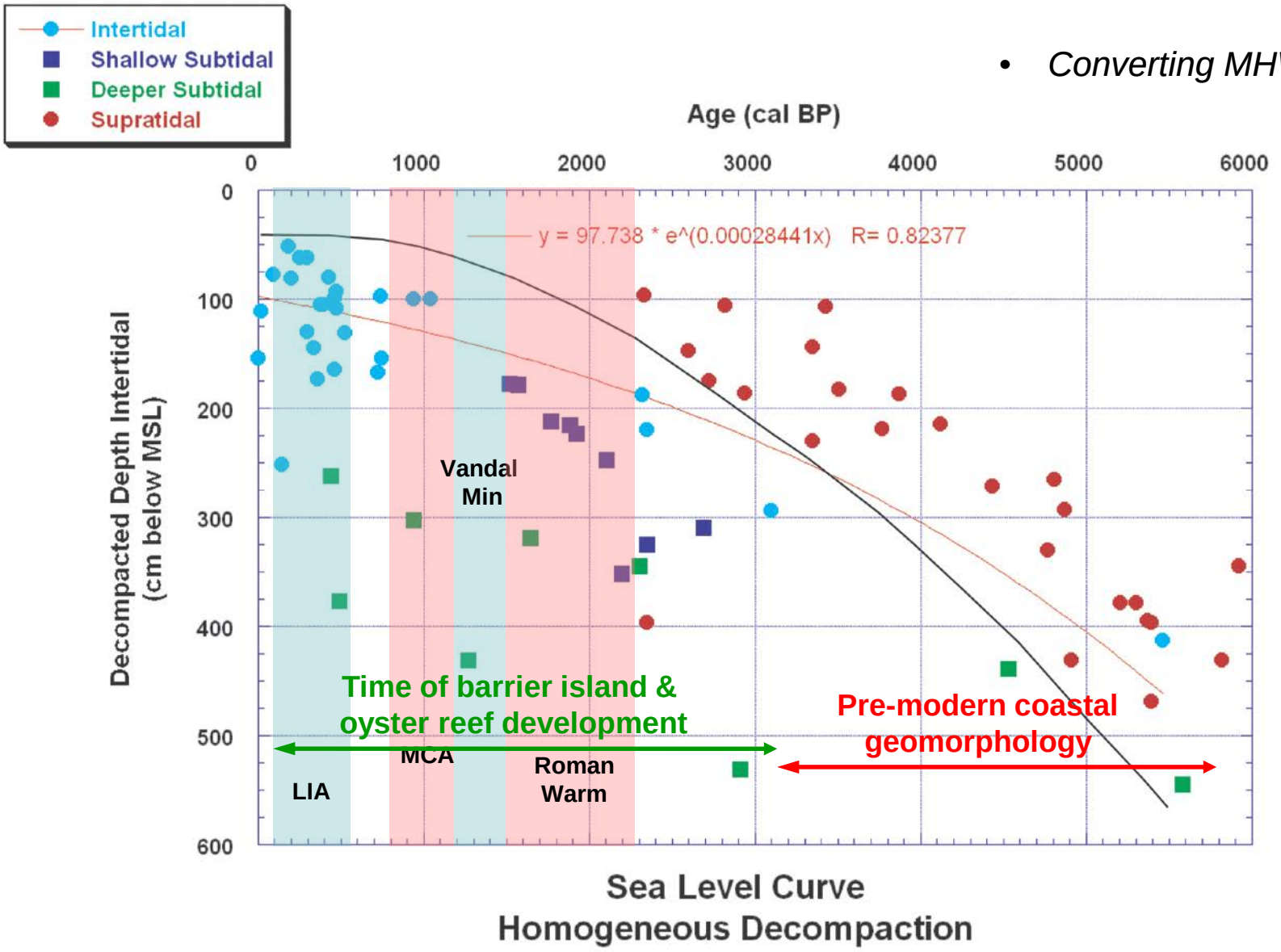
Current SLR Rates: Tide Gauge Data

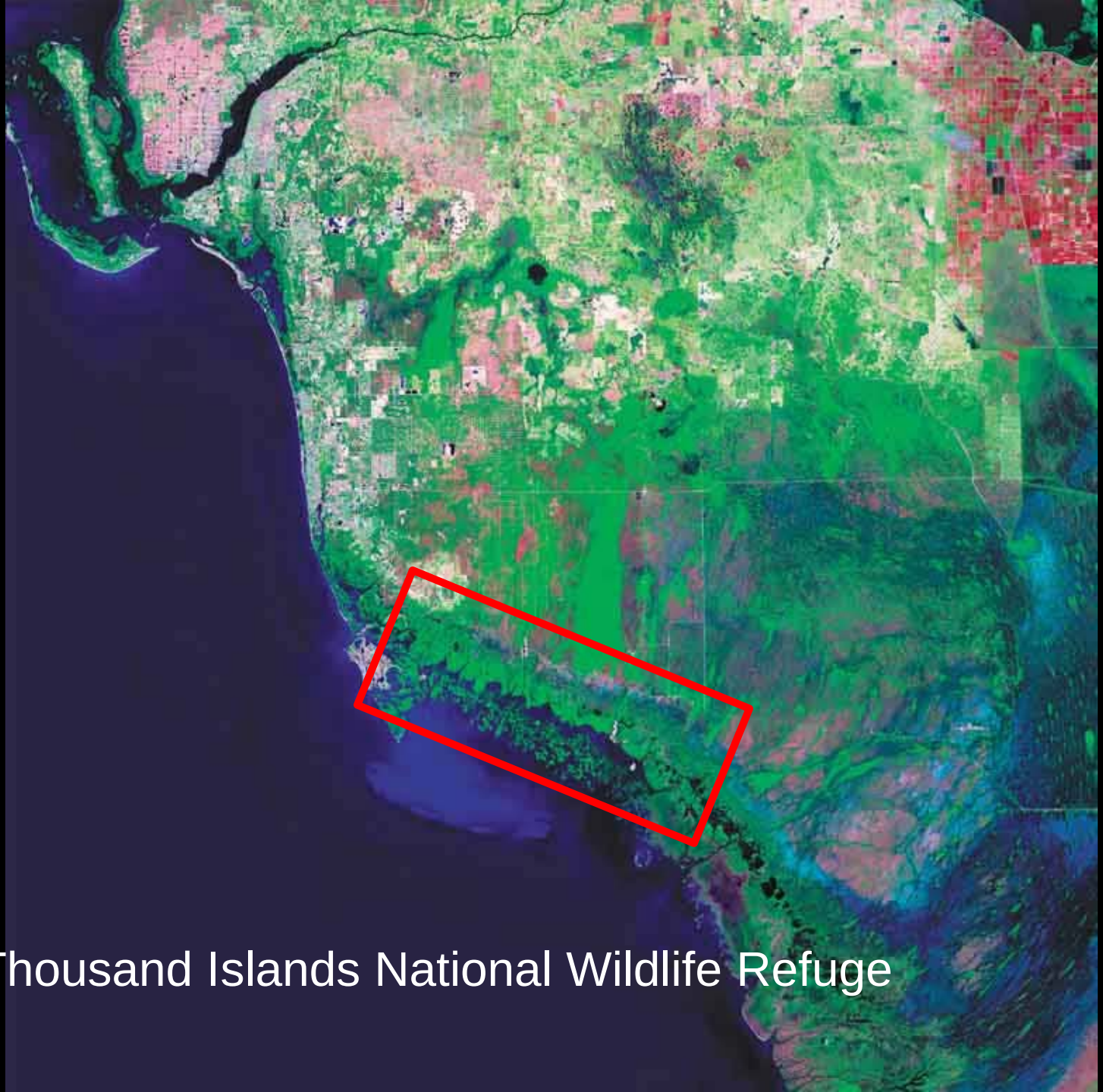

8725110 Naples, Florida
2.80 +/- 0.45 mm/yr
Linear Relative Sea Level Trend
Upper 95% Confidence Interval
Lower 95% Confidence Interval
Monthly mean sea level with the average seasonal cycle removed
For Region: 2.5 – 4 mm / yr (global average)
Meters
0.60
0.45
0.30
0.15
0.00
-0.15
-0.30
-0.45
-0.60
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020
Naples 2.80 +/- 0.46 mm / yr


8723970 Vaca Key, Florida
3.69 +/- 0.46 mm/yr
Linear Relative Sea Level Trend
Upper 95% Confidence Interval
Lower 95% Confidence Interval
Monthly mean sea level with the average seasonal cycle removed
Meters
0.60
0.45
0.30
0.15
0.00
-0.15
-0.30
-0.45
-0.60
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020
Vaca Key 3.68 +/- 0.46 mm / yr

