Coastal Vegetation Succession in the Everglades Landscape Vegetation Succession Model

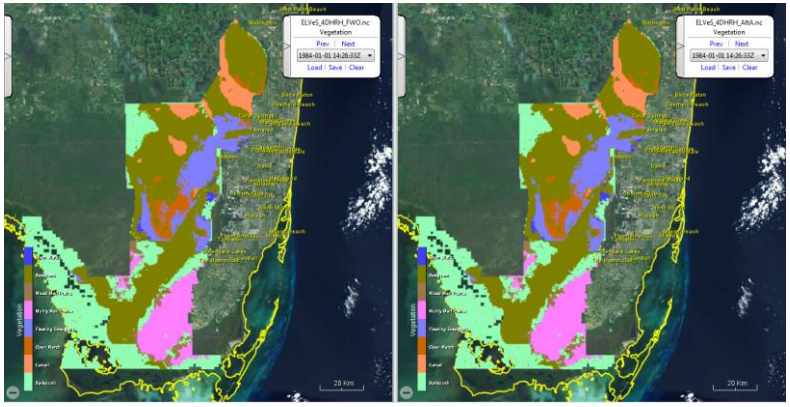
Leonard Pearlstine[1], Steve Friedman[1], Stephanie Romañach[2], Tom Doyle[3], Jimi Sadle[1], Sonali Saha[1,6], Tom Smith[4,] Don DeAngelis[2,7], Michael Turtora[5], Leo Sternberg[7], Kristie Wendelberger[8], Ronnie Best[2], Eric Swain[2]

[1]National Park Service, Homestead, FL, USA
[2]U.S. Geological Survey, Fort Lauderdale, FL, USA
[3]U.S. Geological Survey, Lafayette, LA, USA
[4]U.S. Geological Survey, St. Petersburg, FL, USA
[5]U.S. Geological Survey, Gainesville, FL, USA
[6]The Institute for Regional Conservation, Miami, FL, USA
[7]University of Miami, Miami, FL, USA
[8]Florida International University, Miami, FL, USA

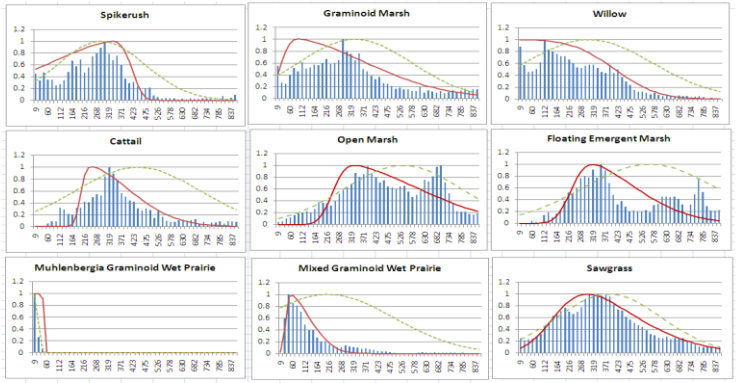
ELVeS

Everglades Landscape Vegetation Succession

- Empirically-based probabilistic functions of vegetation community responses to changing environmental conditions.
- Linking ELVeS with wildlife planning tools provides a dynamic land cover layer for habitat.
- Designed to encourage updating as new information becomes available.
- Annual time step



