Disturbance and mangrove expansion in the Southeast Saline Everglades

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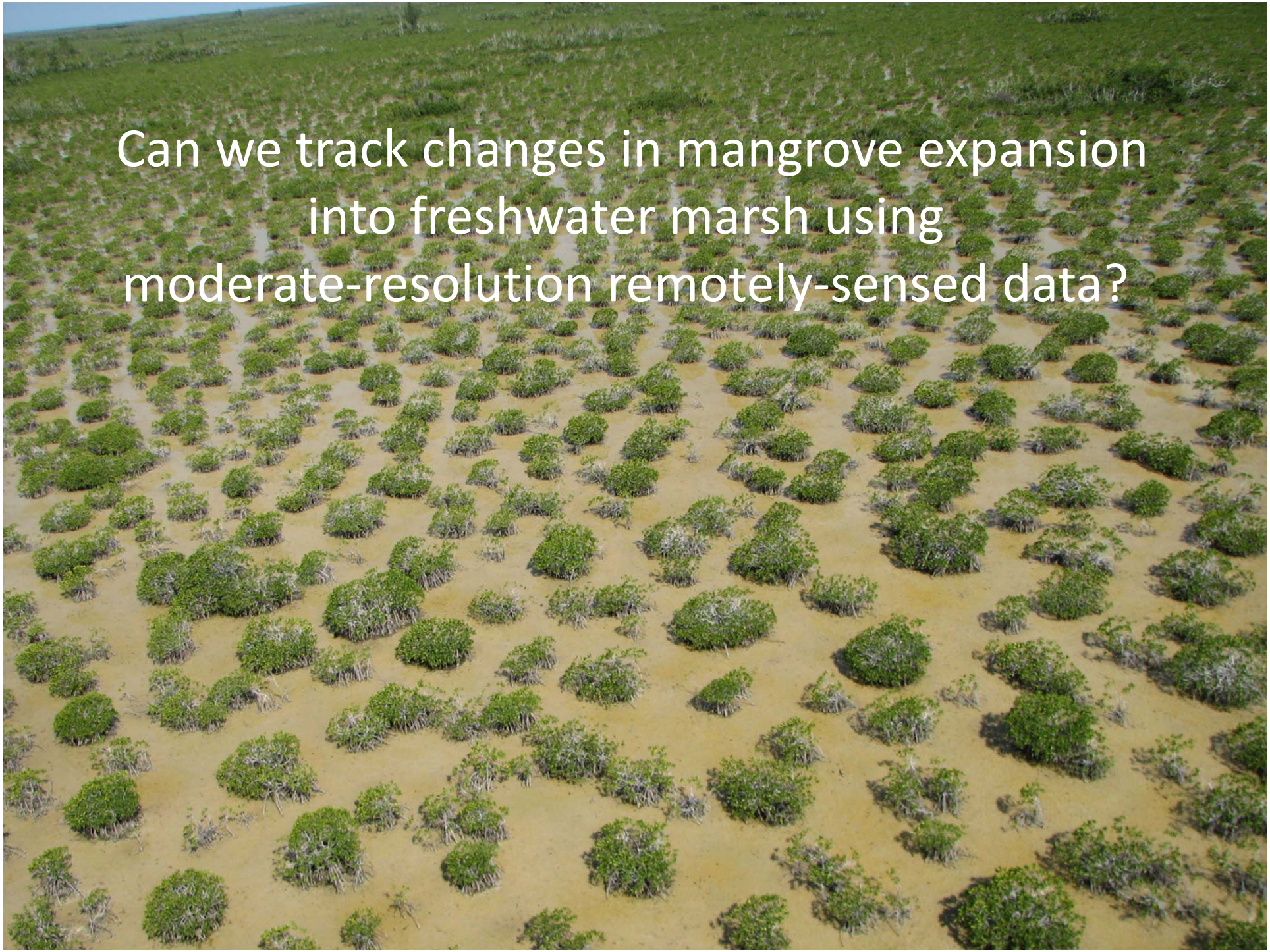
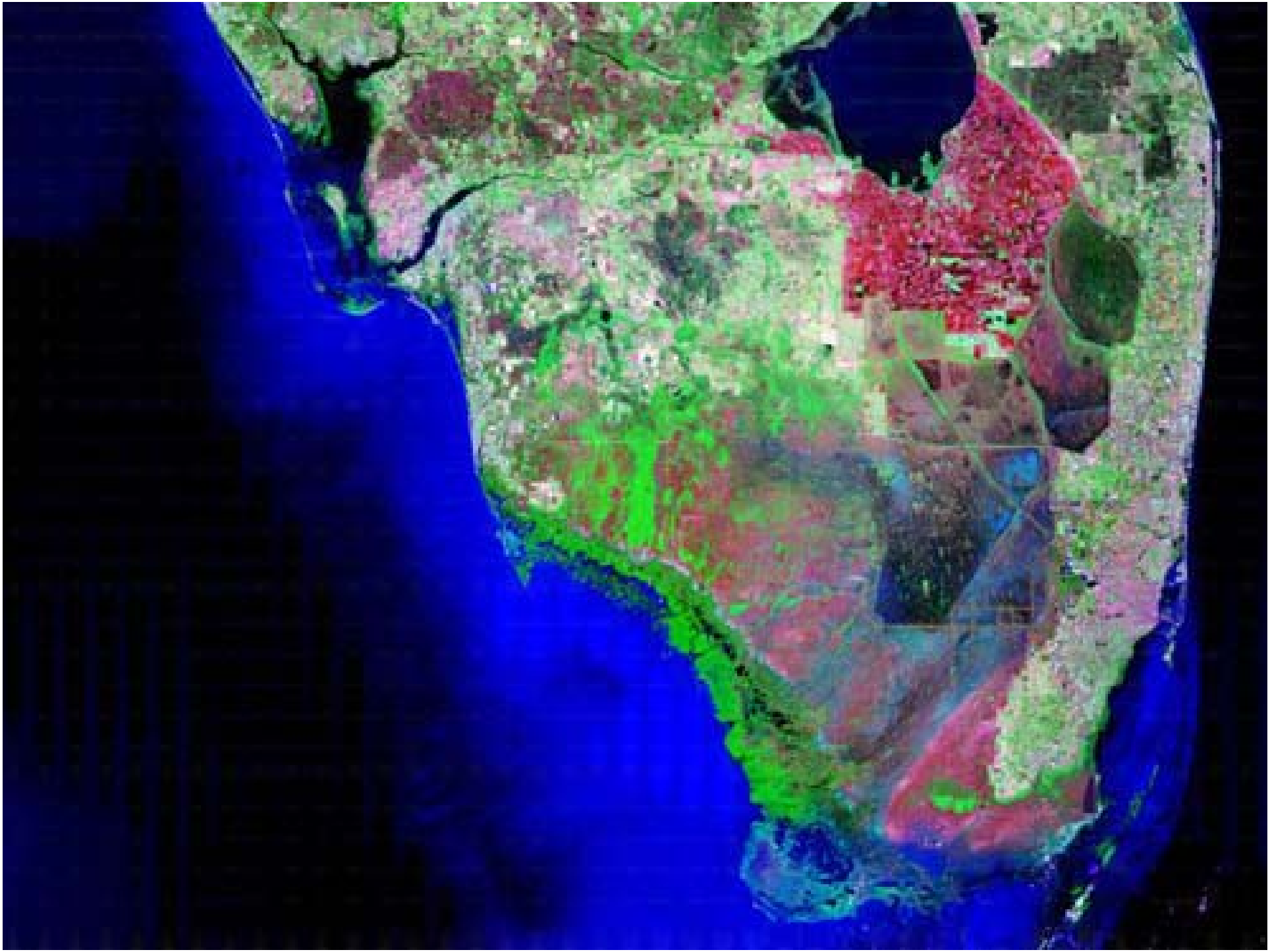
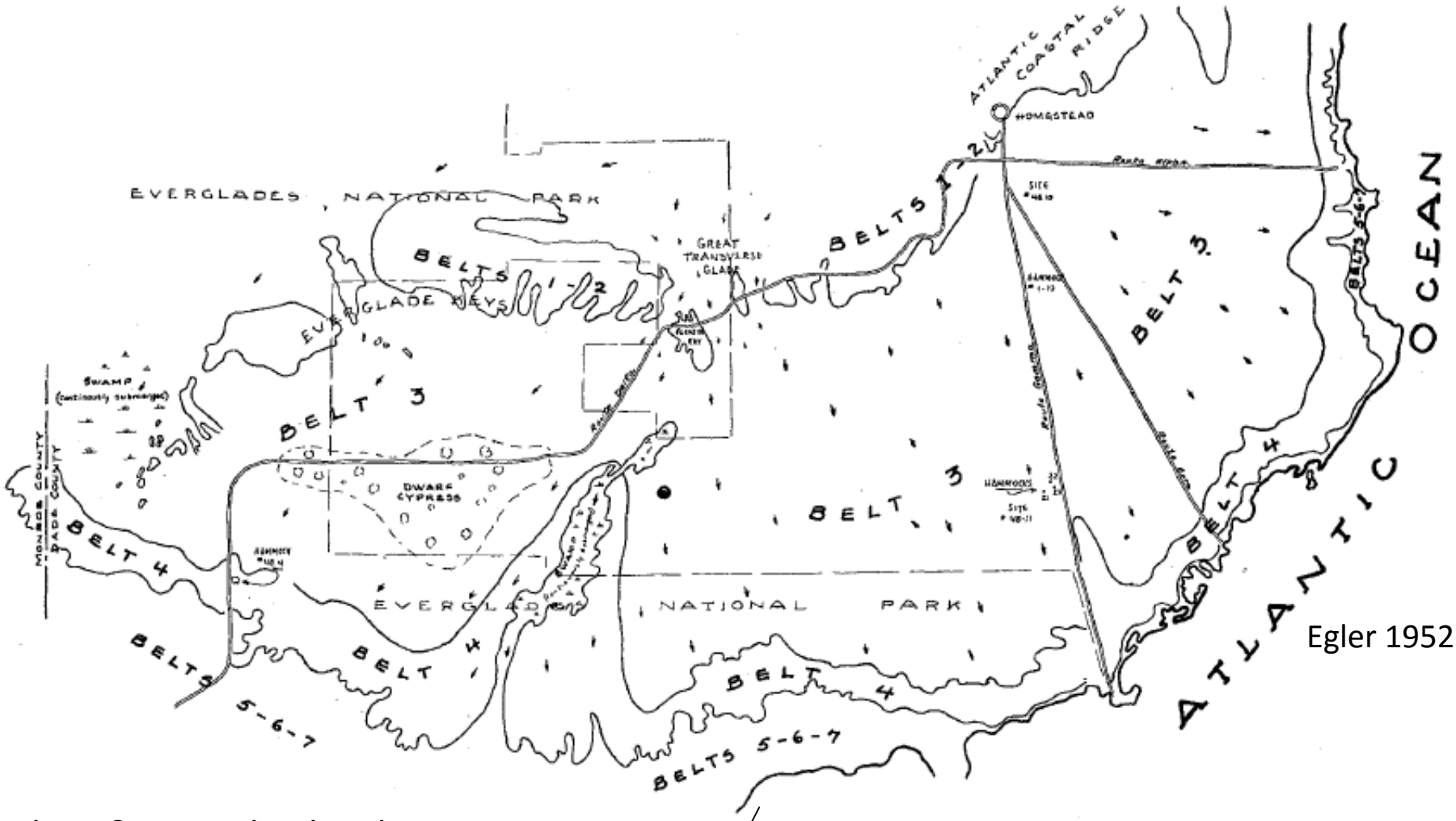

