

# RECOVER Applied Science Framework Supporting Everglades Restoration Implementation

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Determining Everglades Ecosystem Restoration  
Benefits for Projects

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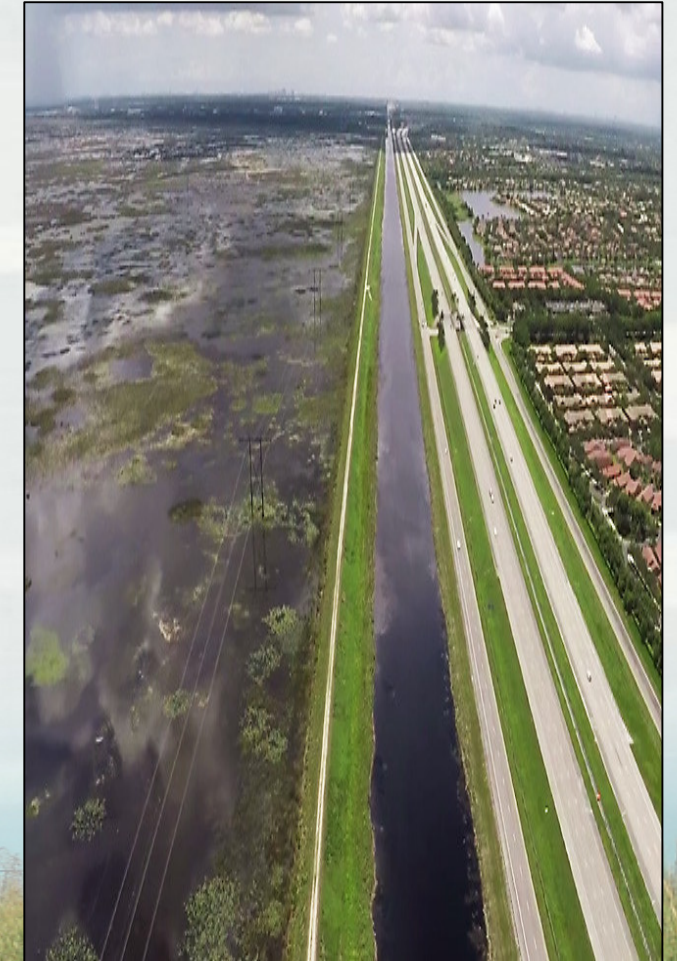
# Outline

- Introduction
- RECOVER Science Framework
  - ▶ Conceptual Ecological Models
  - ▶ Hypothesis Clusters
  - ▶ Performance Measures
- Example – Prey base fish



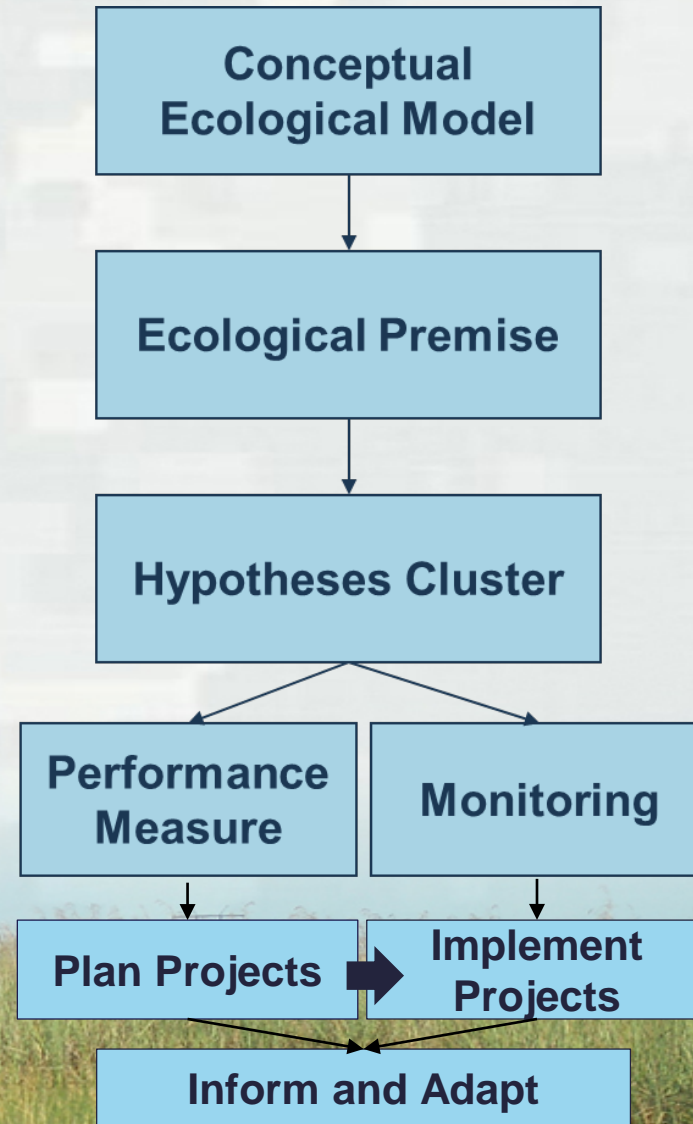
# Human impacts on natural ecosystems

- Challenges for natural resource managers responsible for protecting and restoring natural systems
  - ▶ Chesapeake Bay – Degraded waters
  - ▶ Louisiana – Receding coastlines
  - ▶ Florida Everglades – Altered hydrology, increased nutrients
- Restoration programs need the integration of science and policy to establish agreement on restoration objectives



