NSF-LTER Mini-Symposium

Arlington, VA , 26 Feb, 2004

Water Management in Florida's Everglades

Fred H. Sklar, Chief Scientist
Everglades Division
South Florida Water Management District

CENTRAL & SOUTHERN FLORIDA PROJECT

COMPREHENSIVE EVERGLADES RESTORATION PLAN

SFWMD Background

- Required by Florida Statutes to supply water to municipalities.
- Required by the 1988 Settlement Agreement (Dept. of Interior vs. the State of Florida) to stop polluting the Everglades so as to not cause "ecological imbalance."
- Required by Federal Regulations to work with the US Army Corps of Engineers to operate the system** for flood control.

The Everglades Management System**

6 million people

1 million acres of wetland

500,000 acres of agriculture

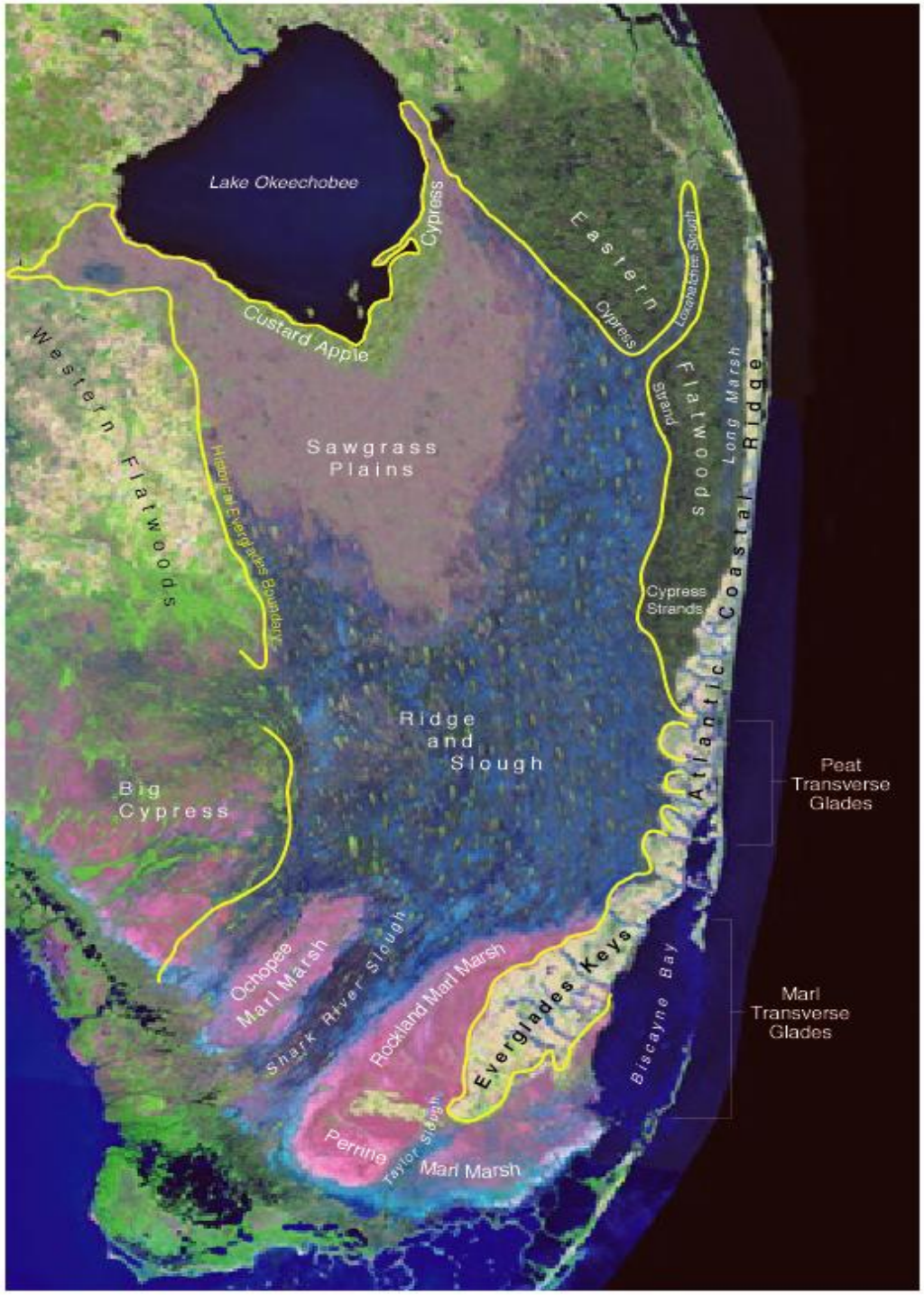
1600 km of canals and levees

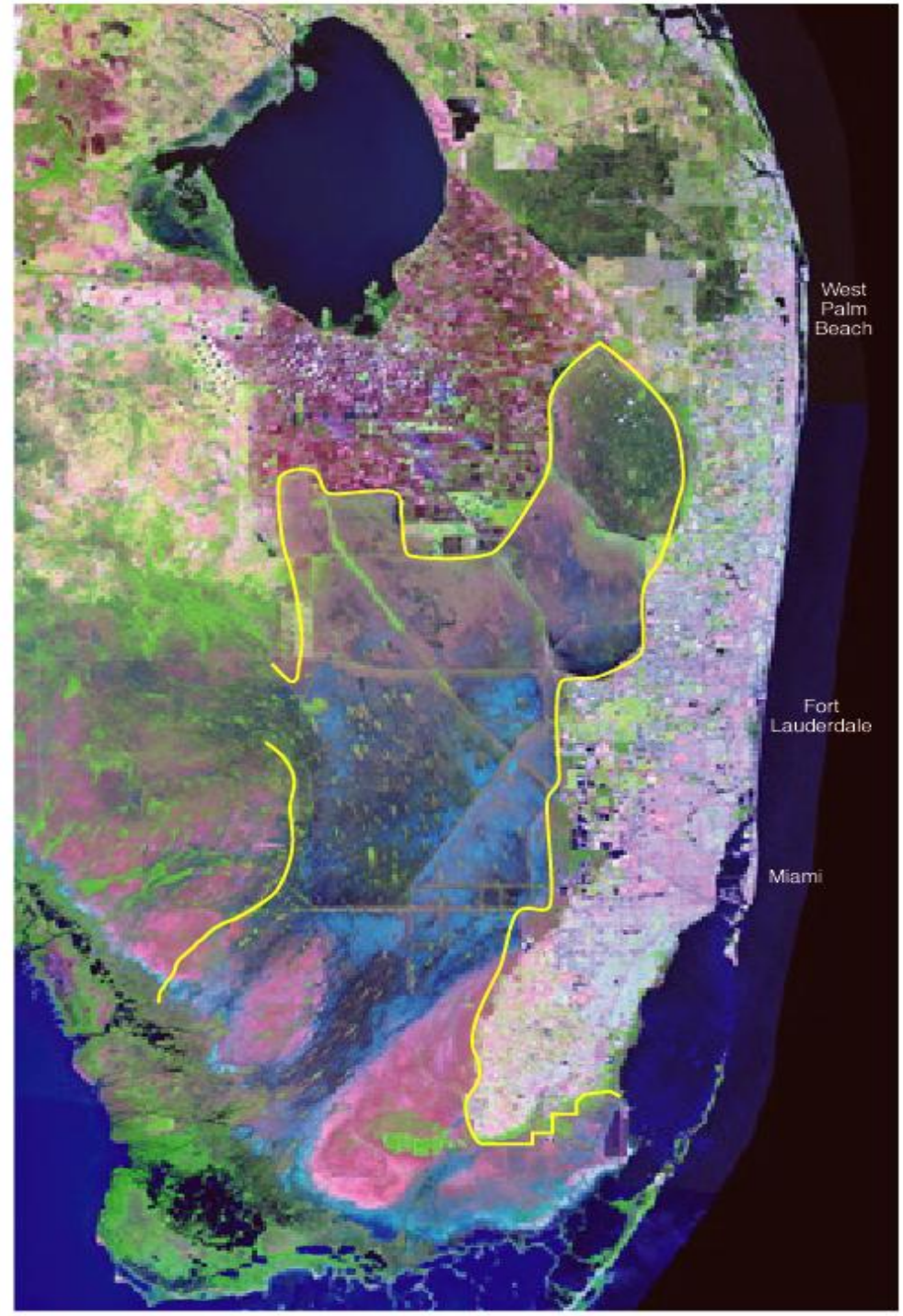
500 water control structures

Restoration Background

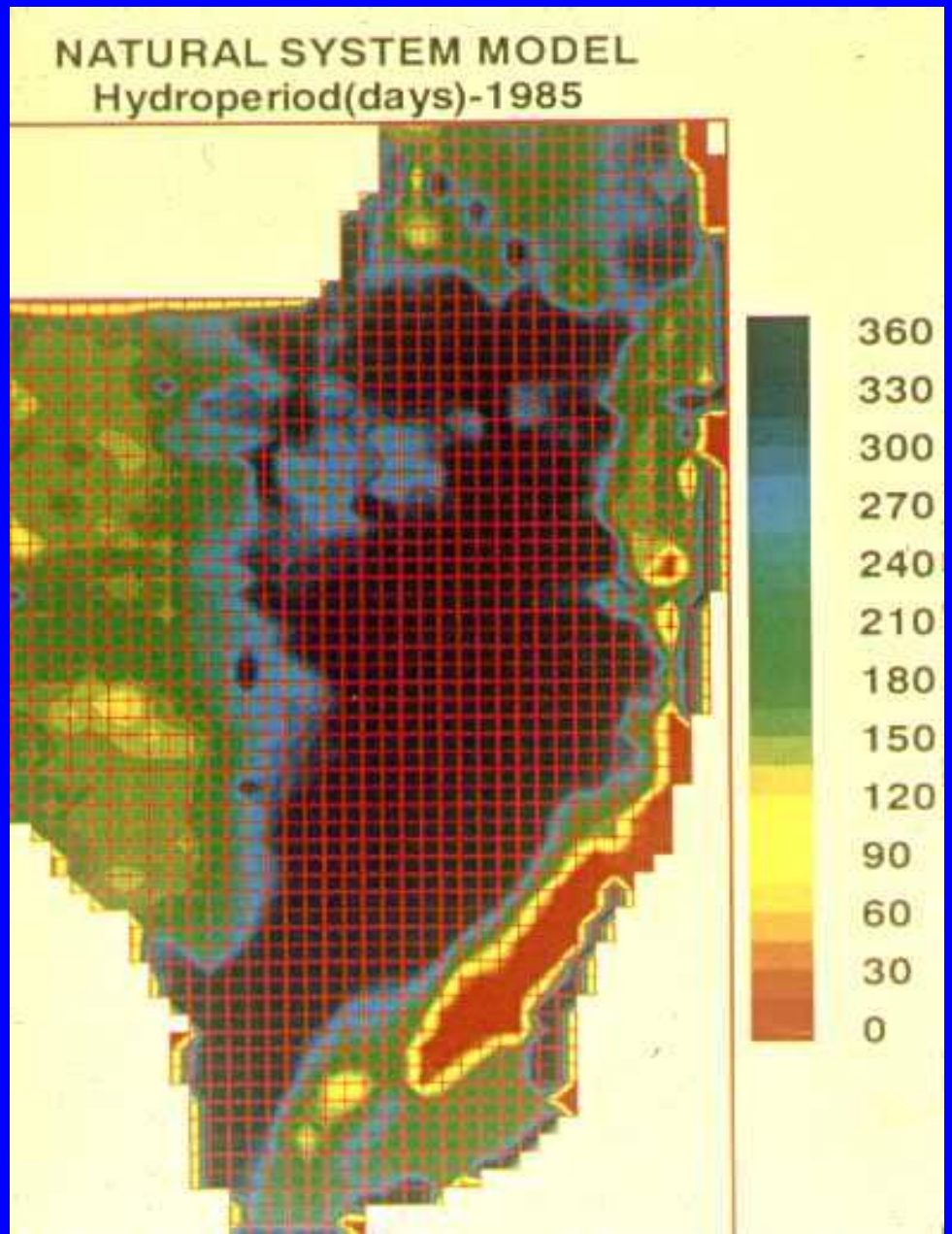
The Water Resource Development Act of 2000 approved the potential to spend $8.4 billion over 24 years as outlined in the Comprehensive Everglades Restoration Plan (CERP).