Late Holocene Sea-level Curve: Homogeneous Decompaction Relative to MSL

- *Converting MHW to MSL*

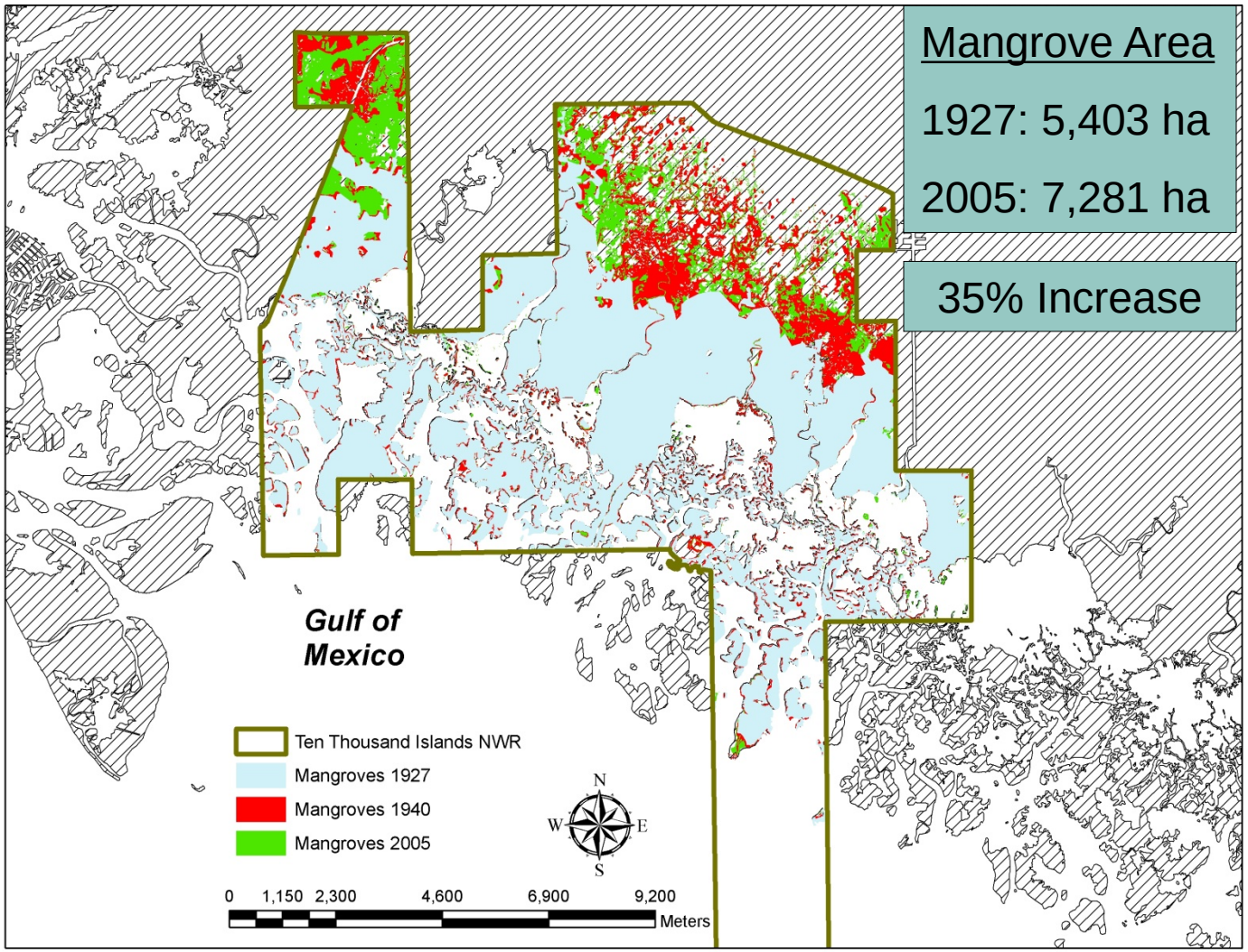




Ten Thousand Islands National Wildlife Refuge

Red Mangroves Invading *Eleocharis* Freshwater Marsh

Ten Thousand Islands NWR



Up-slope migration

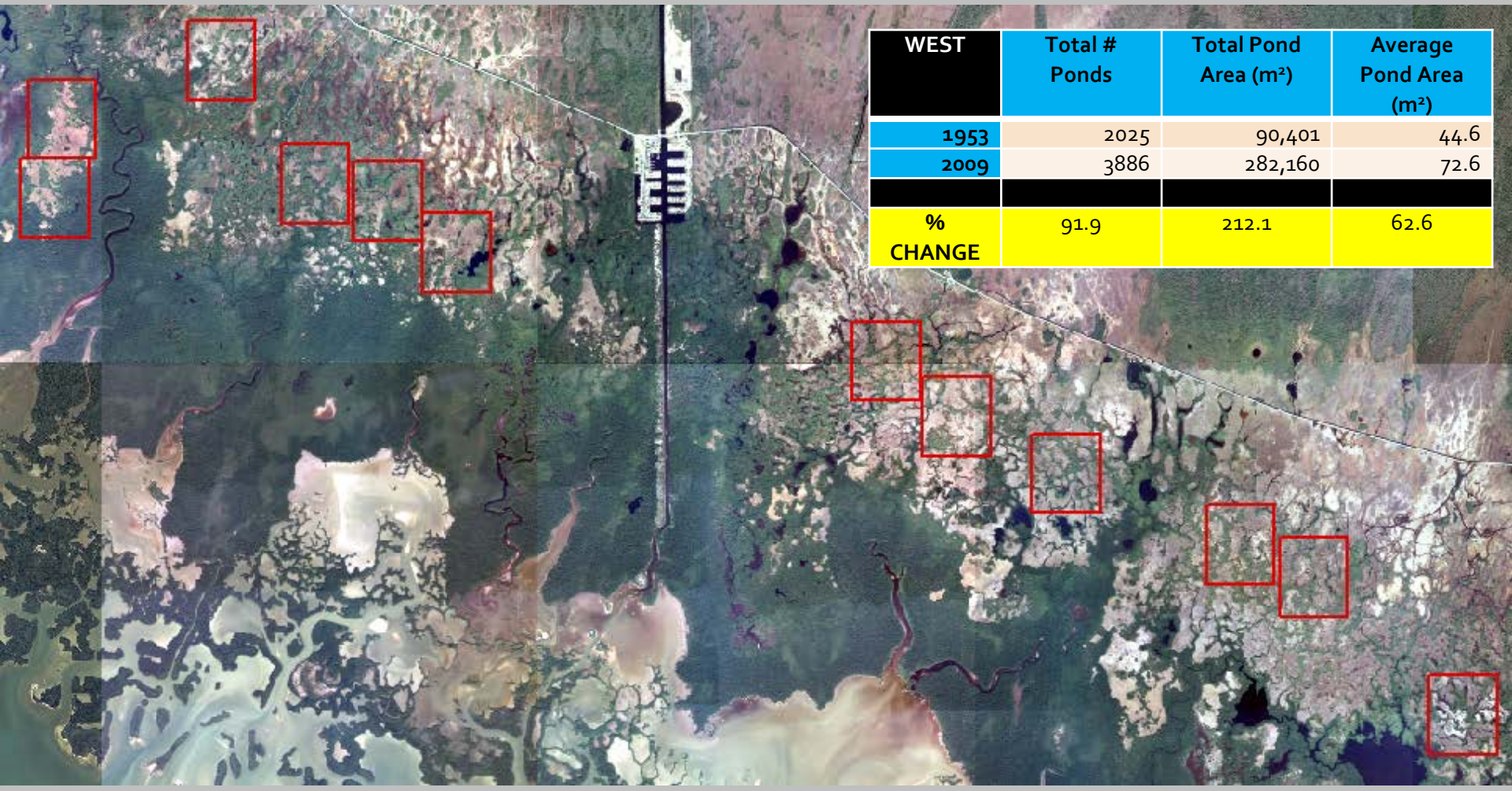
In situ elevation adjustment

Krauss et al. 2011. **J. Coast. Conserv.** 15, 629–638.