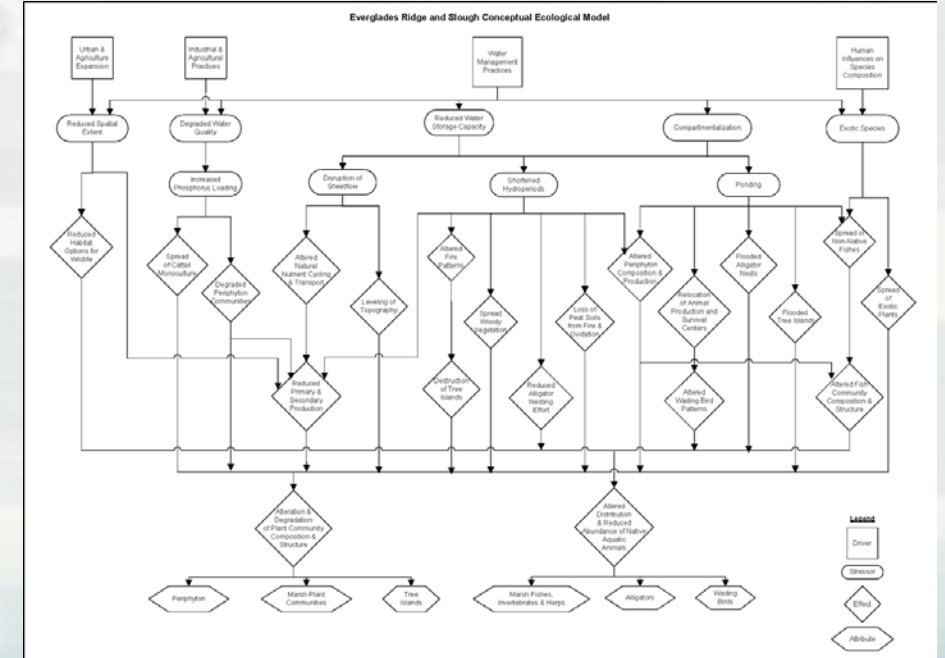
# CERP Science Framework

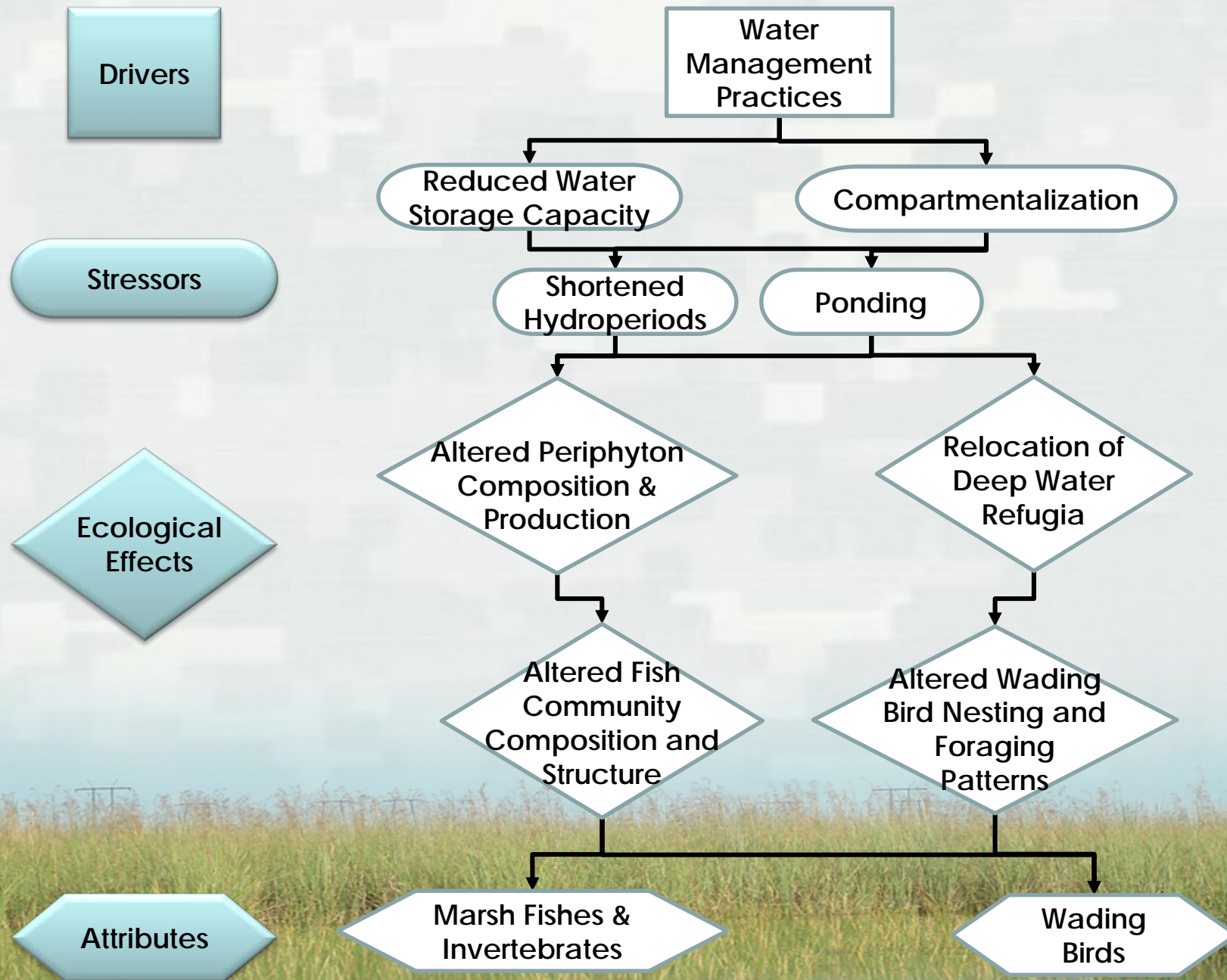
- The Science Behind CERP
- The RECOVER Monitoring and Assessment Plan
  - ▶ Organized around Conceptual Ecological Models
  - ▶ Hypothesis Clusters
  - ▶ Indicator Species
  - ▶ Performance Measures
- Adaptive Management
  - ▶ Feedback Loop