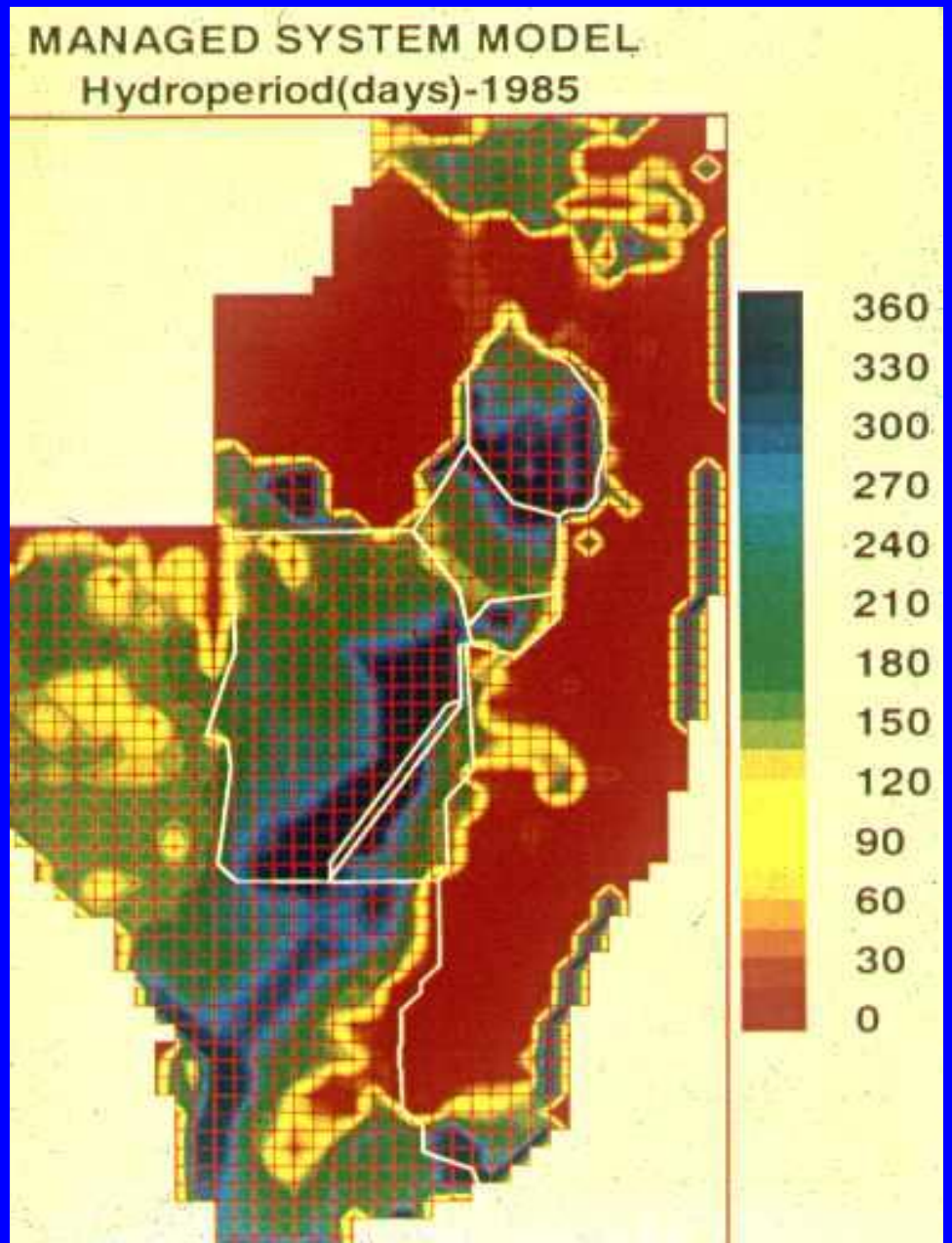
- CERP is "a framework for modifications and operational changes to the Central and Southern Florida Project that are needed to restore, preserve, and protect the South Florida ecosystem...".
- CERP will "ensure that new scientific or technical information or information that is developed through the principles of adaptive management…are integrated into the plan"
- CERP will "…provide a means by which the restoration success of the Plan may be evaluated throughout the implementation process."