Pocking in the Ten Thousand Islands National Wildlife Refuge

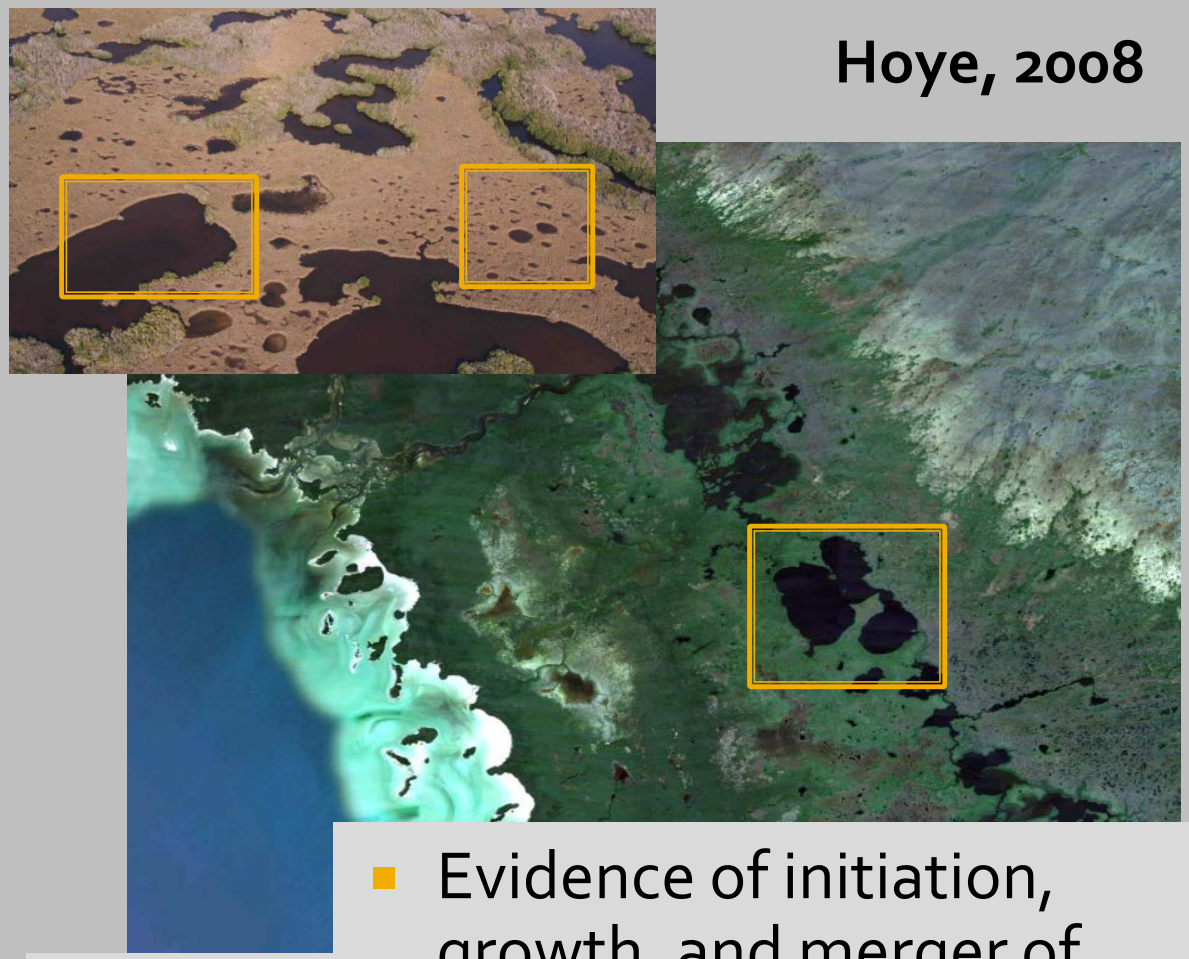
GIS Image Analysis: Tidal Pond Progression over time

Andres & Savarese, 2015



WEST	Total # Ponds	Total Pond Area (m²)	Average Pond Area (m²)
1953	2025	90,401	44.6
2009	3886	282,160	72.6
% CHANGE	91.9	212.1	62.6

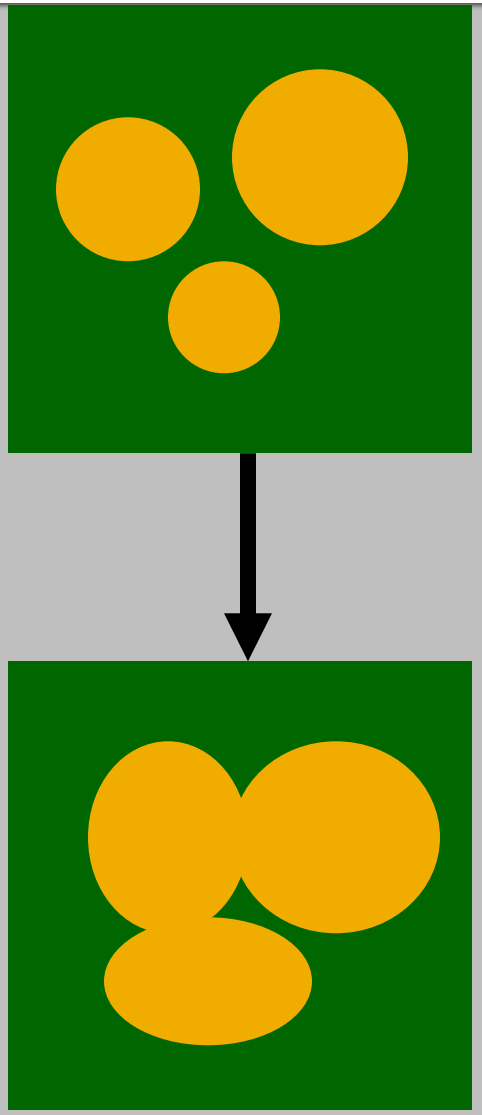
Implications of SLR: Tidal Pond Evolution