Can we track changes in mangrove expansion into freshwater marsh using moderate-resolution remotely-sensed data?



Southeast Saline Everglades (SESE)



Egler 1952

Belts 1 & 2: Pineland and prairie
Belt 3: Sawgrass
Belt 4: Dwarf mangroves, sparse graminoids
Belts 5, 6, & 7: Mangroves

Low productivity zone at lower end of high marsh.
Infrequently inundated: variable conditions, low nutrient supply (Carter 1988)

Species of Zones 3 and 4

<u>Mangrove Species:</u>

Avicennia germinans

Laguncularia racemosa

Rhizophora mangle

<u>Graminoids:</u>

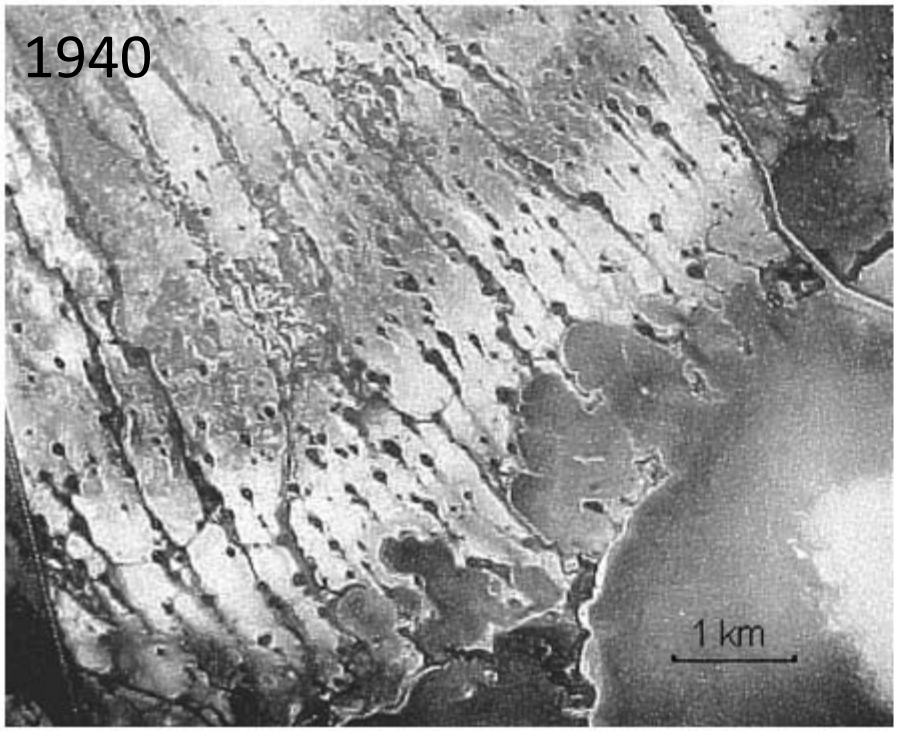
Cladium jamaicense

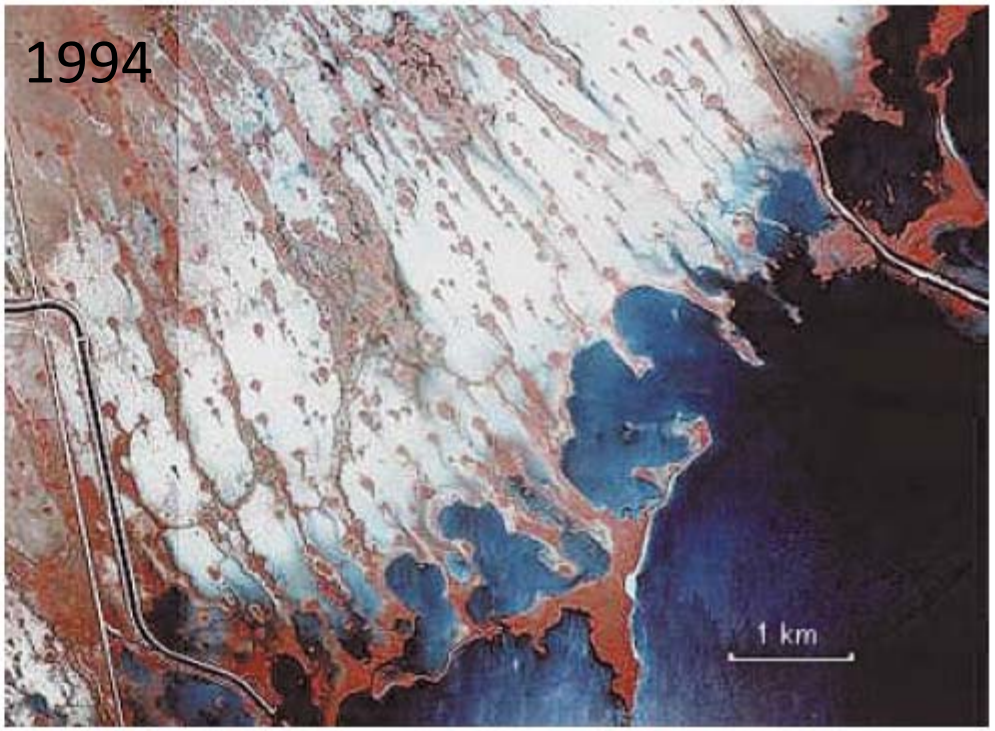
Eleocharis cellulosa

Distichlis spicata

Juncus roemarianus

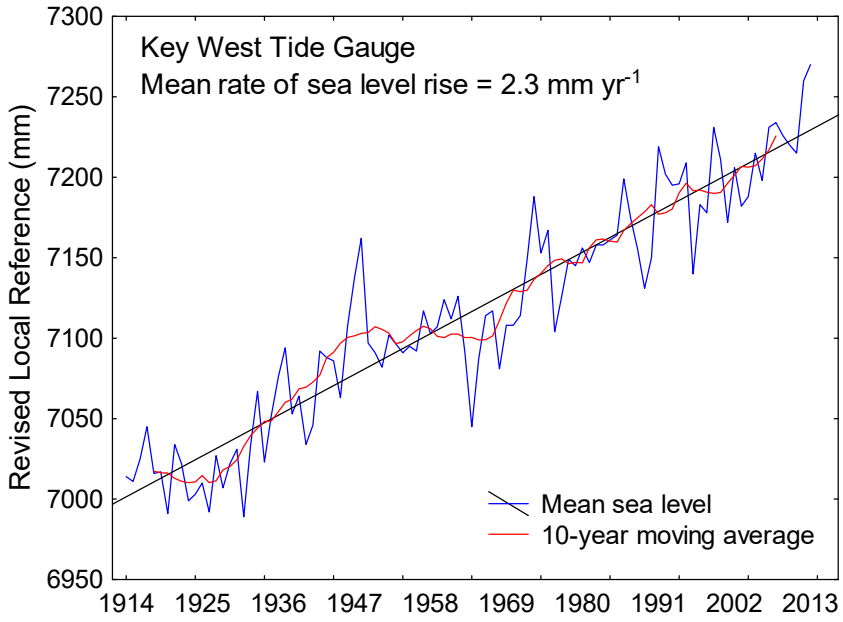
Landward movement of the ‘white zone’

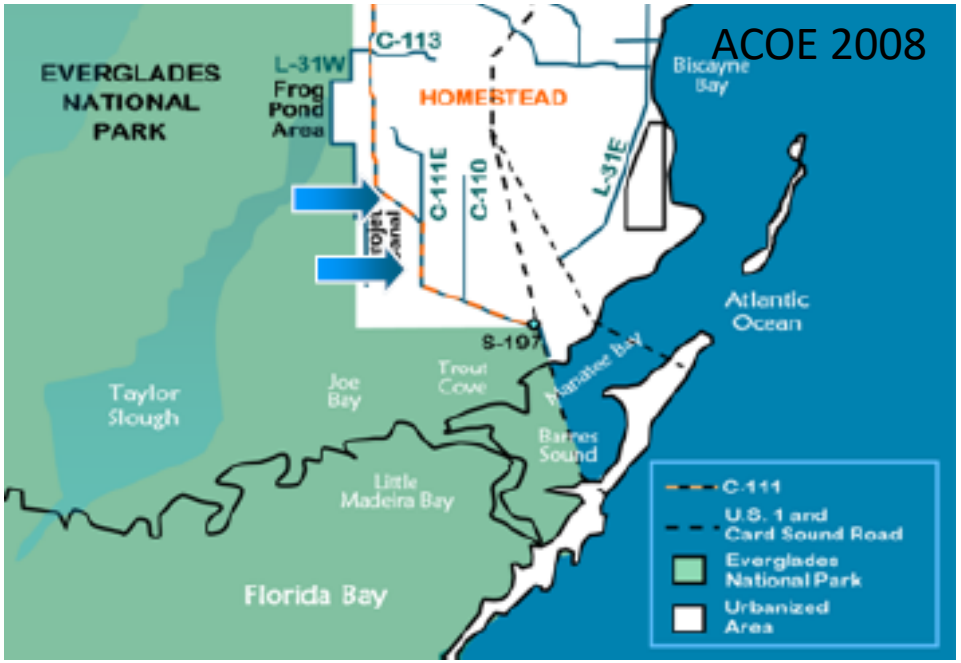




Ross et al. 2000

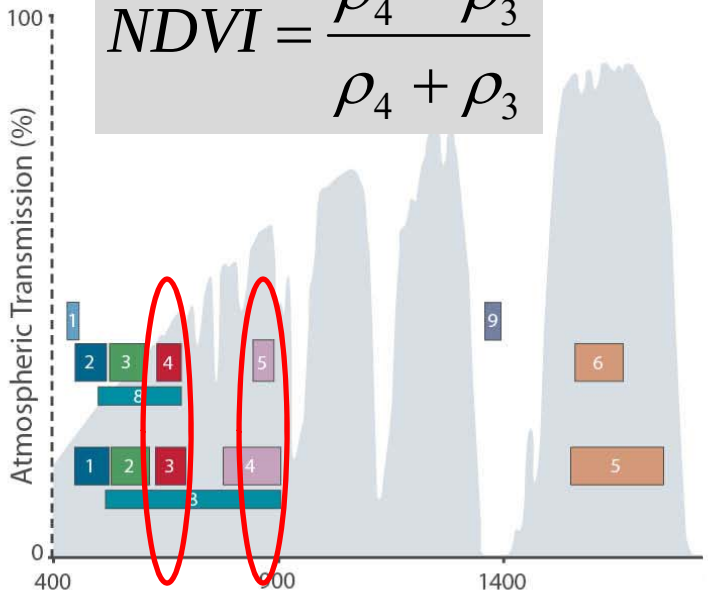
The Interaction of disturbance and freshwater availability