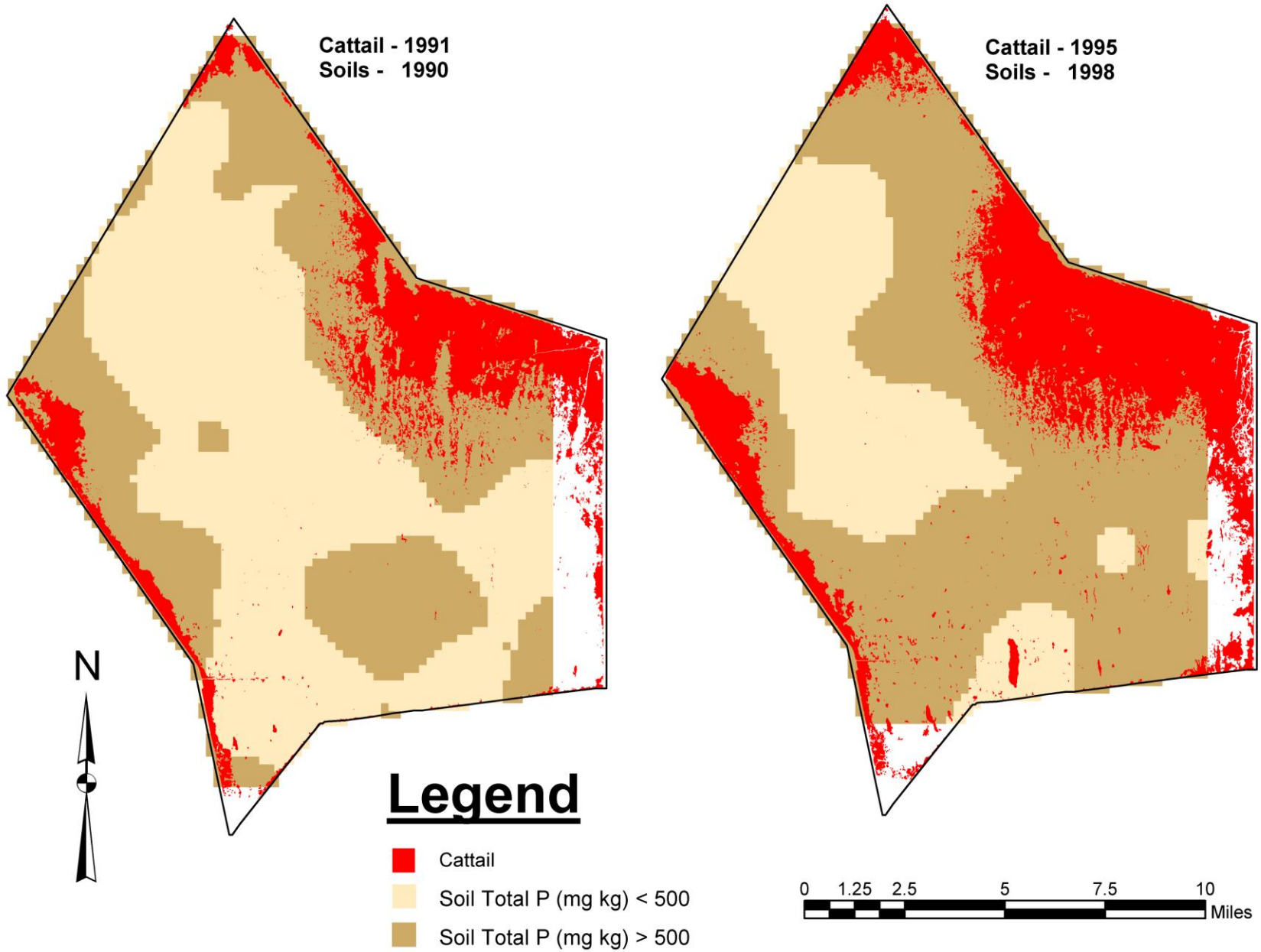

Lake Okeechobee
Cypress
Custard Apple
Eastern
Cypress
Loxahatchee Slough
Western Flatwoods
Sawgrass Plains
Historical Everglades Boundary
Flatwoods
Strand
Long Marsh
Ridge
Cypress Strands
Coastal
Ridge and Slough
Atlantic
Peat Transverse Glades
Big Cypress
Ochopee Marl Marsh
Shark River Slough
Rockland Marl Marsh
Everglades Keys
Biscayne Bay
Marl Transverse Glades
Pennine
Taylor Slough
Marl Marsh


West Palm Beach
Fort Lauderdale
Miami

Duration of flooding (hydroperiod), currently (right) and under pre-drainage conditions (left).