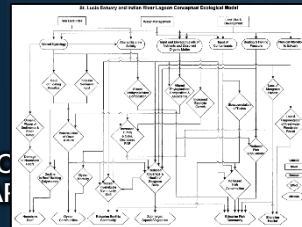
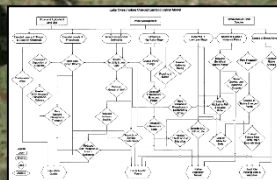
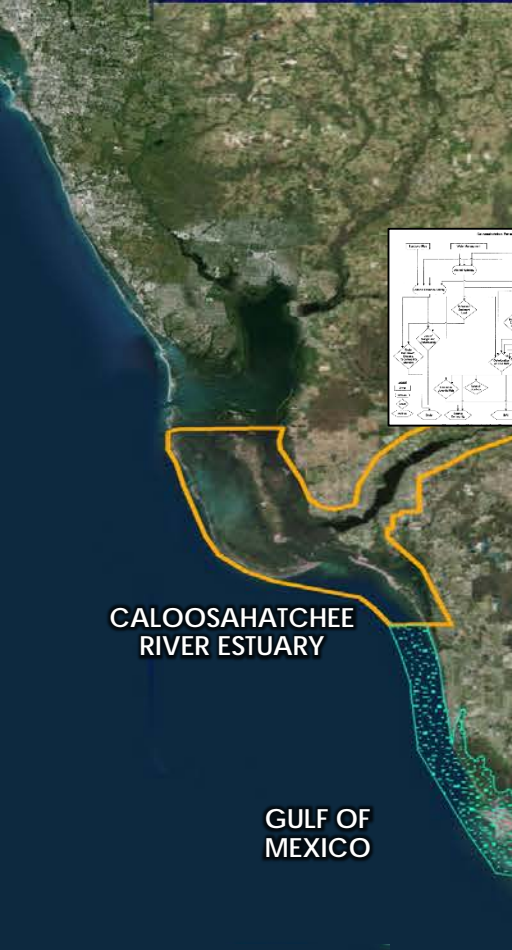


# Conceptual Ecological Models

- Non-quantitative planning tools that identify:
  - ▶ Major anthropogenic drivers and stressors on natural systems
  - ▶ Ecological effects
  - ▶ Best biological indicators (attributes)
- Provide a logical process for **synthesizing, organizing, and prioritizing** existing ecological knowledge











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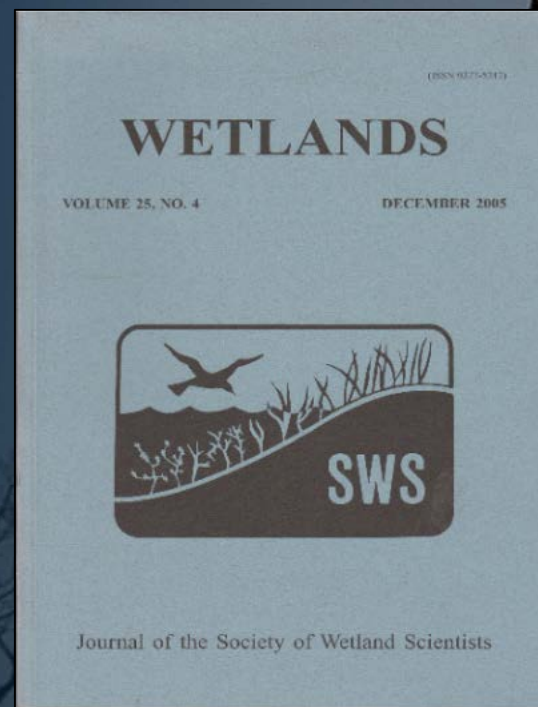
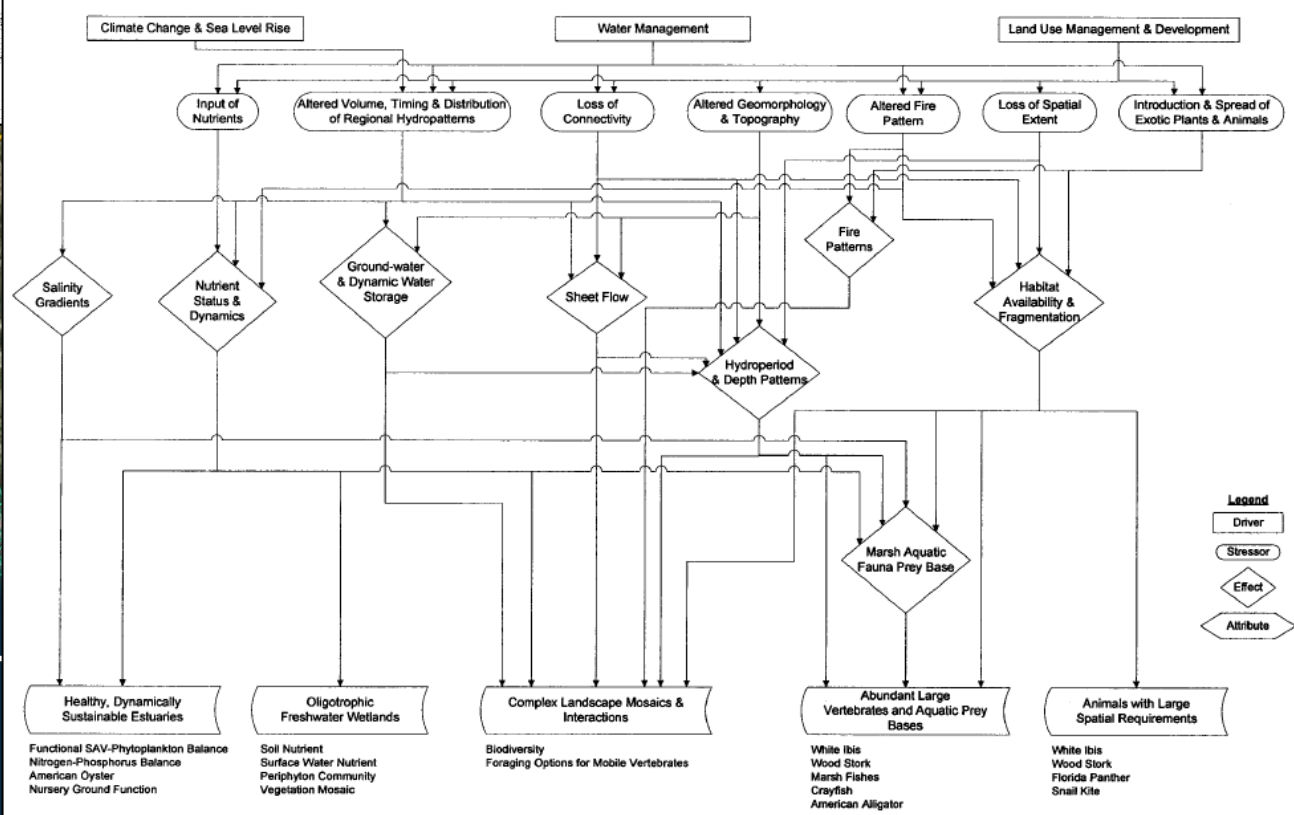
CALOOSAHATCHEE RIVER ESTUARY