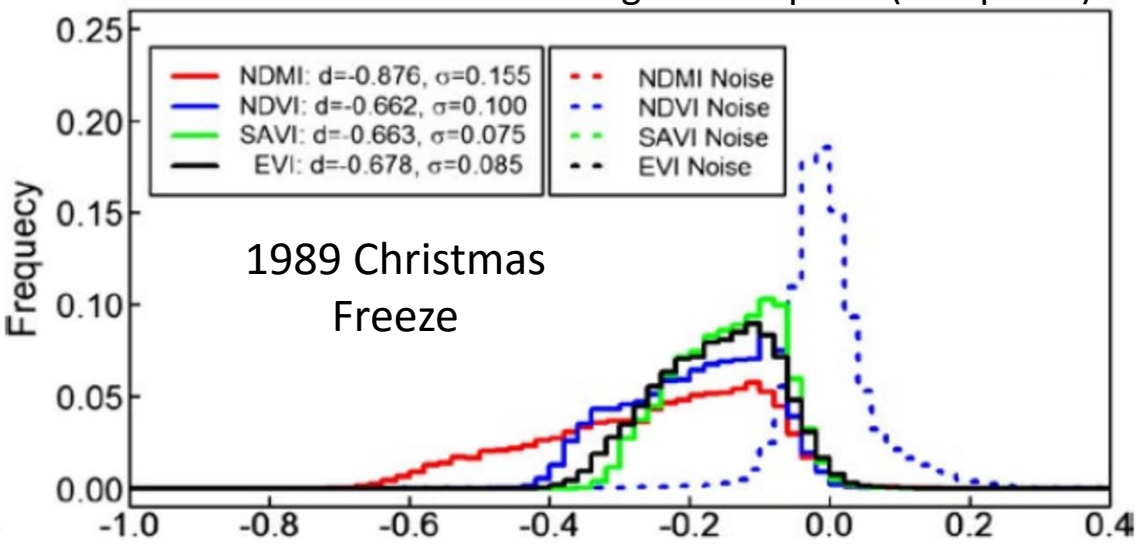


Spectral reflectance & plant physiology

$$NDVI = \frac{\rho_4 - \rho_3}{\rho_4 + \rho_3}$$

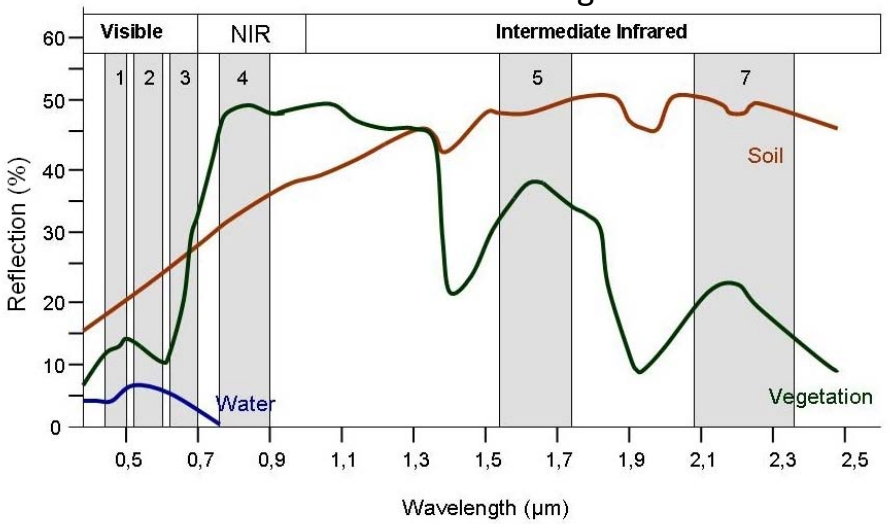


Zhang et al. in press (Ecosphere)



Landsat bands & wavelengths (um)	Plant Physiology/Forest Structure
Red 0.63 – 0.69	Photosynthetic activity
NIR 0.76 – 0.90	Canopy/biomass
SWIR 1.55 – 1.75	Leaf moisture content