FWO **AltA**

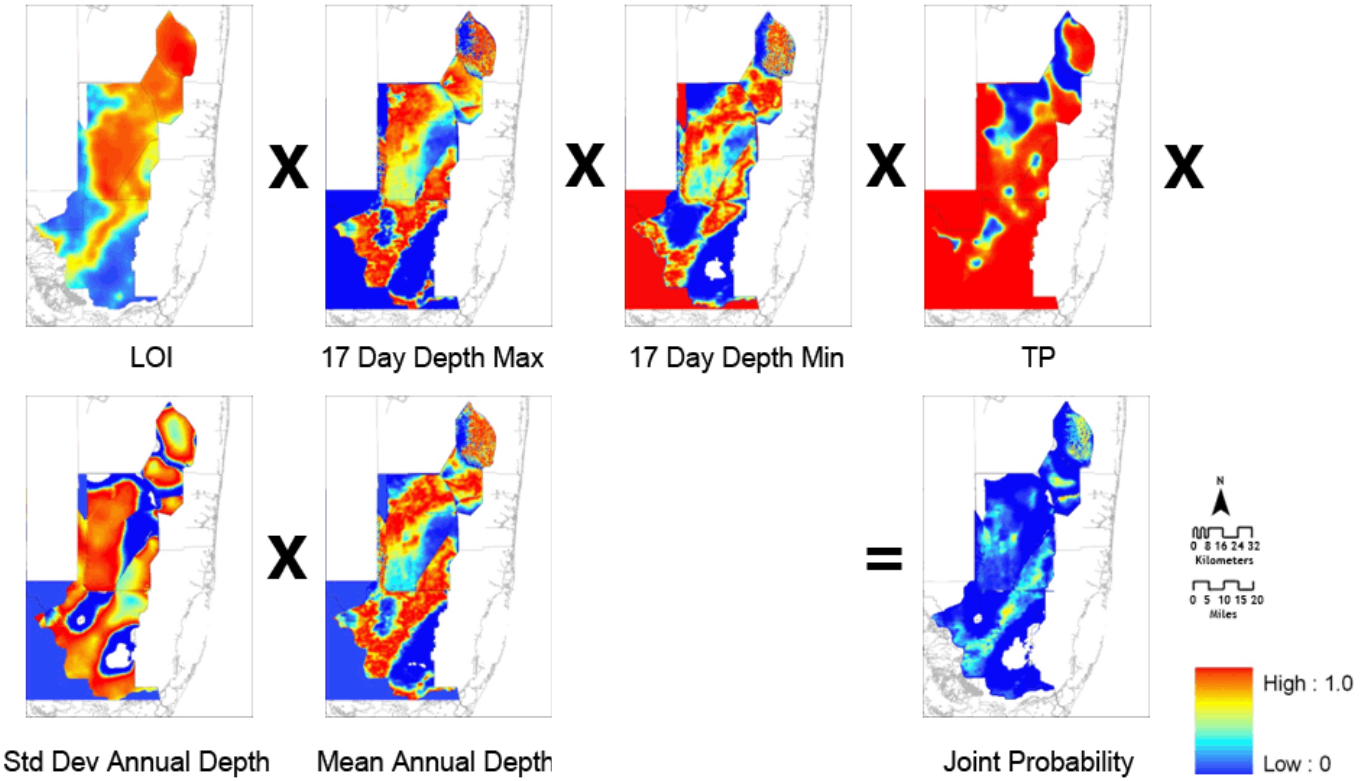


Example empirical fitting of annual water depths to vegetation communities

ELVeS

Everglades Landscape Vegetation Succession

Example for Sawgrass Community



Adding Coastal Communities to ELVeS

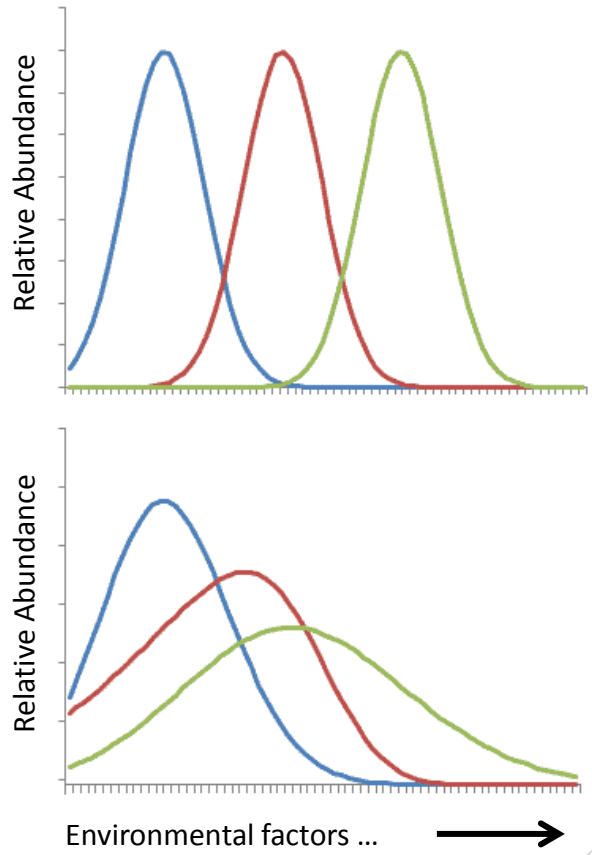
Goals:

1. Regional modeling of coastal landscape change with restoration and climate change

2. Inform management and policy decisions by enhancing understanding of projected vegetation response patterns

3. Identify limitations of existing landscape data and models

Coastal Community Drivers



Optimal (i.e., greenhouse) versus realized niche

Regional

- Temperature

Local

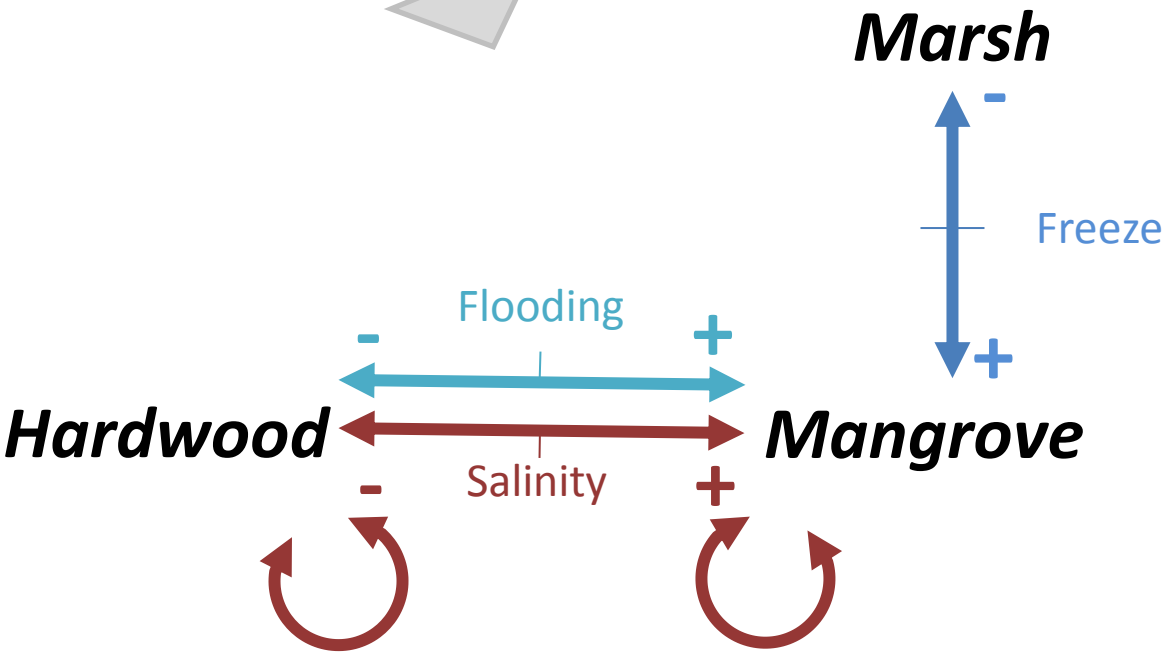
- Hydrology
- Nutrients (P)
- Salinity
- Soils
- Temperature
- Disturbance history

Community Transition Driven by:

Storms
Fire & Frost
Tidal variation
Precipitation variation

Fire

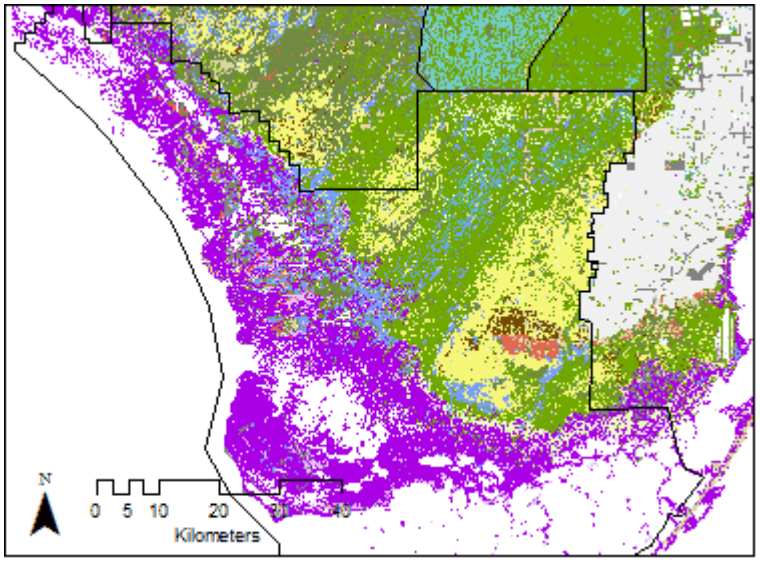
Frost



Sea Level Rise

- Mangrove keeping pace with current rate of sea level rise.
- Expansion of mangrove in 10,000 Islands tracks MHW increase.
- Expansion of mangrove is at the expense of Buttonwood. (Doyle et al 2010)

- Growth eventually reduced with increasing levels of inundation.
- Increased CO_2 benefit may be offset by reduced growth from increased flooding and increased hydroperiod. (Krauss et al 2008)



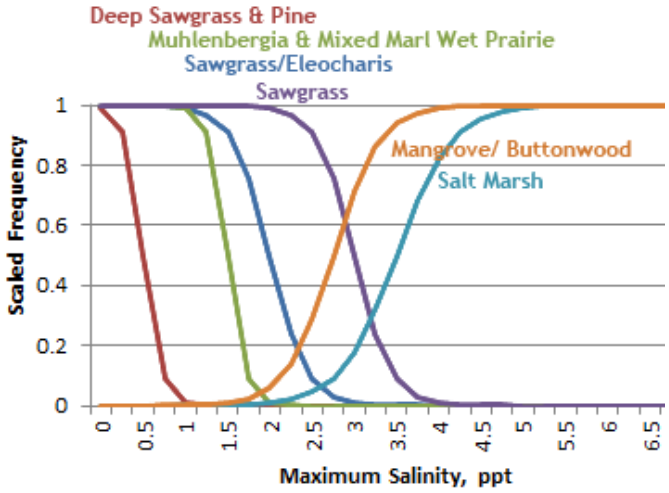
Mapped Existing Conditions

- Urban/ Agriculture
- Exotics
- Wet Shrub & Forest
- Other
- Sawgrass/ Spikerush
- Deep Sawgrass
- Floating Emergent Marsh
- Muhlenbergia/ Mixed Marl Wet Prairie
- Sawgrass
- Salt Marsh
- Mangrove/ Buttonwood
- Pine
- Cattail
- Other Fresh Marsh
- Hardwood Hammock

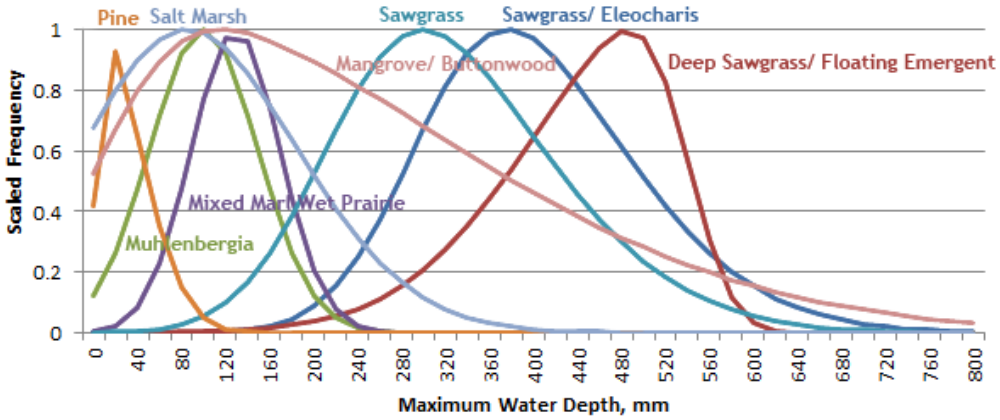
Annual Metrics Used in Coastal Model

1. Max Salinity
   (17 day running average)
2. Max Water Depth
3. Min Water Depth
   (17 day running average)
4. Mean Water Depth
5. Std. Dev. Water Depth