GULF OF MEXICO

REGIONS

-  LAKE OKEECHOBEE
-  NORTHERN ESTUARIES
-  GREATER EVERGLADES
-  SOUTHERN COASTAL SYSTEM

Total System Conceptual Ecological Model



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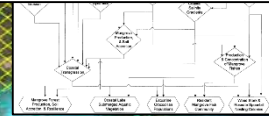
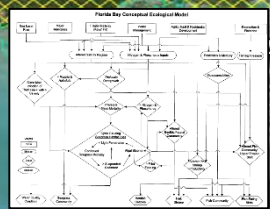


Figure 1. Overview for Ecosystem Model Diagram.

# Conceptual Ecological Models

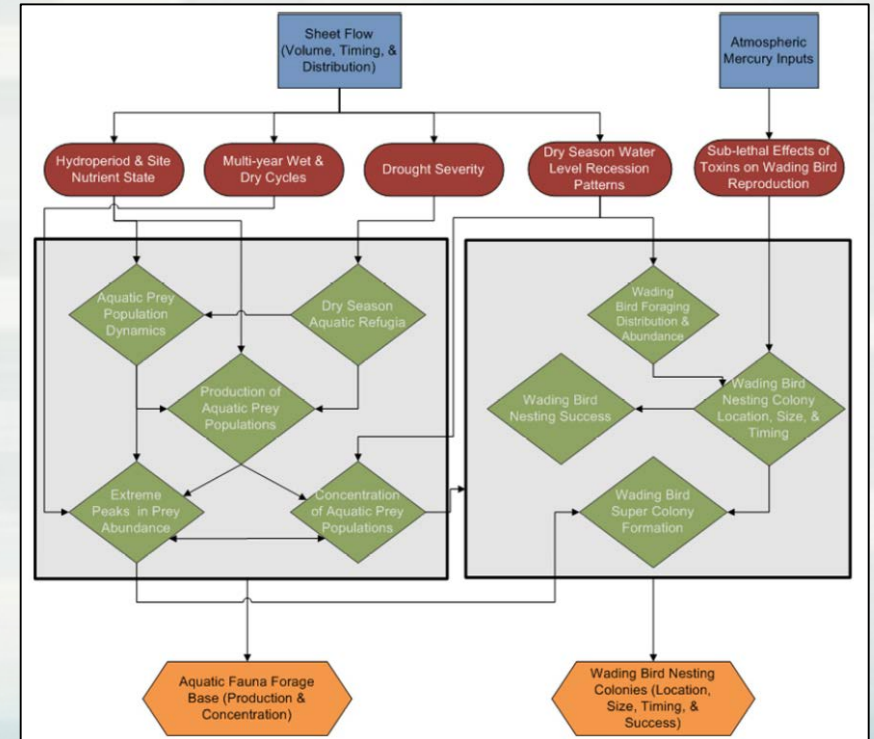
- Facilitate the formulation of hypotheses describing not only what system attributes are important but why changes occur
- Provide the framework for creating performance measures