Hoye, 2008

Southwest Everglades

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



Effects upon barrier islands

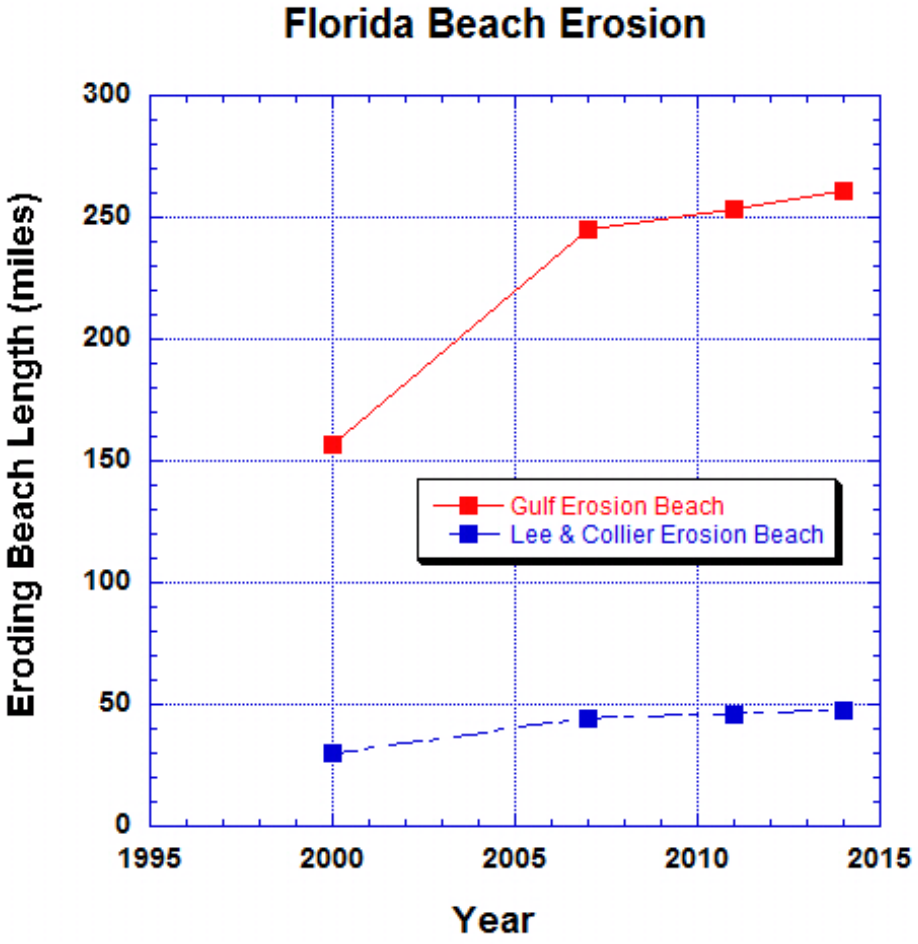
Saltern Formation
Rookery Bay NERR

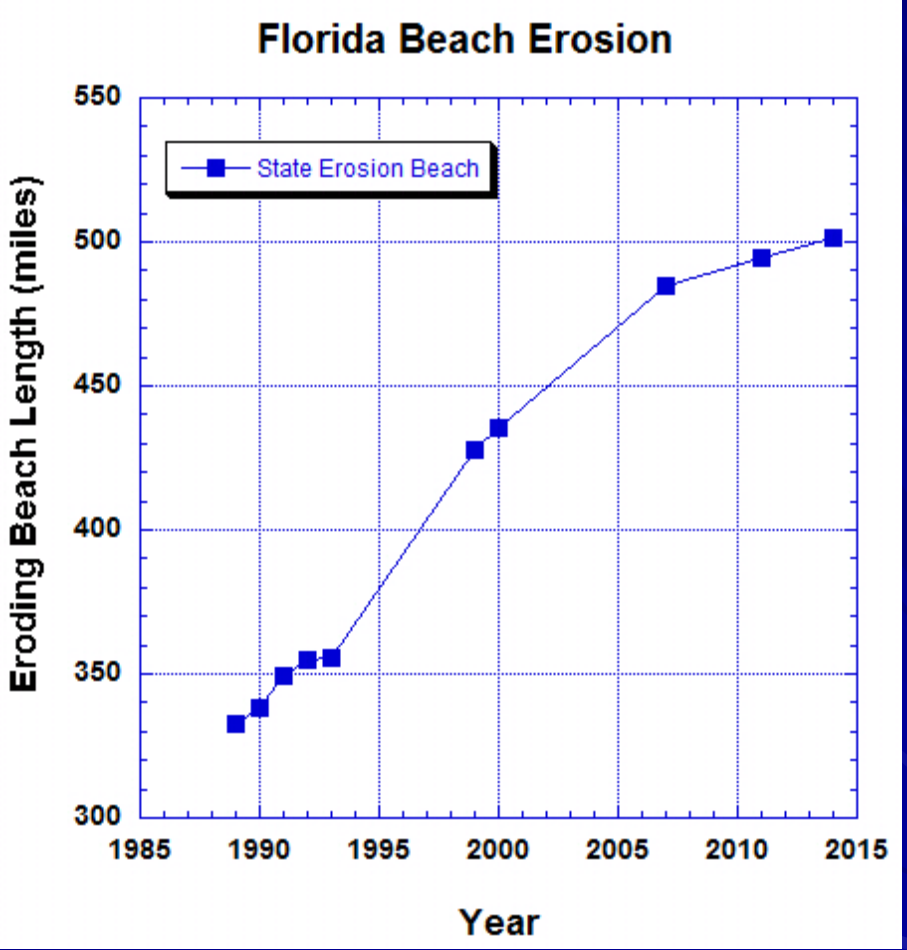
Barrier Island Instability, Erosion, and Migration

