RECOVER Update to Conceptual Ecological Models and Hypothesis Clusters

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**Why Update CEMs & Create HC*s?**

- RECOVER Models first published in 2005... Much has been learned over past 10-15 years.
- New problems/issues have emerged.
- Restoration actions better defined.
- Needed to update Monitoring and Assessment Plan (MAP) and determine priorities for funding.
- Puts basic understanding of system in one document.
What is a Conceptual Ecological Model (CEM)?

- CEMs, as used in CERP, are non-quantitative planning tools used to identify major ecological and anthropogenic drivers and stressors on natural systems, the ecological effects of these stressors, and biological attributes or indicators of these ecological responses (Ogden et al. 2005a).

- What is causing this system to change?
What is a Conceptual Ecological Model (CEM)?

Narrative

The Big Cypress region covered by this conceptual ecological model includes the freshwater portions of the area extending from the southern edge of the Caloosahatchee River watershed boundary in Lee, Hendry, and northern Collier Counties, and west of the Everglades, as delineated approximately by the eastern and southern boundary of Big Cypress National Preserve (Figure 1). In this region, historic water flows were primarily south to the Gulf of Mexico, with minor flows in small creeks that pass through the west coast ridge to the Gulf (Klein et al. 1970). I define the water table throughout Big Cypress as being at the top of the surficial aquifer, which is above ground over much of the area during wet seasons and below ground over most of these areas during dry season.

The Big Cypress region has three distinct subsections based on the kind and degree of development present in each (Lehman 1976). The least disturbed area, where hydrology is largely rainfall-driven, is located within Big Cypress National Preserve in the southeastern portion of the region (Duerer et al. 1982). The most developed portion of the area, including both urban and agricultural development, is located on and just east of the coastal ridge from Naples north to Fort Myers. The rest of the area is a mixture of agricultural lands, suburban and rural communities, and small-to-large natural areas that have been altered to varying degrees by upstanding and/or adjacent development. Despite varying degrees of development in the three subsections, kinds of stresses and their effects on ecosystem attributes are similar throughout the Big Cypress region, and they differ only in severity of their impacts.

The Big Cypress region is comparable to the freshwater Everglades in natural community diversity, although Big Cypress communities are primarily forested and tend to form more of a mosaic, as opposed to vast expanses of a number of primarily herbaceous community types. The most extensive natural communities in Big Cypress are distributed throughout the region along very gentle topographic gradients from short-hydroperiod uplands on uplands through marshes to long-hydroperiod cypress domes on lower elevations (Davis 1945; Klein et al. 1970; Craighead

Diagram

Figure 2. Big Cypress Regional Ecosystem Conceptual Ecological Model Diagram.
Drivers are forces that are the underlying causes of change in the Everglades system.

Stressors are physical, chemical, and biological mechanisms that cause change(s) in the ecosystem. Stressors are the particular effects of Drivers in the ecosystem.

Ecological effects are physical, chemical, and biological responses that are intrinsic to the ecological system and which are triggered by stressors. Ecological effects can be dynamic processes, and can be positive, negative, or neutral.

Attributes are a parsimonious subset of ecosystem components that are thought to be representative of overall ecological conditions of the system.
**RECOVER Conceptual Ecological Models (CEMs)**

- **Total System**
  - Lake Okeechobee
  - Northern Estuaries
  - Greater Everglades
    - Ridge & Slough
    - Southern Marl Prairies
    - Big Cypress
  - Southern Coastal Systems
    - Biscayne Bay
    - Florida Bay
    - Southwest Coast
What is a Hypothesis Cluster (HC)?

- Subsets of CEM with more details, especially how restoration is anticipated to affect ecosystem components and relationships.
- Don’t follow Driver-Stressor-Effect-Attribute framework
What is a Hypothesis Cluster
## Hypothesis Clusters

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<th>GREATER EVERGLADES</th>
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<td>Benthic Infauna</td>
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<td>Characteristics of Everglades Coastal Wetlands Prior to Drainage</td>
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Identify Critical Uncertainties

That constrain decision-making and/or put restoration success at risk, e.g.

- Critical information needed for modeling or planning
- Verify critical assumptions
- Optimize balance between competing objectives or constraints
- New or unclear issues that may slow or prevent achieving goals
How do CEMs & HC's help CERP?

- Conceptual Ecological Model
  - Hypothesis Cluster
  - Hypothesis Cluster
  - Hypothesis Cluster

- Ecological Models
- Performance Measures

- Critical Uncertainties
- Monitoring and Assessment Plan; Adaptive Management Plans

- Project Planning
Biggest Changes

• Greater emphasis on Sea Level Rise & Climate Change
• Big Cypress Hypothesis Clusters being added,
  • Flood & Fire, Traditional Use Plants
• Better links to management actions
• Some uncertainties resolved & new ones identified:
  • Some linkages confirmed: e.g., between alligators and wading birds; juvenile crocodiles and salinities
  • More details determined: relationship between oyster impacts and frequency & duration of high inflow events; specifics of water recession rates on wading bird foraging
  • New uncertainties: links between nutrient spikes and end of dry season flows; new invasive species-- pythons
Report Status

• Northern Estuaries and Lake Okeechobee sections are nearly done
• Greater Everglades, Southern Coastal Systems, and Big Cypress are further behind
• Coming Soon... June? July?
• We will need your help to REVIEW!!!
Thank you!!!

• Lake Okeechobee: Therese East (Lead), Zach Welch, Mike Baranski, Chuck Hanlon, Alyssa Jordan, Rich Botta, Paul Gray, Dale Gawlik, David Essian

• Northern Estuaries: Phyllis Klarmann (Lead), Melanie Parker, Ramon Martin

• Greater Everglades: Tasso Cocoves (Lead), Agnes Mclean, Miles Meyer, Christa Zweig, Fred Sklar, Jed Redwine, Andrea Atkinson

• Southern Coastal Systems: Mike Simmons & Ramon Martin (Co-Leads), Amanda McDonald, David Rudnick, Tasso Cocoves, Melody Hunt, Chris Kavanaugh, Leonard Pearlstine, Fred Sklar, Carlos Coronado, Jerry Lorenz, Jen Rehage, Brad Furman, and more helping update HC’s.

• Big Cypress: Andrea Atkinson (lead), Tony Pernas, Shawn Clem, Eric Cline, Kevin Whelan, Kevin Cunniff, Tasso Cocoves, Art Roybal, Karli Eckel, Pablo Ruiz, Deb Jansen, Jed Redwine, Bob Sobczak, Holly Andreonata, Jimi Sadle, Melissa Nasutti, Andrea Nocetini, Mike Duever, Joe O’Brien, Grant Sullivan, Whitney Sapienza, Stacy Myers, Maya Tupaj