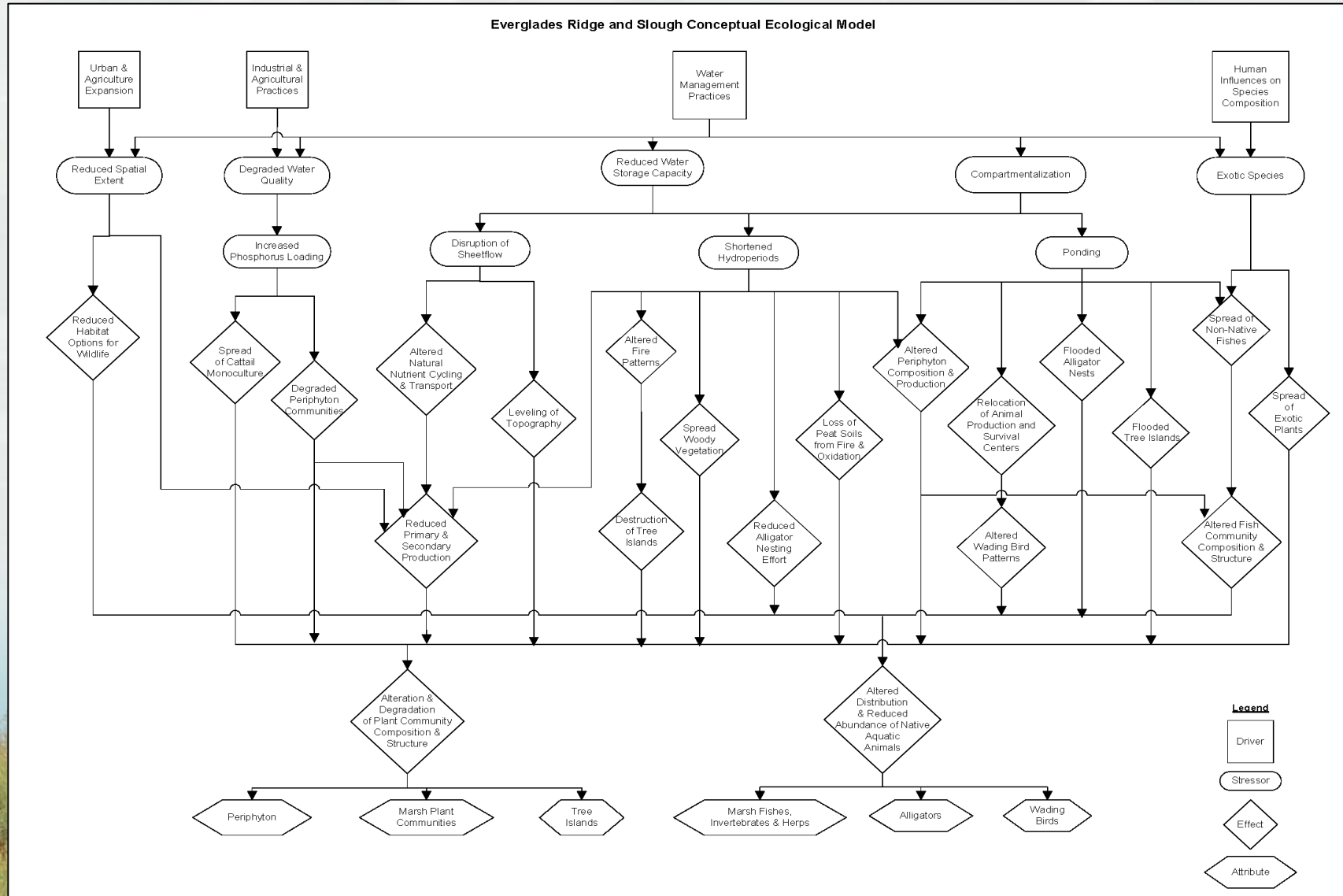


# Hypothesis Clusters

- Subject-specific conceptual ecological models
- Address the integration of stressor-response relationships of the system
- Provide refinement in types and numbers of performance measures and metrics
  - ▶ Linked to monitoring components
- Identify monitoring/research needs and plan the design of restoration programs



# Greater Everglades Example: Prey Base Fish



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## Aquatic fauna as indicators for Everglades restoration: Applying dynamic targets in assessments

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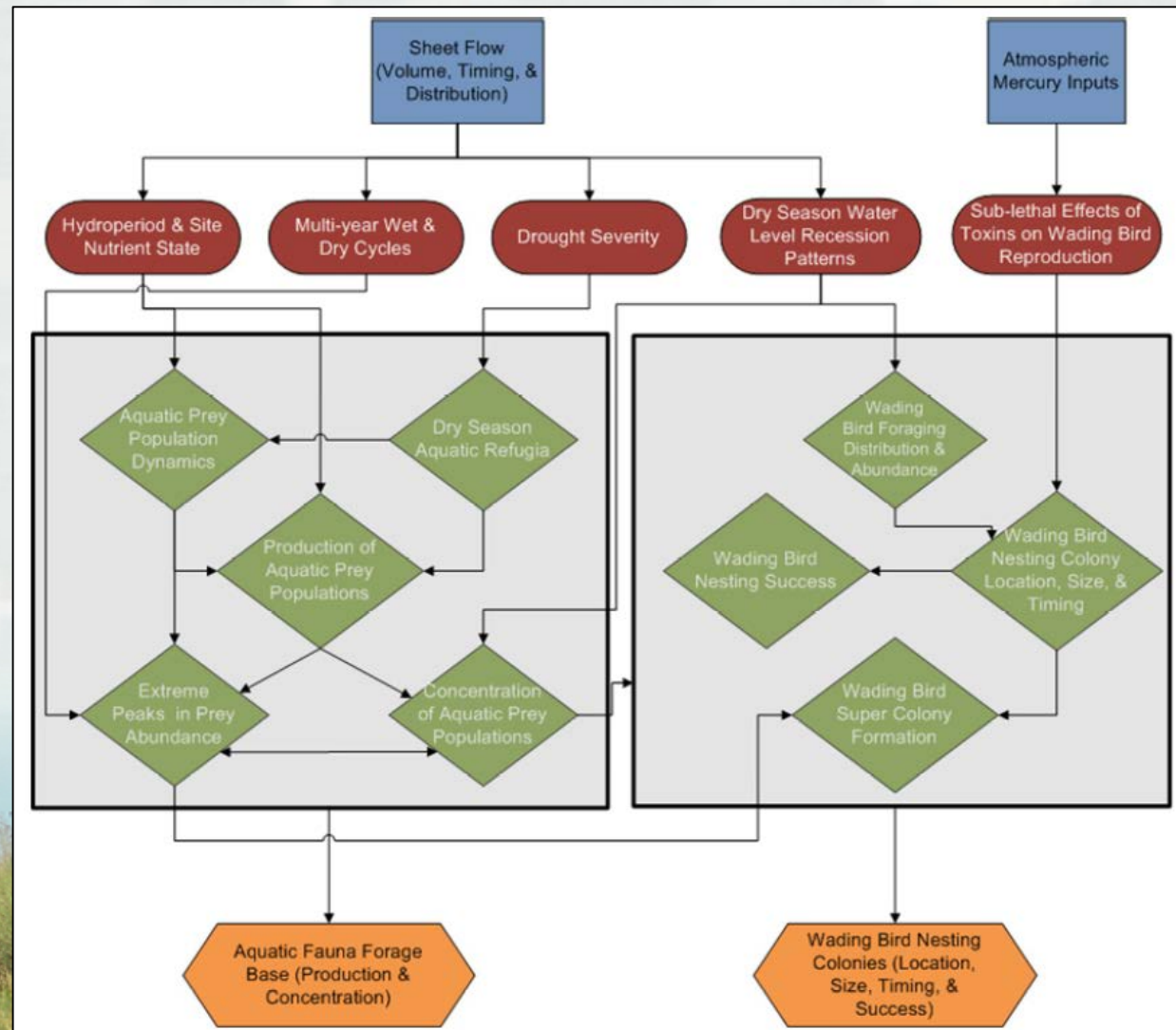
Ecological targets