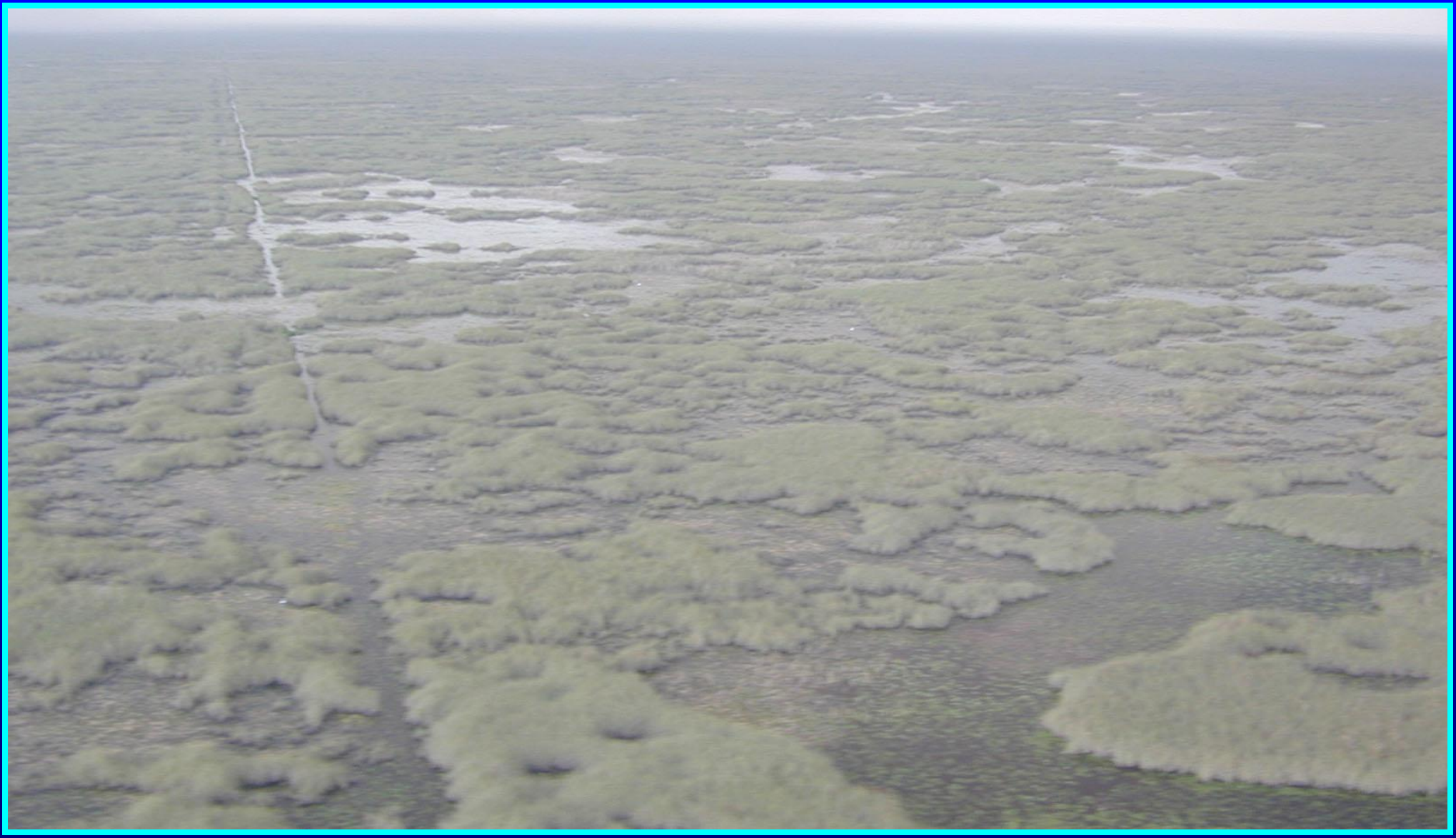




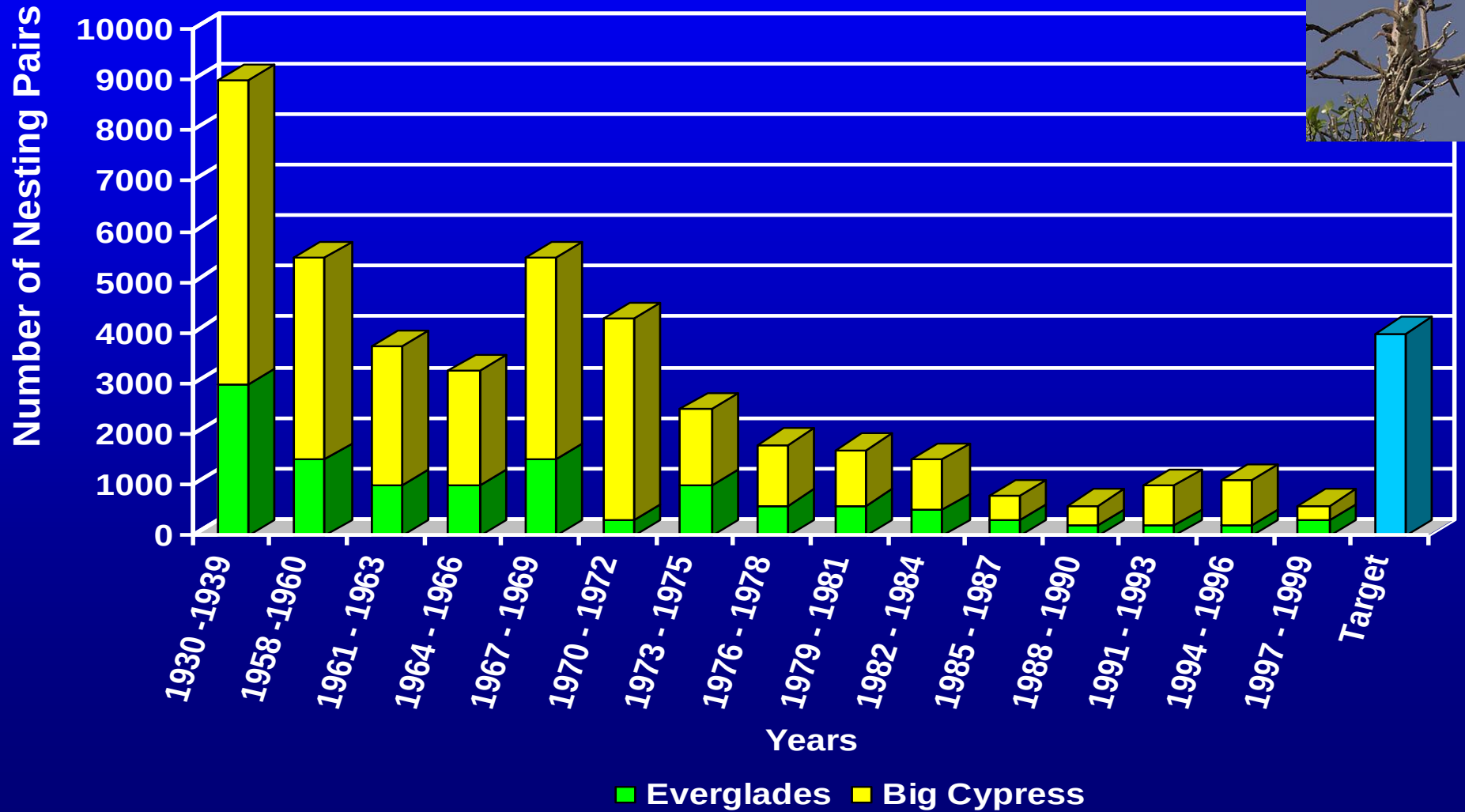

Cattail - 1991
Soils - 1990
Cattail - 1995
Soils - 1998
N
Legend
Cattail
Soil Total P (mg kg) < 500
Soil Total P (mg kg) > 500
0 1.25 2.5 5 7.5 10
Miles

“pre-drainage” ridge & slough landscape.