Back-barrier Mangroves on Beach
Keewaydin Island

Erosional Dune Scarp After Debby
Keewaydin Island

Trends in Florida's Beach Erosion



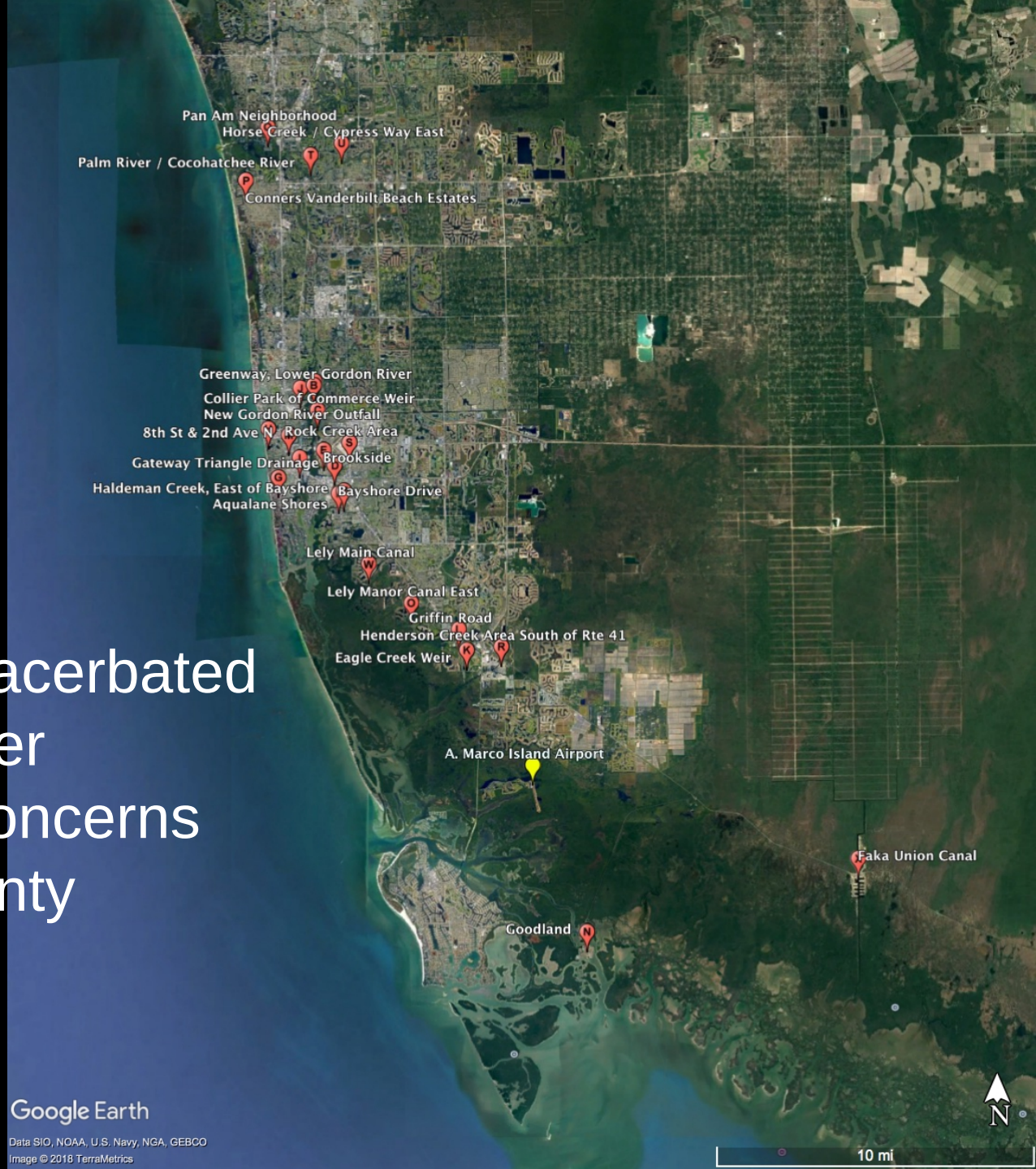


Data from DEP's Critically Eroded Beaches and FL Assessment of Coastal Trends reports

Sunny Day Tidal Flooding: Marco Island

Sunny Day Tidal Flooding: Miami

Prioritized SLR Exacerbated Storm Water Management Concerns Collier County



Part 2: Future Projections

SLR Projections Used By Collier County

Period	RCP	SLR (ft)*		
		Low	Medium	High
Current	---	---	---	---
2030	4.5	0	0.5	1
2060	4.5	0.5	1.5	2.5
2100	4.5	1	3	6.6
2100	8.5	1	3	6.6

Based on NOAA estimates (2012, 2014, 2017)