### ABSTRACT

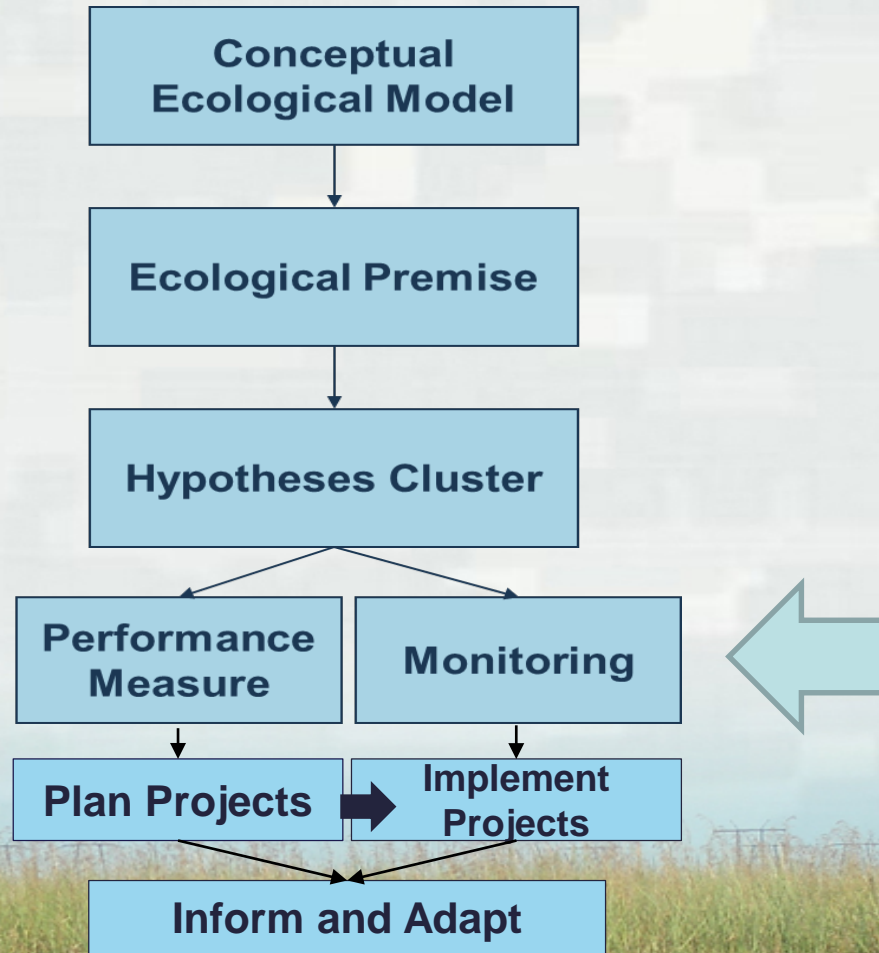
A major goal of the Comprehensive Everglades Restoration Plan (CERP) is to recover historical (pre-drainage) wading bird rookeries and reverse marked decreases in wading bird nesting success in Everglades National Park. To assess efforts to restore wading birds, a trophic hypothesis was developed that proposes seasonal concentrations of small-fish and crustaceans (i.e., wading bird prey) were a key factor to historical wading bird success. Drainage of the Everglades has diminished these seasonal concentrations, leading to a decline in wading bird nesting and displacing them from their historical nesting locations. The trophic hypothesis predicts that restoring historical hydrological patterns to pre-drainage conditions will recover the timing and location of seasonally concentrated prey, ultimately restoring wading bird nesting and foraging to the southern Everglades. We



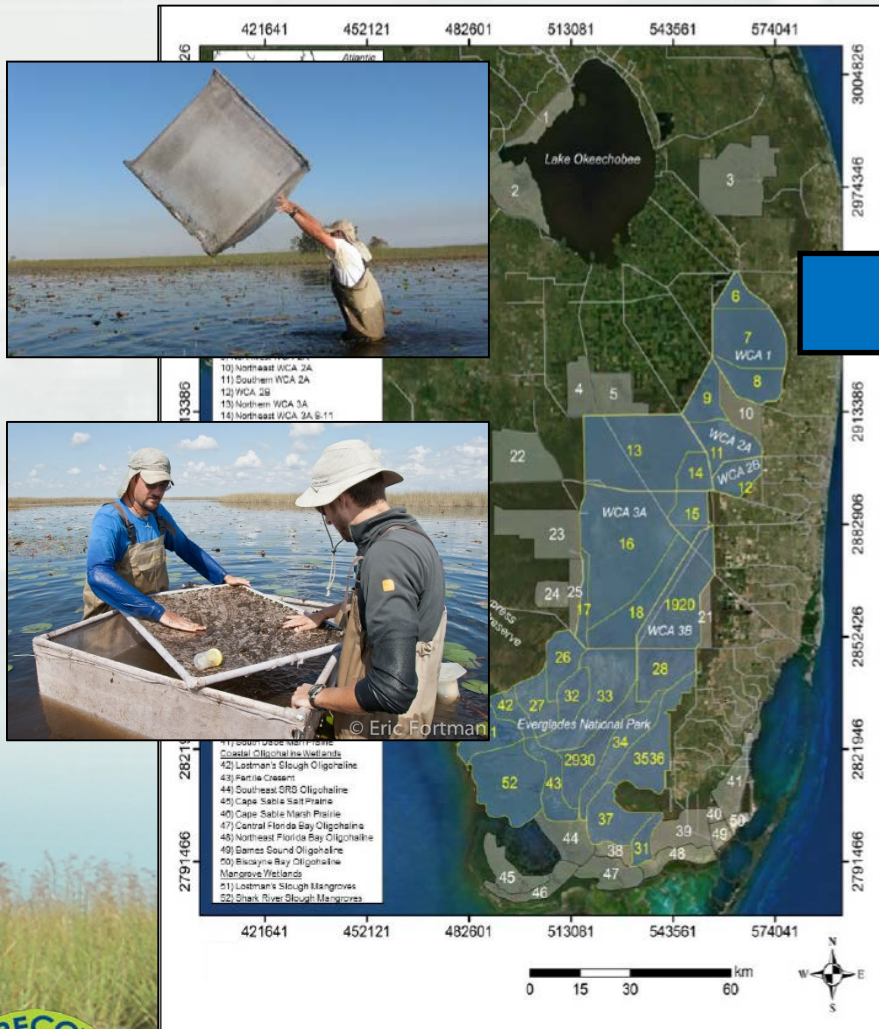
# Greater Everglades Example: Prey Base Fish