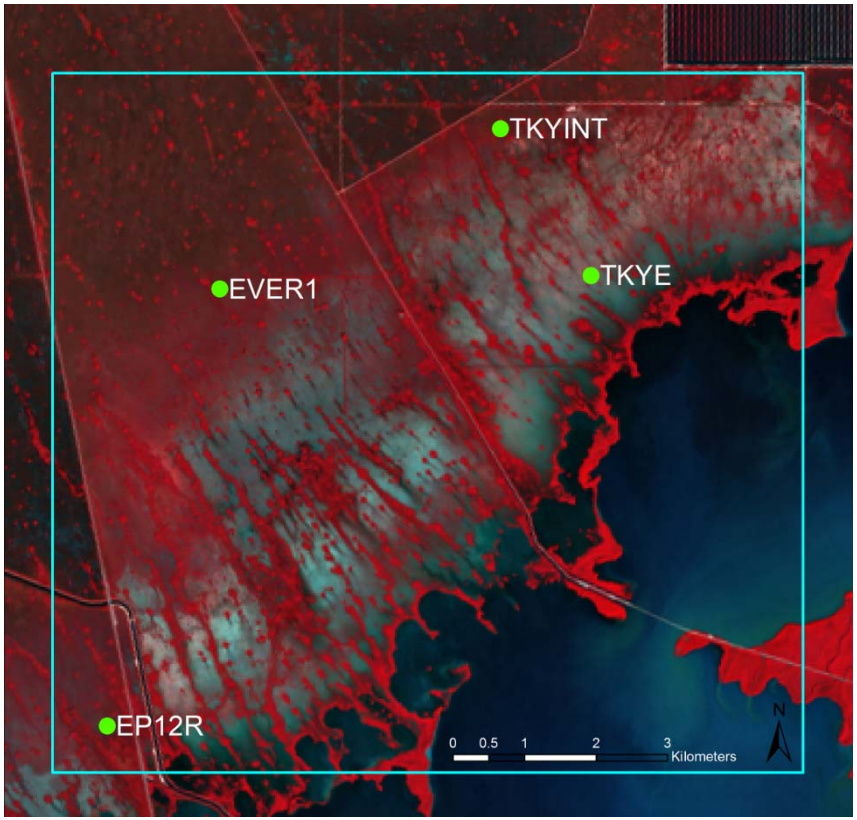
Siegmund & Menz 2005

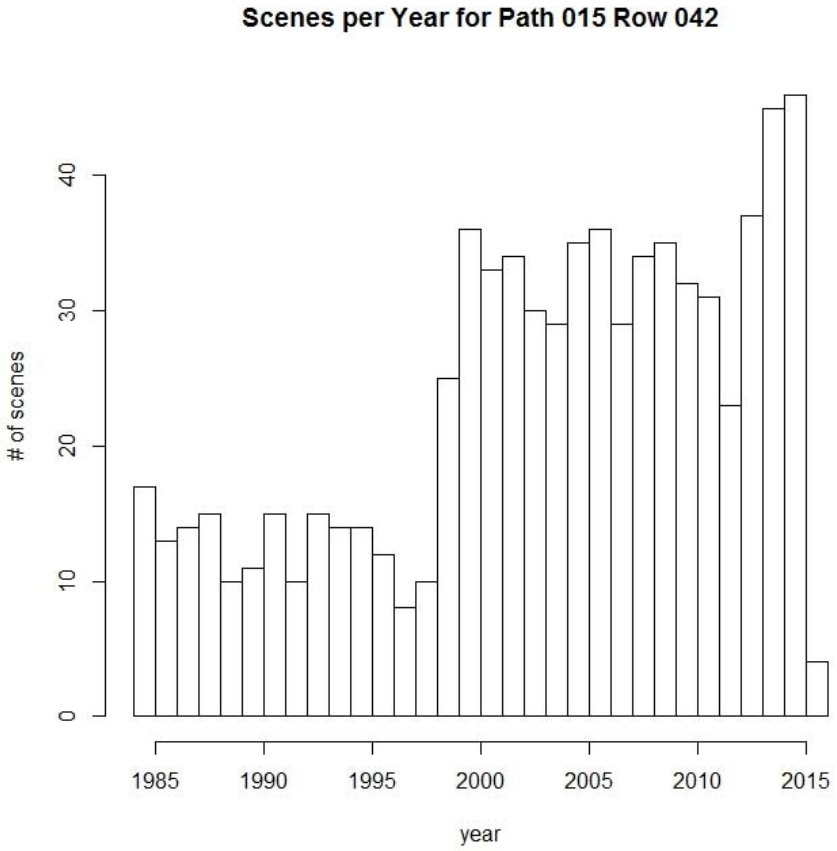


Field and Remote Sensing Methodology

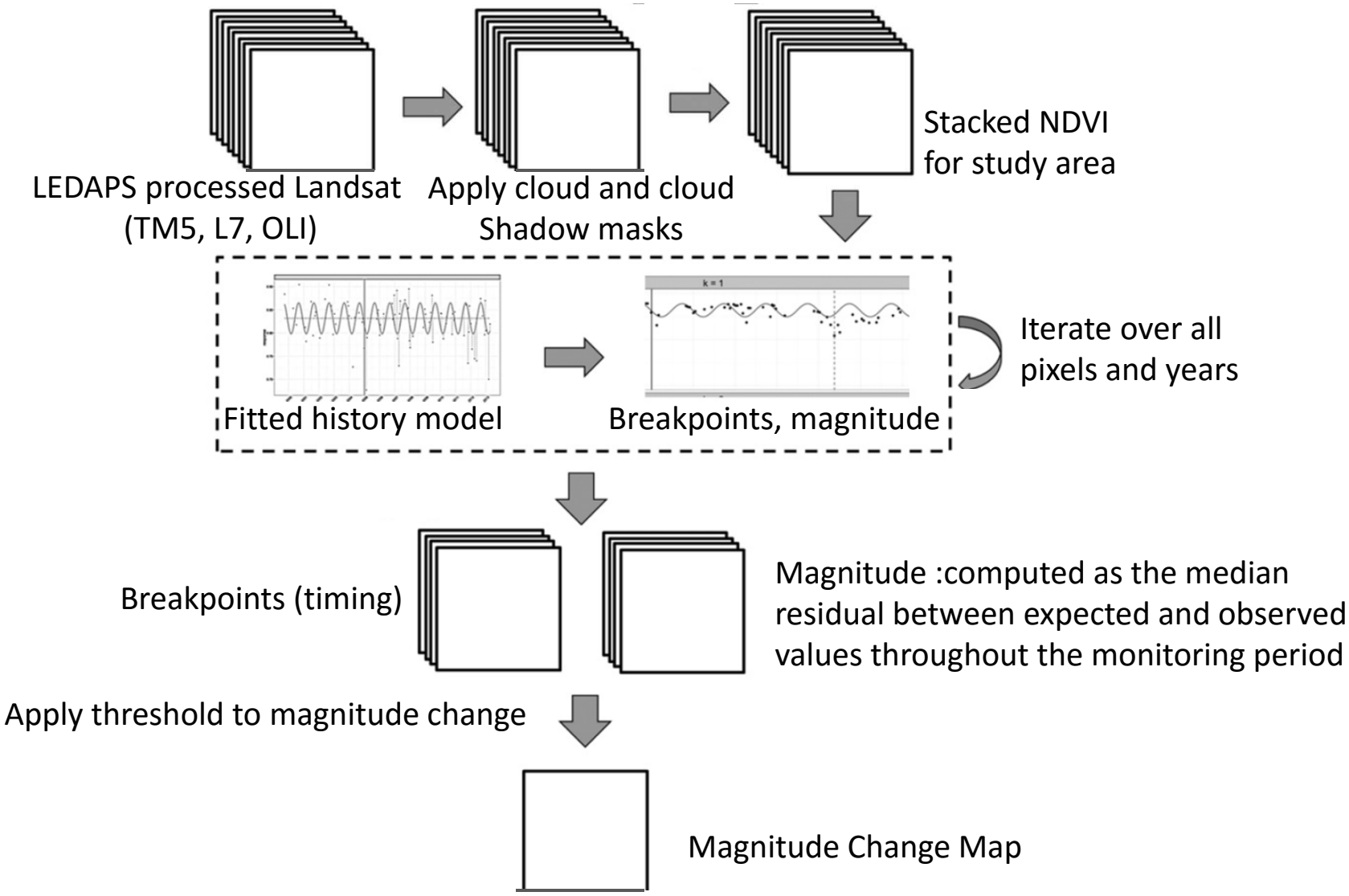
- Vegetation composition sampling in 1996 and 2016 (30 1m^2 subplots per site); relative abundance values reported
- Temporal sequence (1984 to 2016) of Landsat Surface Reflectance with LEDAPS atmospheric correction obtained from USGS (http://earthexplorer.usgs.gov/)