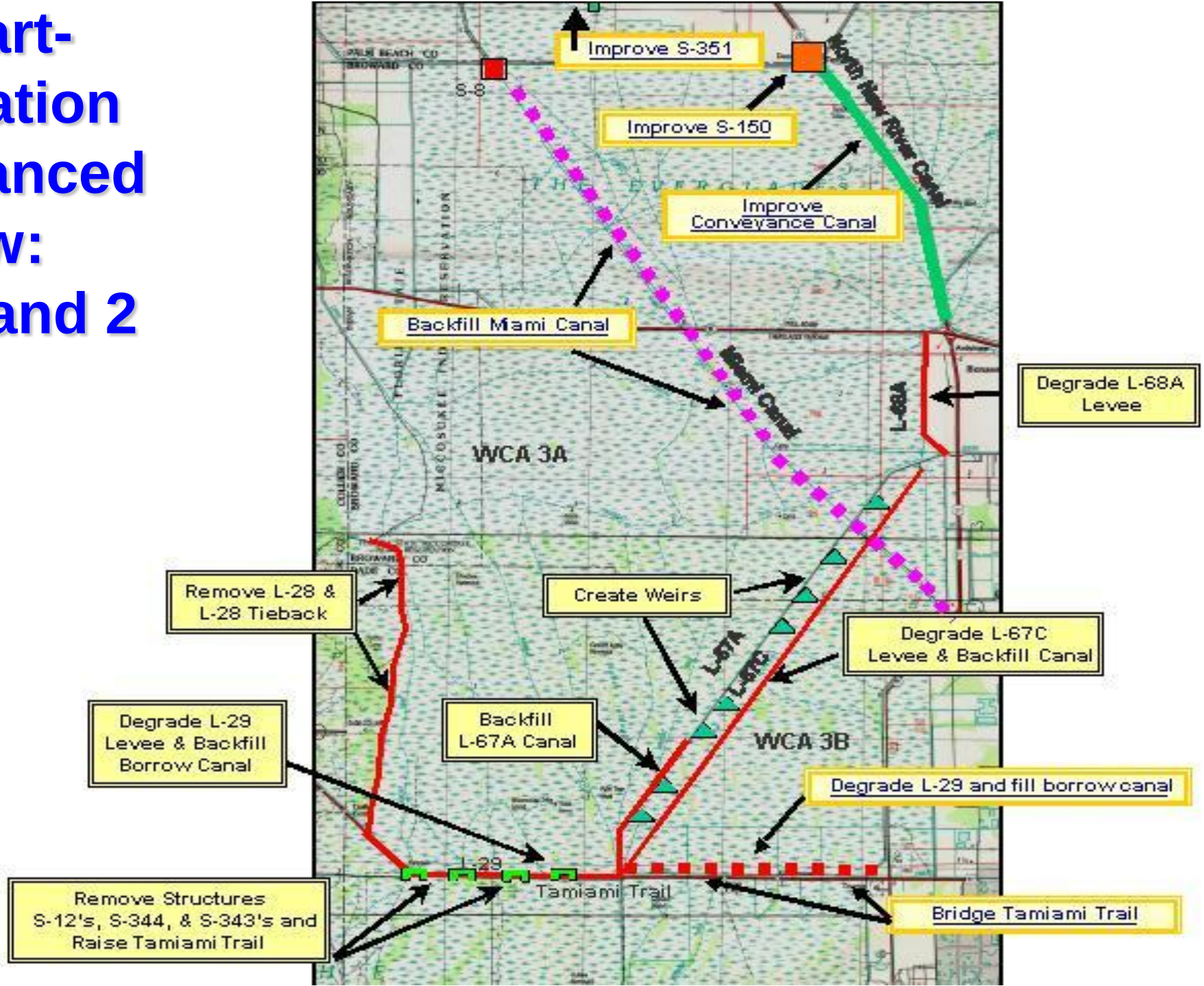
impacted ridge & slough landscape



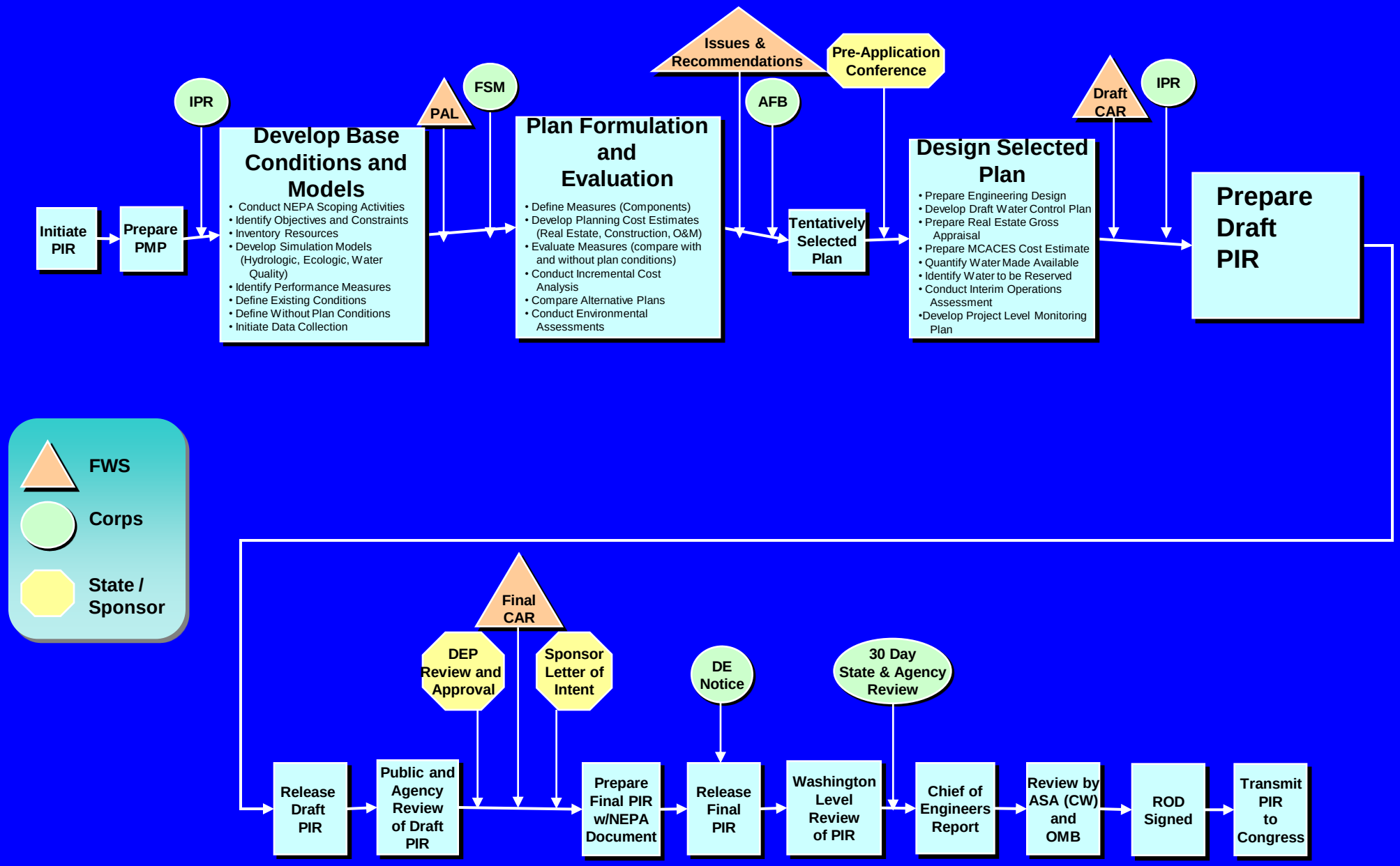
Example: Trends in South Florida Wood Storks



Decompart-mentalization and Enhanced Sheetflow: Phase 1 and 2



TYPICAL PIR PROCESS



Web Joke

- A man in a hot air balloon realizes he is lost, reduces altitude and spots a woman below. He descends and shouts:
  - "Excuse me, can you help me? I promised a friend I would meet him an hour ago, but I don't know where I am.
- The woman below responds:
  - You are in a hot air balloon, hovering 10 feet above an alkaline desert shrub habitat, 2.7 miles east of the Colorado River, near a remnant population and spawning ground of the razorback sucker.
- The man says:
  - "You must be an LTER biologist."
- The woman says:
  - "I am, how did you know?"
- The man says:
  - "Well, everything you told me was technically correct, but I have no idea what to make of your information, and the fact is - I am still lost. Frankly, you've not been much help."