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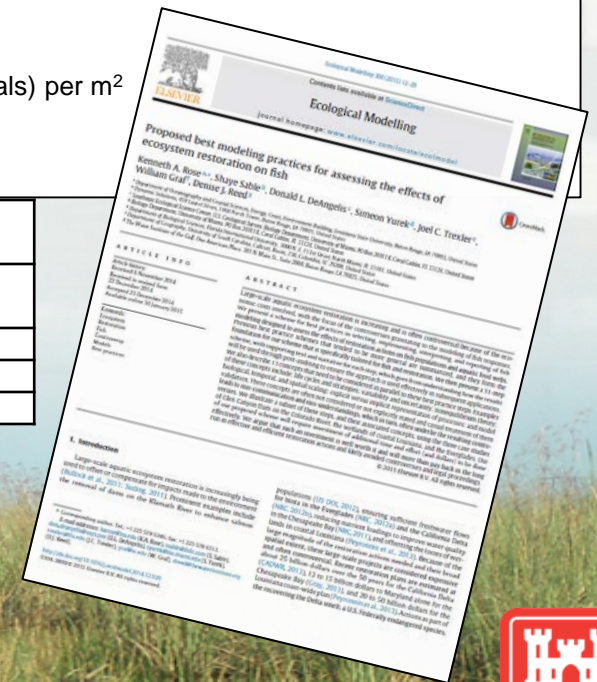
## Equations Developed From The Data:

$$\text{LOG}(\text{TOTFISH} + 1) = \frac{K}{\left(1 + \left(\frac{(K - Y_0)}{Y_0}\right) e^{(-r * \text{DSLDD})}\right)}$$

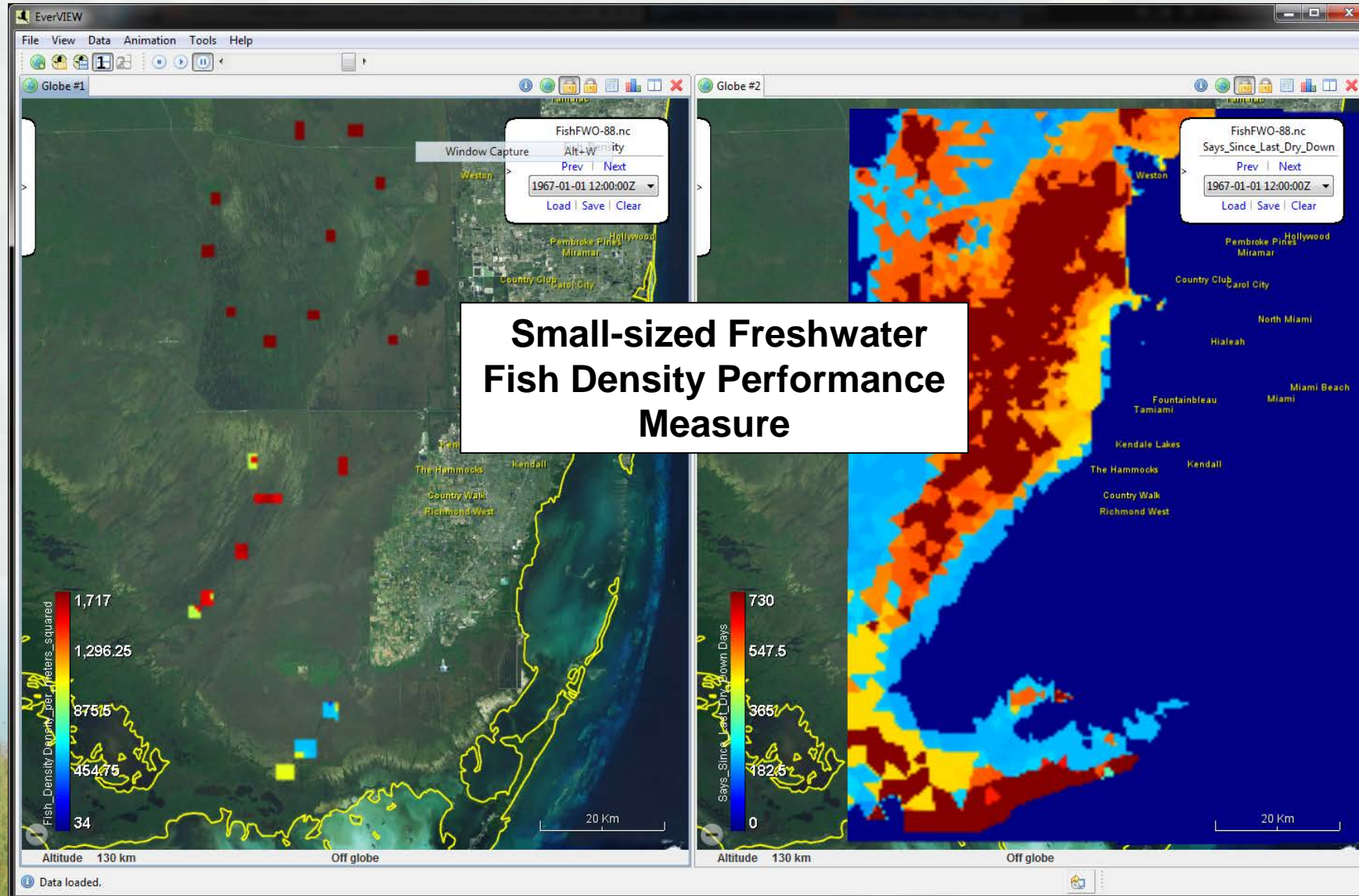
- DSLDD = days since last dry down
- r = growth constant
- TOTFISH = total small-sized fish density (number of individuals) per m<sup>2</sup>
- K=asymptotic density
- Y0=Y intercept

Table 1. Trexler small-sized fish density logistic regression equation parameters per monitoring region