- bfastSpatial package in R (*Loïc Dutrieux, Ben DeVries and Jan Verbesselt*, 2014, *https://github.com/dutri001/bfastSpatial*)

Study Area



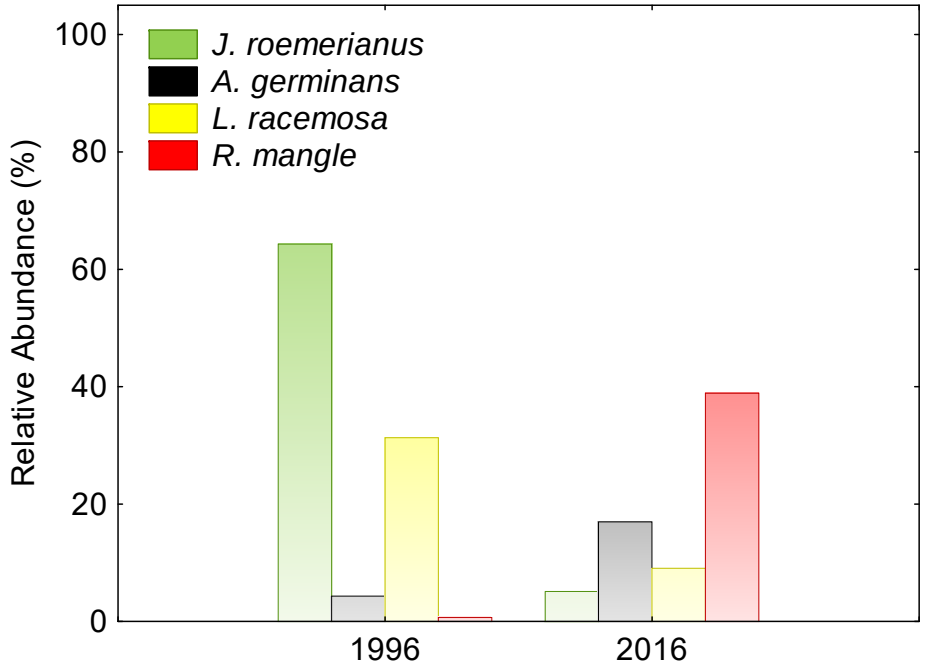


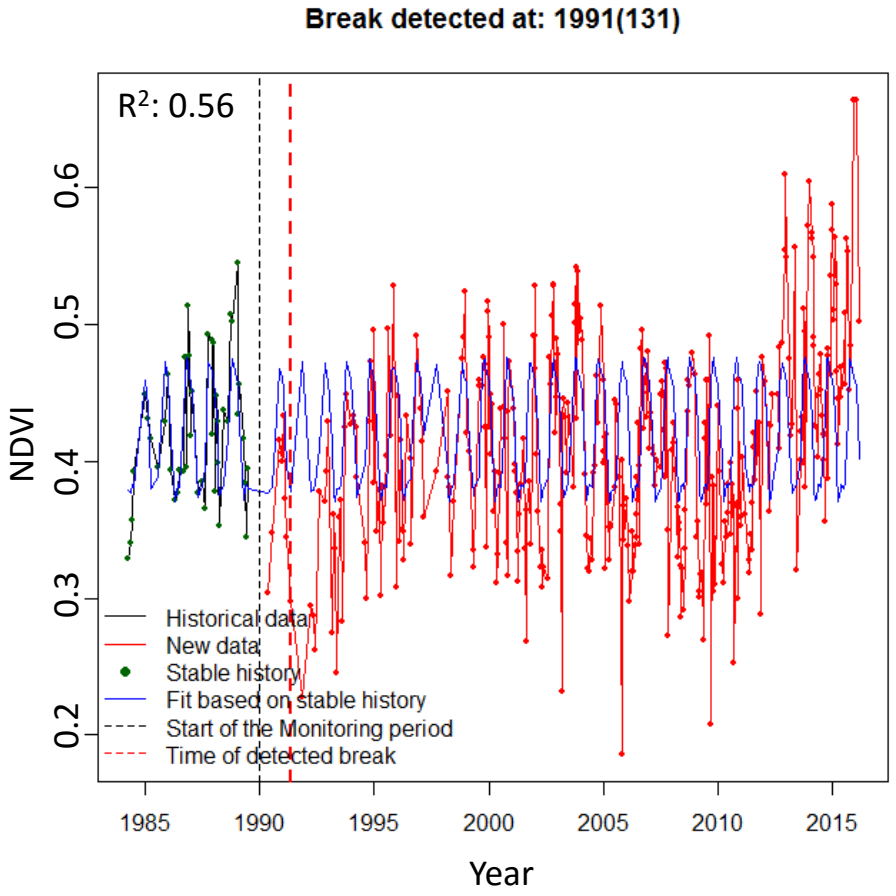
Bfast Spatial Flowchart (after DeVries et al. 2015)

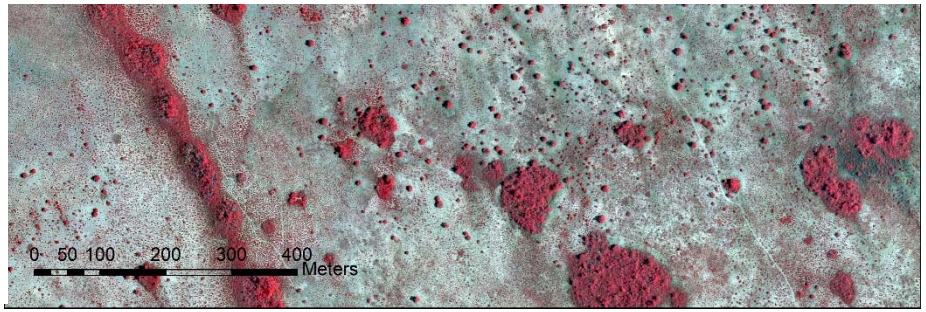


Juncus/white mangrove-dominated site in 1996 (TKYINT)