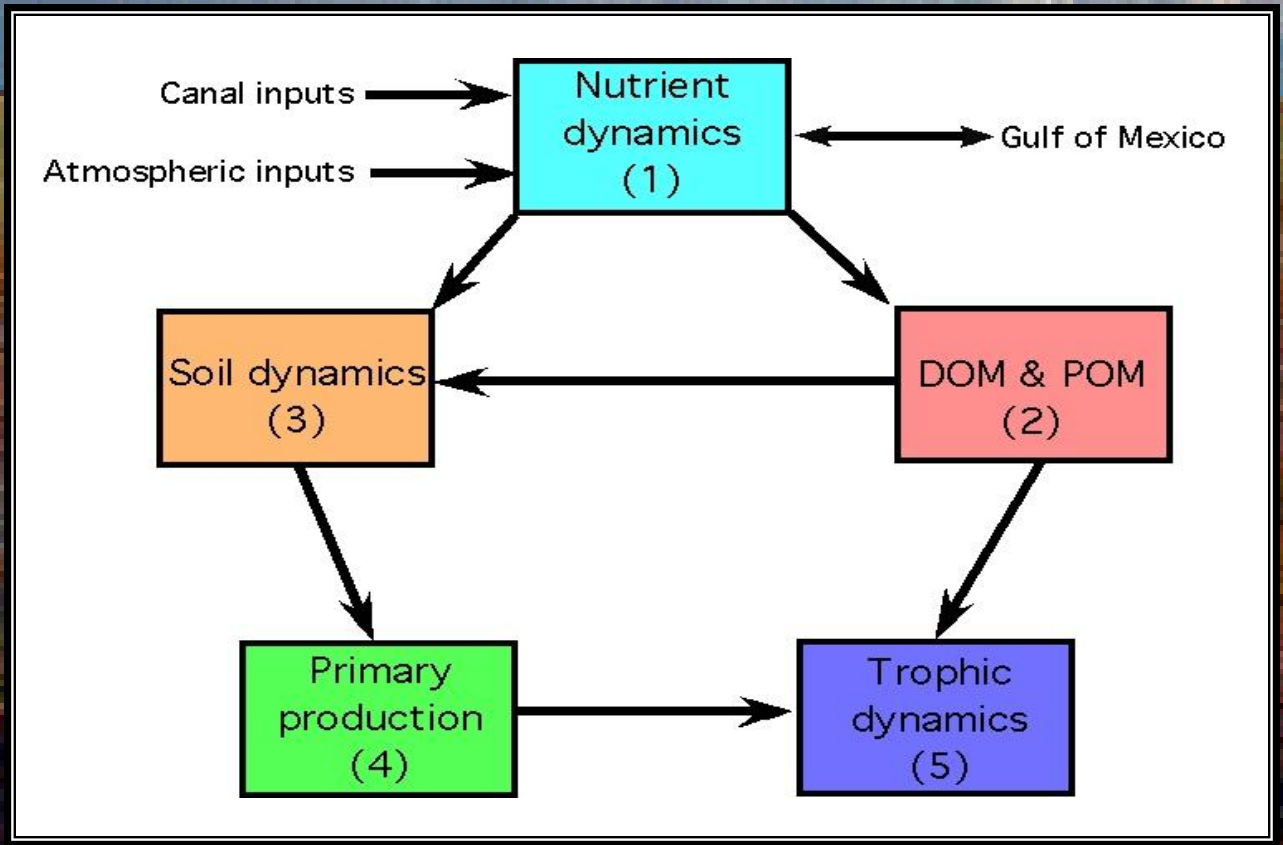
Joke - Cont'd

- The woman says: "You must be a project manager."
- The man says: "I am, how did you know?"
- The woman says: "Well, you don't know where you are, or where you are going.
- You have risen to where you are due to a large quantity of hot air.
- You made a promise to someone that you have no idea how to keep, and you expect me to solve your problem.