SLR Projections Used By SE FL Regional Climate Change Compact

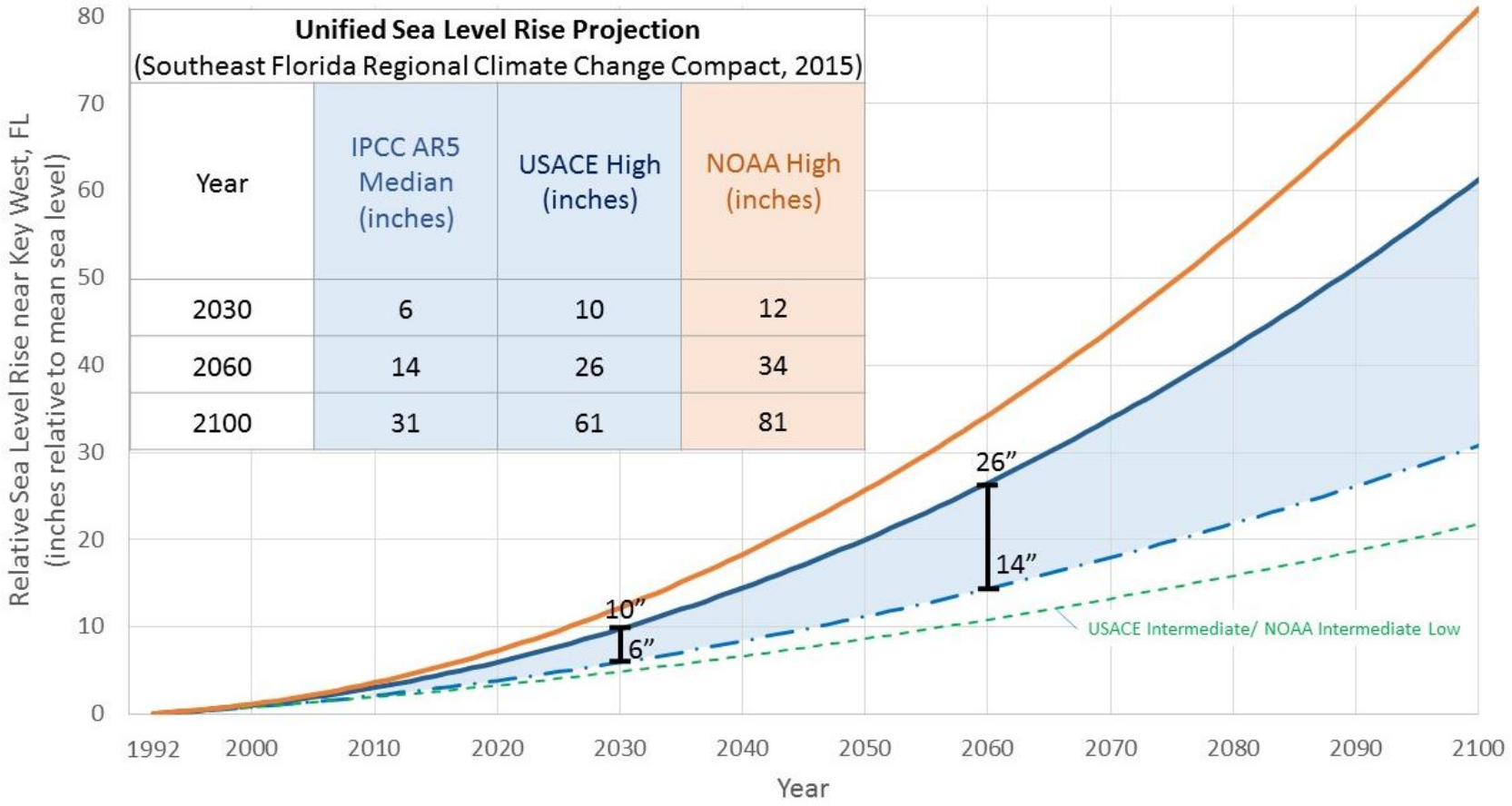
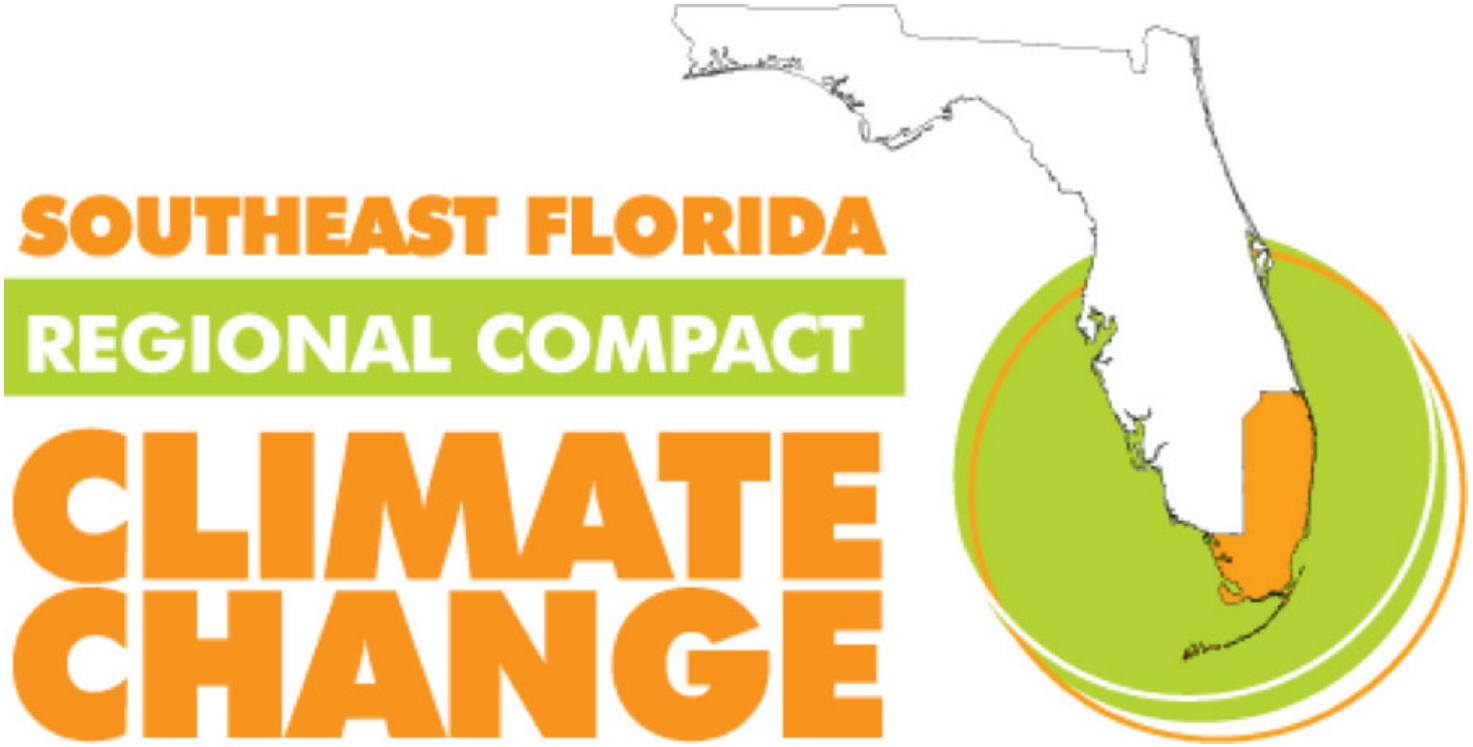