~3.5 km from the coast

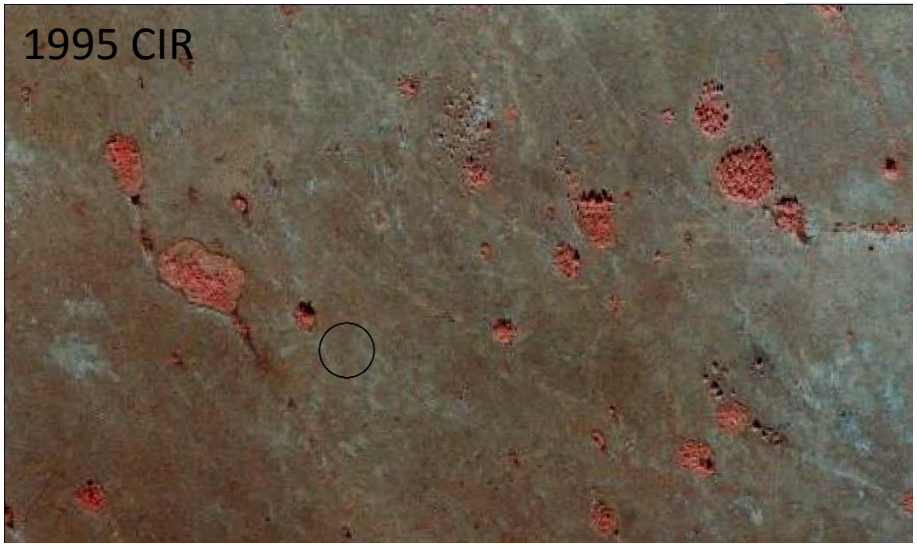


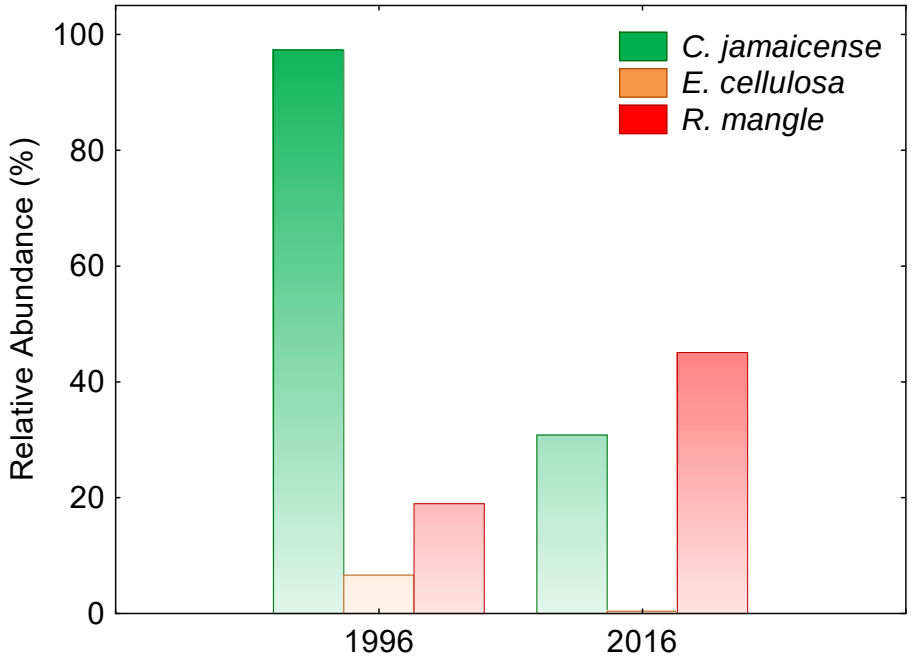


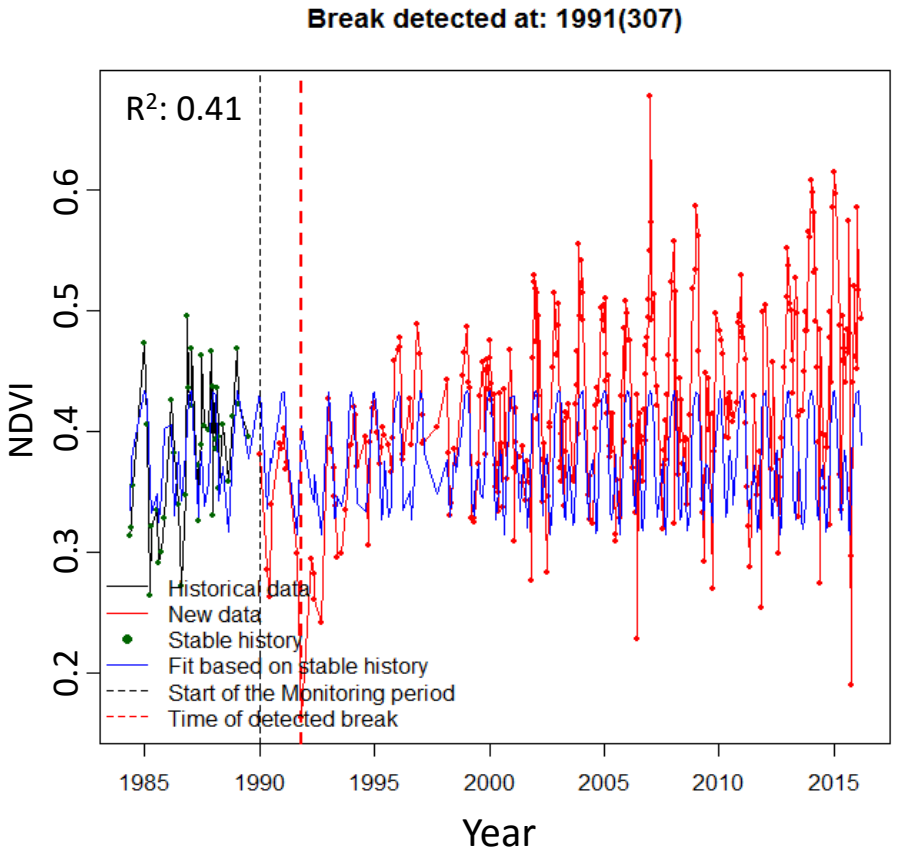


Sawgrass-dominated site in 1996 (EVER1)