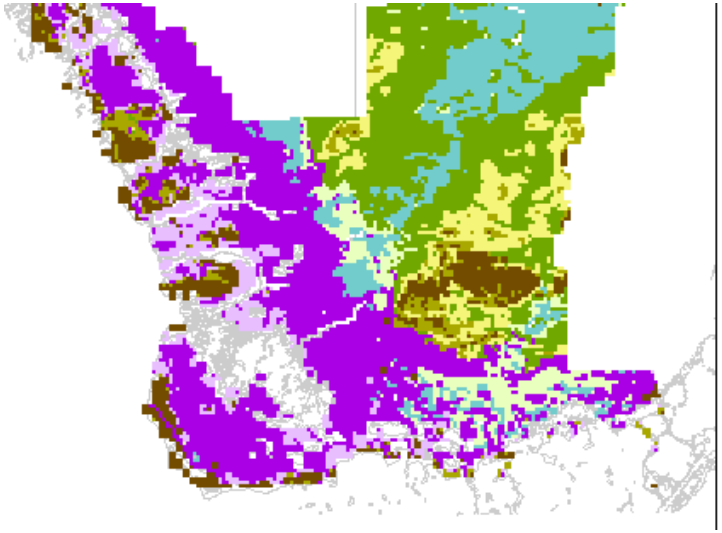
Salinity



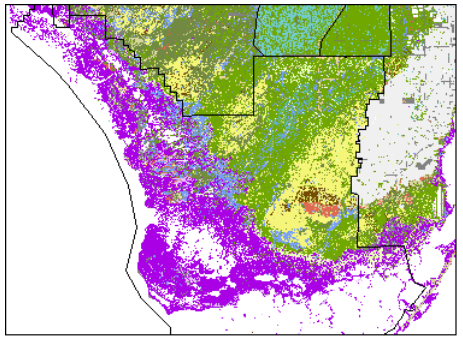
Max Water Depth



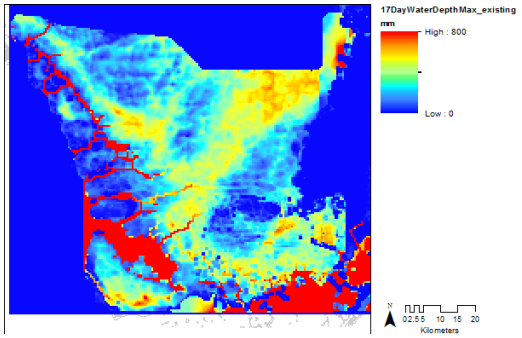
ELVeS Coastal Model Existing Conditions



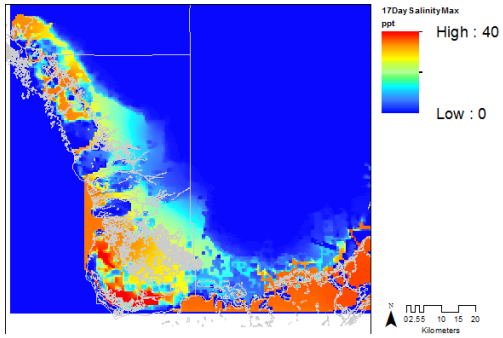
Modeled Existing Conditions



Mapped Existing Conditions

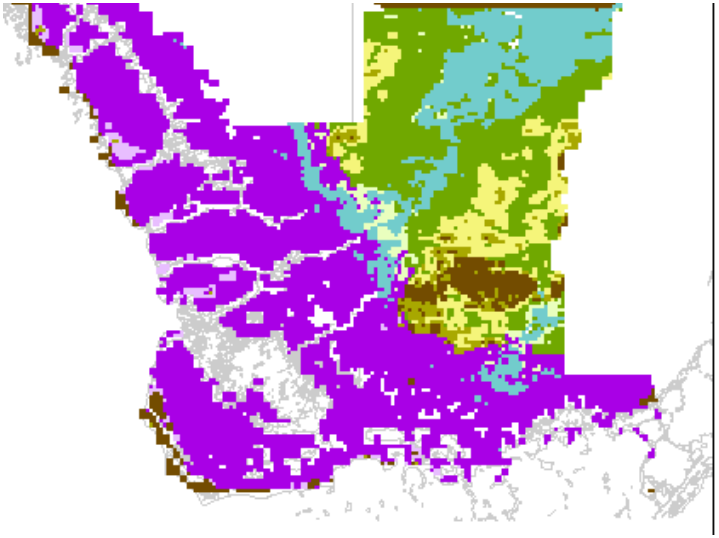


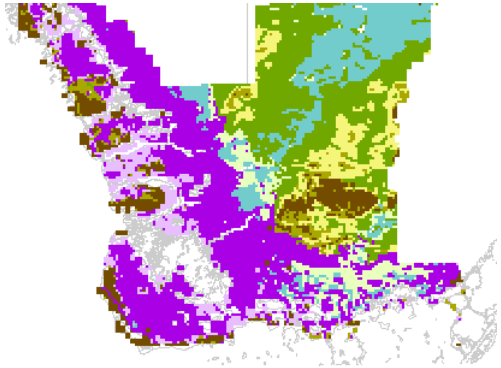
17 day average Maximum Water Depth



17 day average Maximum Salinity

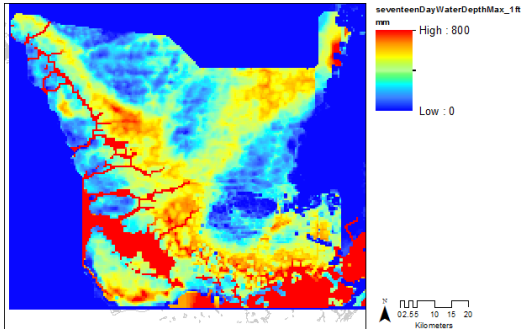
ELVeS Coastal Model
1 ft Sea Level Rise



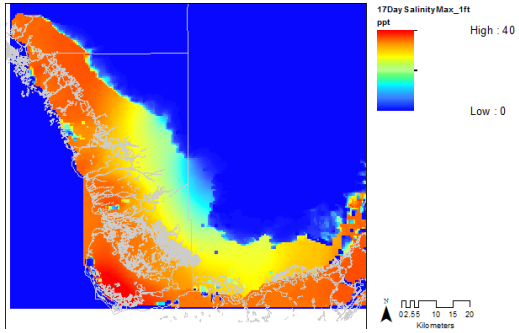