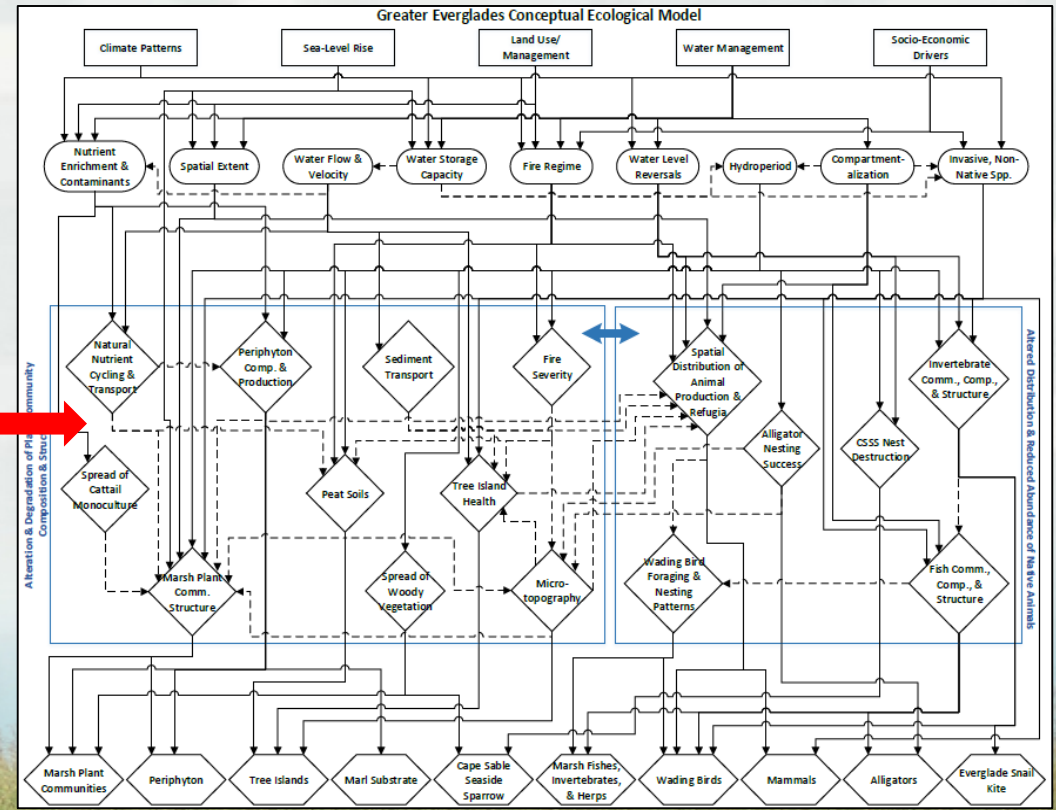
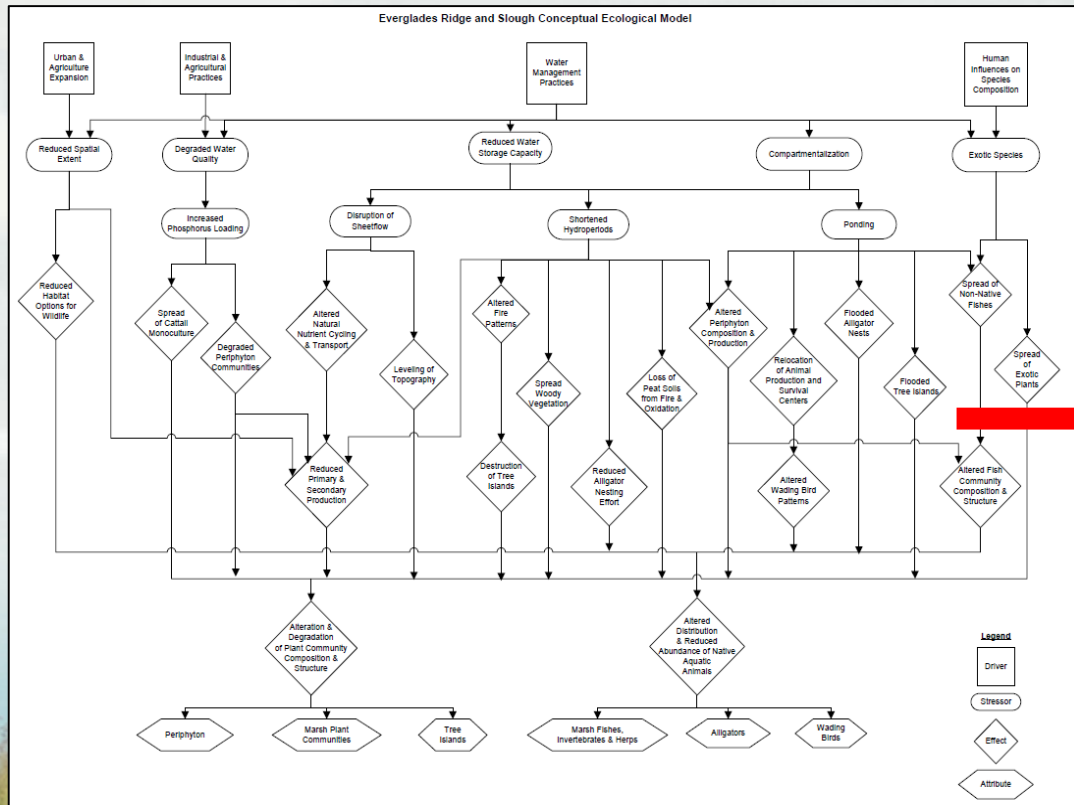
Monitoring region	WCA-3A/B	Shark River Slough	Taylor Slough
K	2.901	2.757	2.625
r	0.097	0.006	0.003
Y0	0.300	1.486	1.08



# Greater Everglades Example: Prey Base Fish



# Improving scientific tools will enhance the ability of Everglades restoration projects to restore and sustain the Everglades ecosystem



- Updates to conceptual ecological models
- Vulnerability analysis





# QUESTIONS

RECOVER Conceptual Ecological Models:  
<http://141.232.10.32/pm/recover/cems.aspx>

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