~5 km from the coast

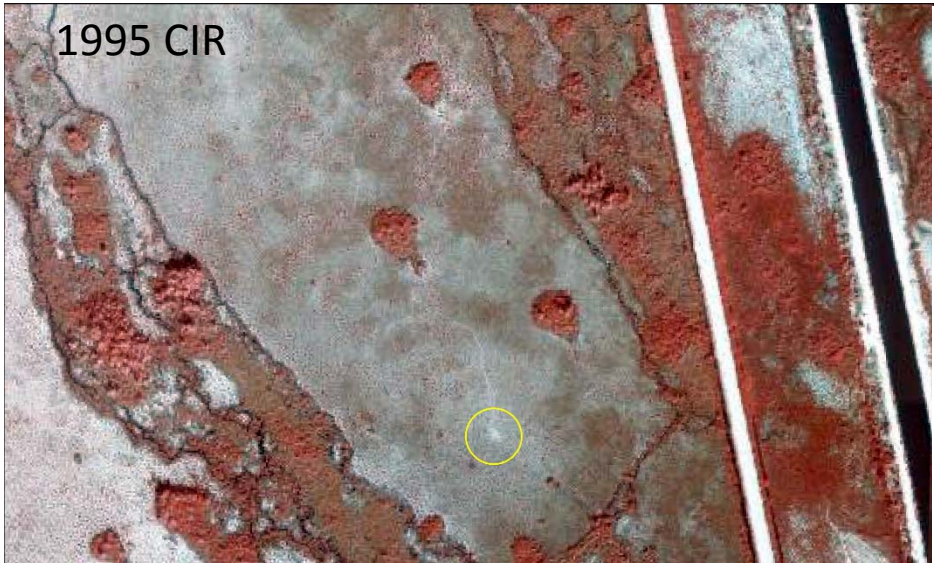


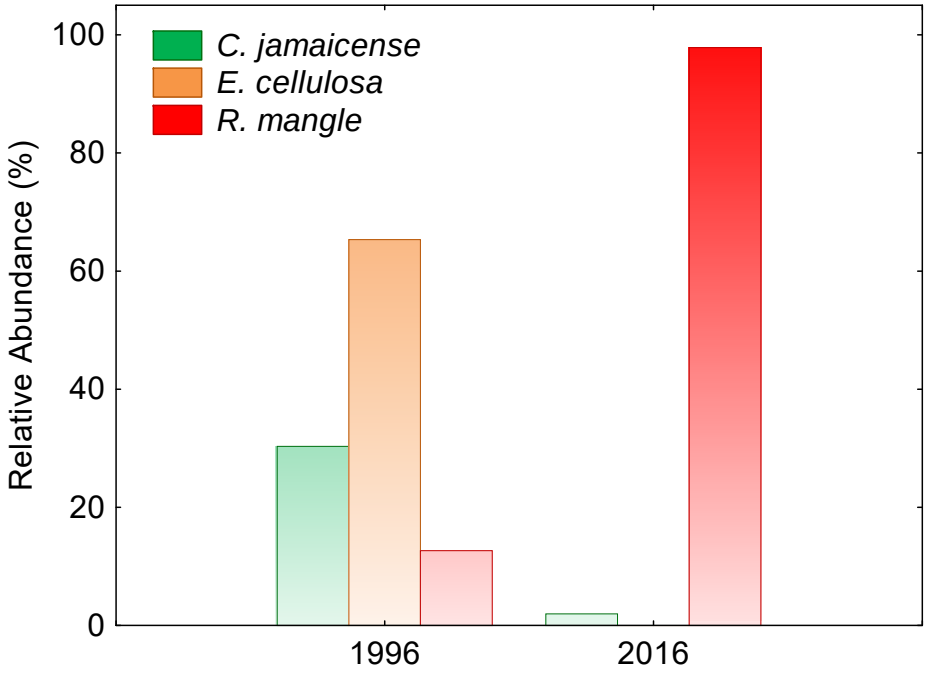


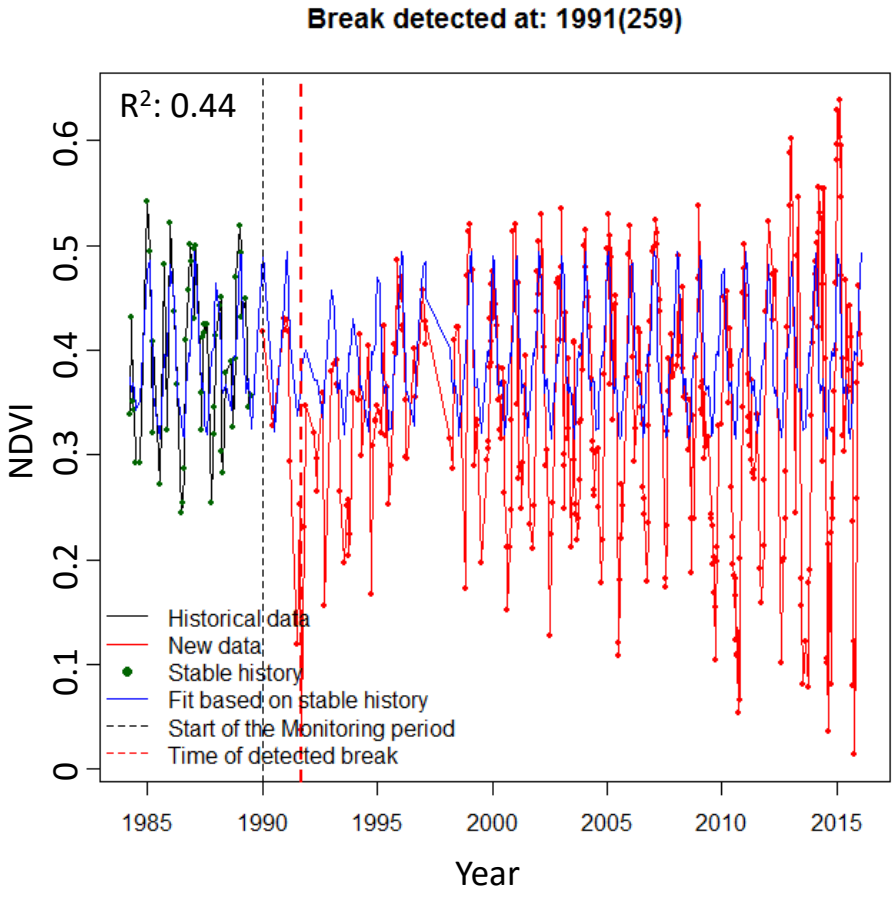


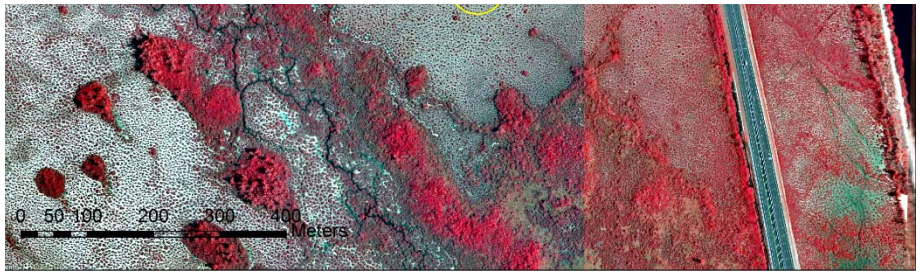
Sawgrass/Eleocharis-dominated site in 1996 (EP12R)