Figure 1: Unified Sea Level Rise Projection. These projections are referenced to mean sea level at the Key West tide gauge. The projection includes three global curves adapted for regional application: the median of the IPCC AR5 RCP8.5 scenario as the lowest boundary (blue dashed curve), the USACE High curve as the upper boundary for the short term for use until 2060 (solid blue line), and the NOAA High curve as the uppermost boundary for medium and long term use (orange solid curve). The incorporated table lists the projection values at years 2030, 2060 and 2100. The USACE Intermediate or NOAA Intermediate Low curve is displayed on the figure for reference (green dashed curve). This scenario would require significant reductions in greenhouse gas emissions in order to be plausible and does not reflect current emissions trends.

Part 3:
Science to Management

Southeast Florida's Science to Management Efforts:

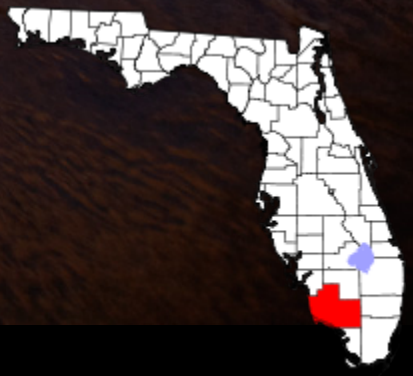


- 4 counties (Monroe, Miami-Dade, Broward, & Palm Beach Counties) + 100 cities
- Group has / is addressing vulnerability, adaptation, and mitigation
- Produced a Regional Climate Action Plan: to reduce greenhouse emissions & build climate resilience
- www.southeastfloridaclimatecompact.org

Southwest Florida's Science to Management Efforts

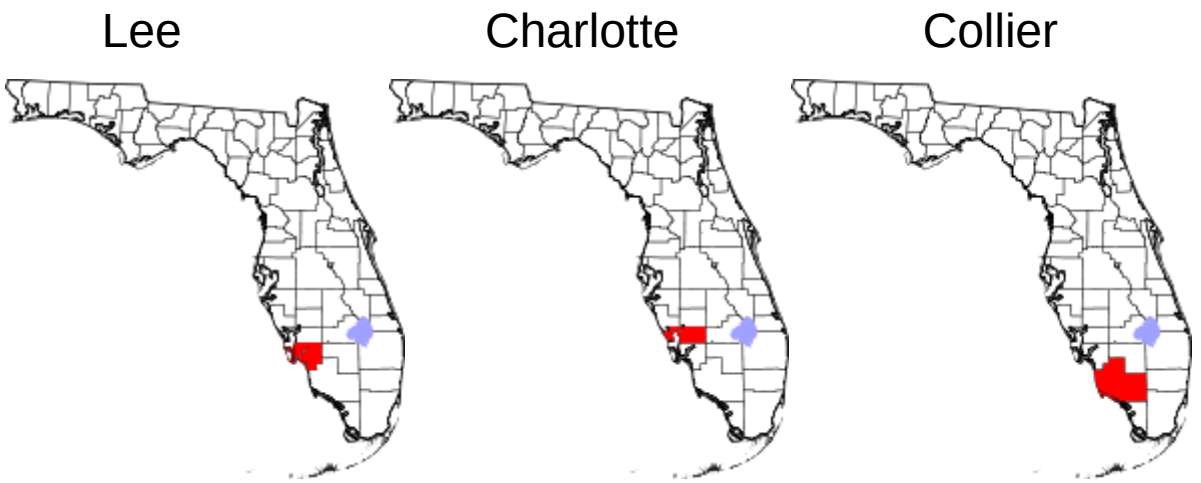
Alliance for Collier's Coastal Resilience

- Collier County + 3 municipalities
- End users are urban, cultural, and natural resource managers
- NOAA-NCCOS funded effort to conduct a vulnerability analysis
- SLR + effects of storms
- To be followed by adaptation planning
- No mitigation component at this point
- www.fgcu.edu/accr/



Greater Southwest Florida's Efforts

- Conversations begun with Lee and Charlotte Counties.
- Develop a 3-county Compact with Collier.



Part 4: Challenges

Challenges for Our Decision Makers

- What SLR rate and magnitude to expect?
- We are transitioning to a transgressive coastal system.
- Integrating / compromising outcomes for both the natural and urban landscapes.
- How to avoid ”avoidance” behavior?
- How to avoid having a vulnerability study just sit on the shelf?
- How do you get beyond adaptation to mitigation? Mitigation is critical.

Thanks . . .