1 ft SLR

Existing Conditions

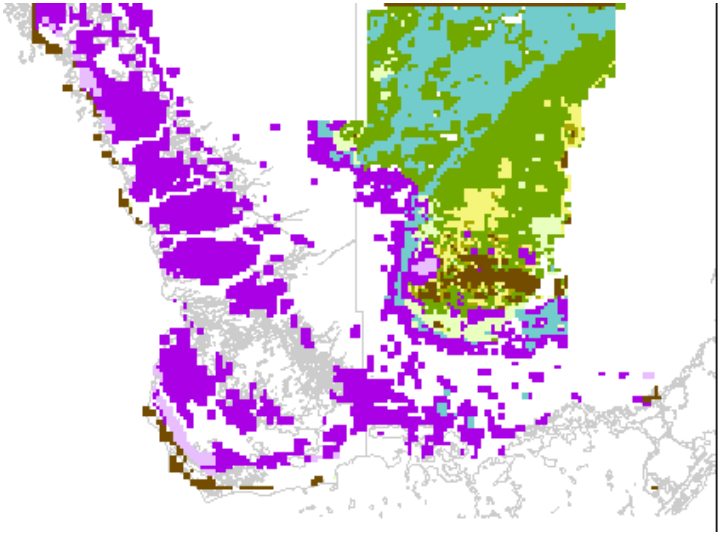


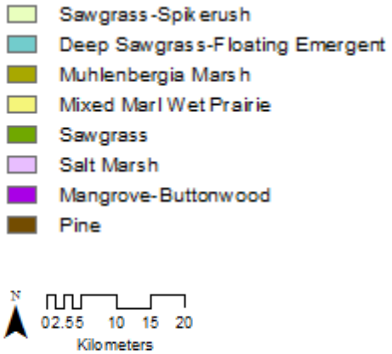
17 day average
Maximum Water Depth



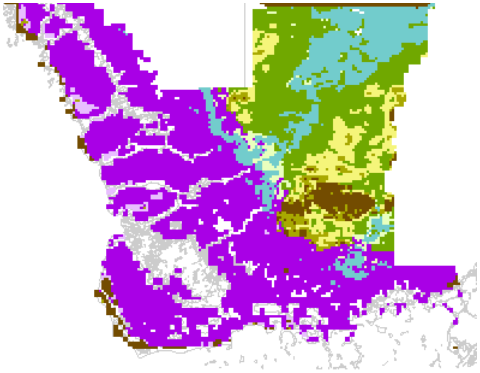
17 day average
Maximum Salinity

ELVeS Coastal Model
2 ft Sea Level Rise

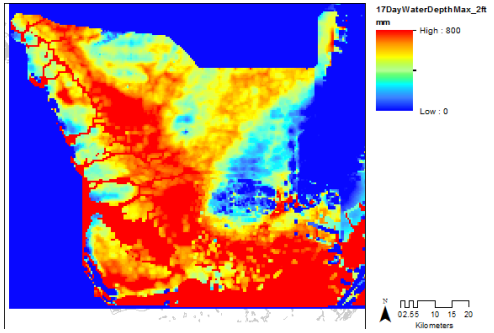




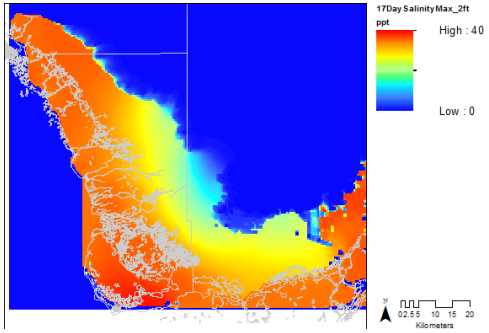
Modeled 2 ft SLR



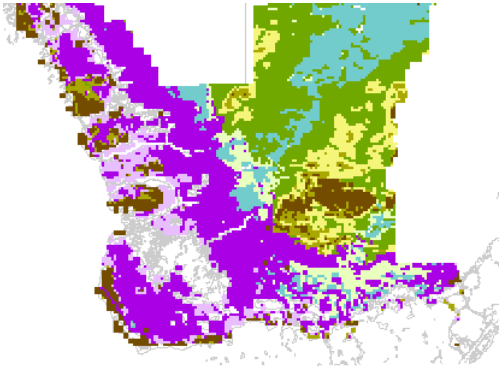
1 ft SLR



17 day average
Maximum Water Depth



17 day average
Maximum Salinity



Existing Conditions

Research Needs

- Better coastal elevation profiles, particularly in channels to improve hydrologic modeling
- Storm & fire events
- Dynamic P modeling
- Accretion & subsidence
- Neighborhood modeling in ELVeS
- Increased vertical resolution of hydrologic models to approximately model the vadose zone

Cape Sable, Everglades National Park

- More long-term data on varying salinity levels along coast under wet/dry season & storm event scenarios

ELVes can be a valuable tool in coastal modeling for:

- Identifying potential areas at risk and spatial distributions of change
- Identifying information gaps

www.simGlades.org