~1 km from the coast



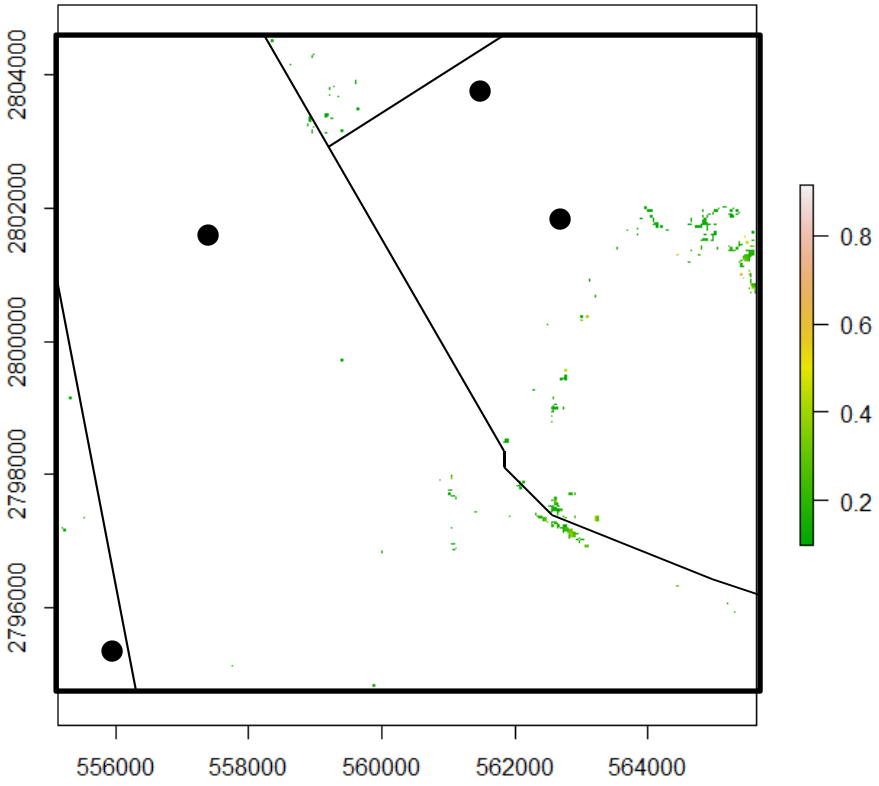




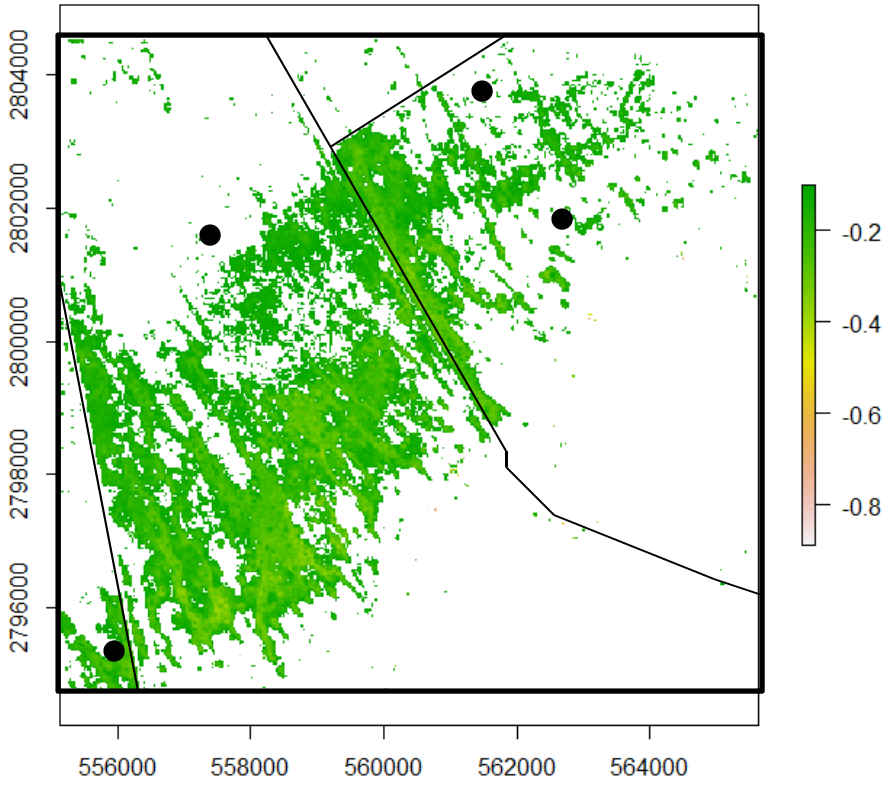


NDVI Magnitude Change 1990 to 1992

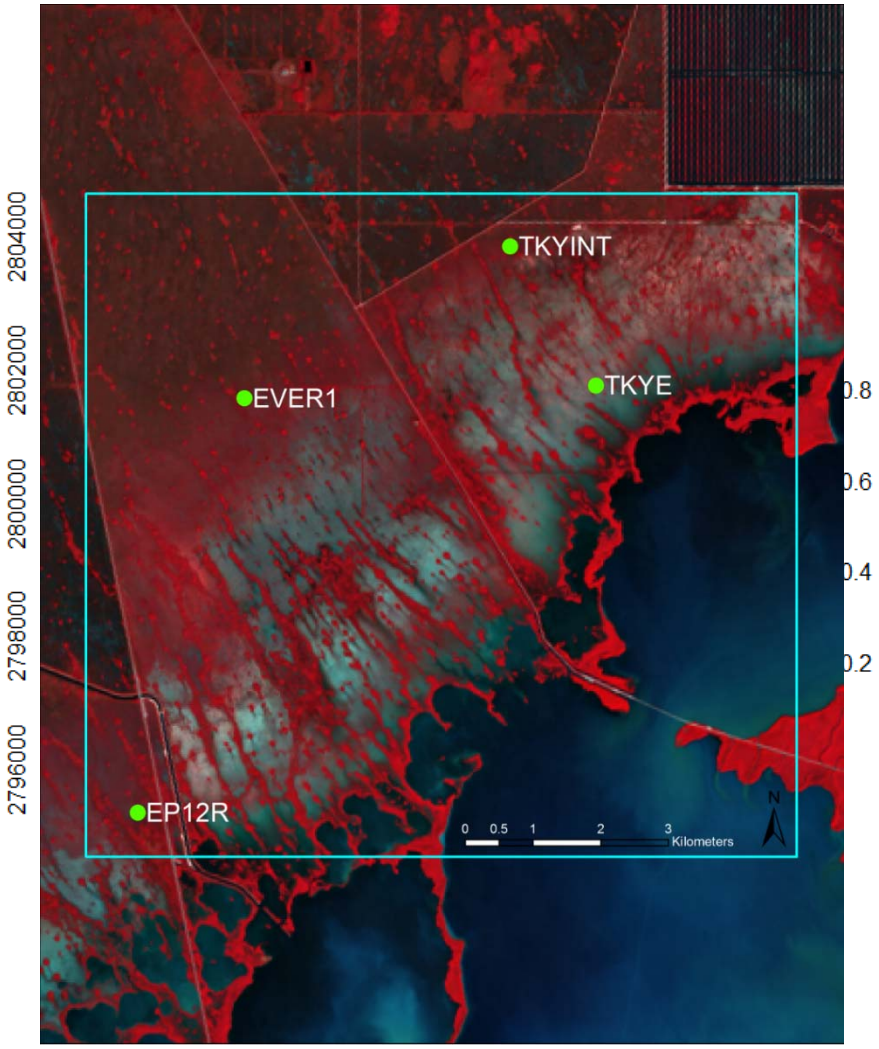
Increase



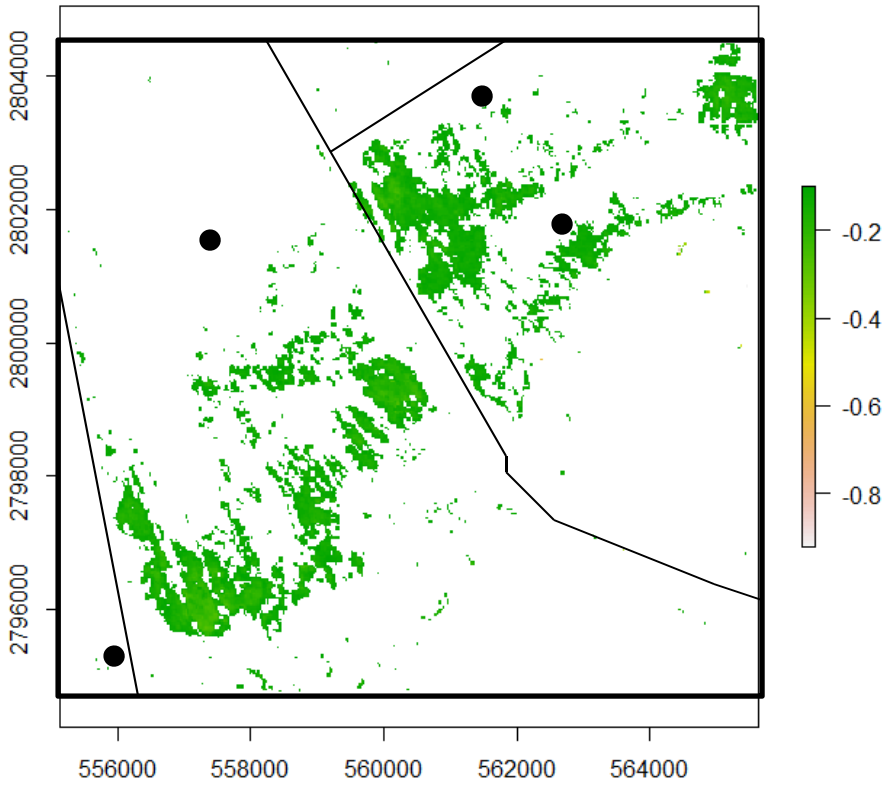
Decrease



NDVI Magnitude Change 1990 to 2016



Decrease



Conclusion and Research Directions

- Disturbance can be detected and long-term changes captured with this method
- Need to incorporate spatiotemporally-explicit hydroperiod information into the model
- Need to identify multiple breakpoints in time series
- Eventual end product: change map of vegetation types from combination of Landsat and higher resolution imagery

Thank you!

- Thank you to Everglades National Park for project funding

- Thank you to the project team: Susana Stofella, Rosario Vidales, Jesus Blanco, Sean Charles , Ania Wachnicka, Len Scinto, Jay P. Sah, Josh Diamond, and Allison Jirout

- Thank you to the FIU GIS Center for providing spatial data and computing access

- Contact dogurcak@fiu.edu for more information

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