Coastal Vegetation Succession in the Everglades Landscape Vegetation Succession Model

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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

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

Environmental factors ...

Relative Abundance
Community Transition Driven by:
- Storms
- Fire & Frost
- Tidal variation
- Precipitation variation

Marsh

Hardwood

Mangrove

Flooding

Salinity

Freeze

Fire

Frost

South Florida Natural Resources Center
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)
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
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

17 day average
Maximum Water Depth

17 day average
Maximum Salinity

1 ft SLR

Existing Conditions

Sawgrass-Spikerush
Deep Sawgrass-Floating Emergent
Muhlenbergia Marsh
Mixed Marl Wet Prairie
Sawgrass Wet Prairie
Salt Marsh
Mangrove-Buttonwood
Pine
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
- 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

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