- The fact is, you are in exactly the same position you were before we meet, but somehow it's now my fault."

Lesson to Learn: Managers and scientists must do a better job of working together.

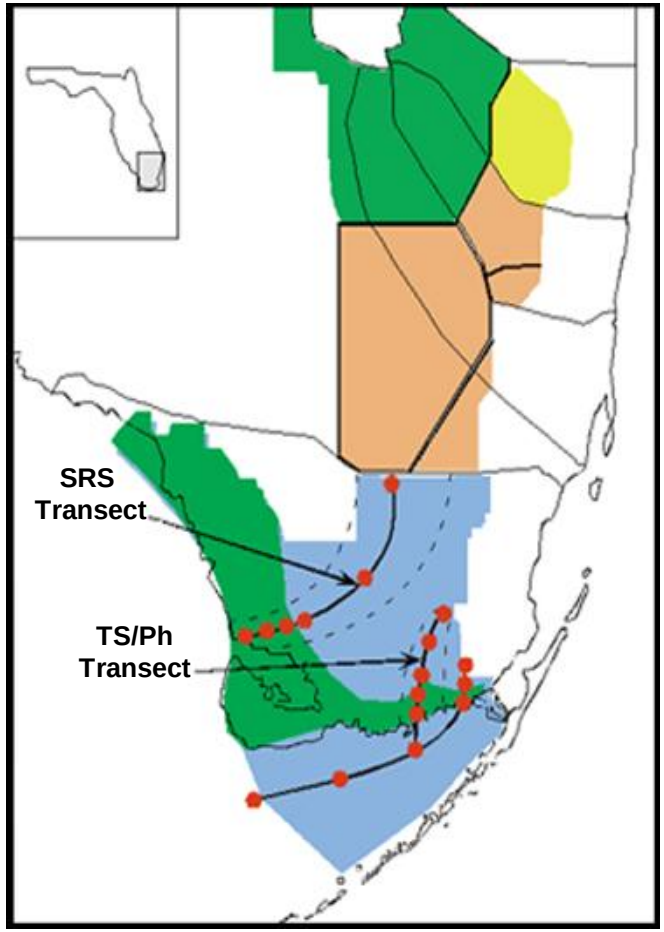
The Florida Coastal Everglades LTER Program

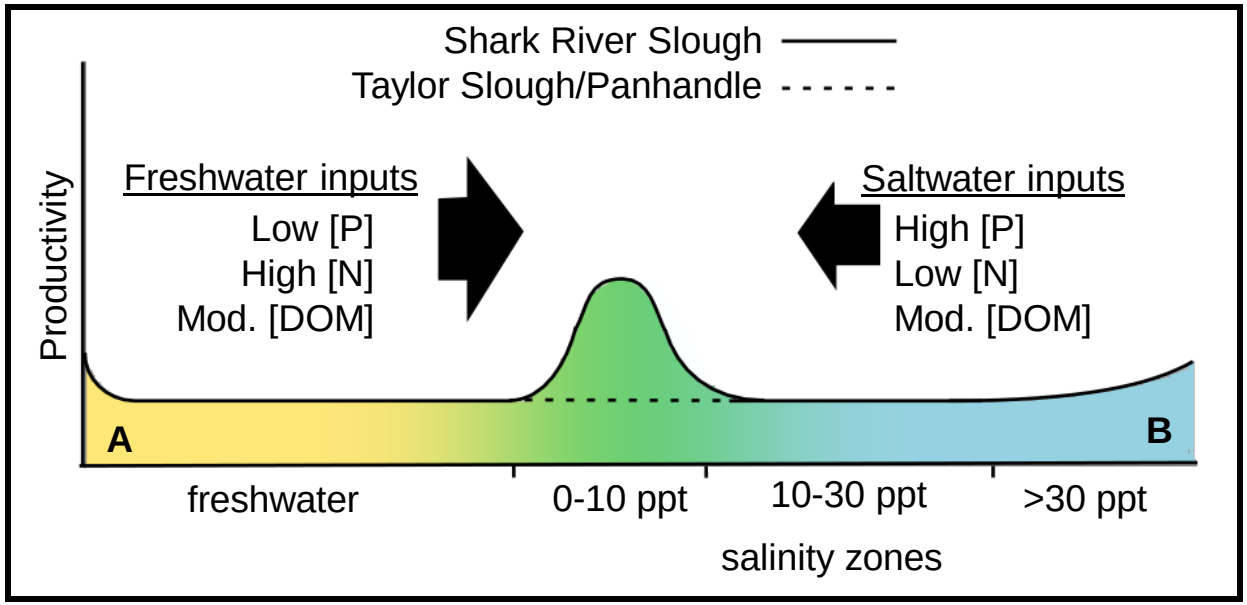
http://fcelter.fiu.edu



The FCE LTER Central Theme

The quality and quantity of ecosystem productivity is a landscape feature controlled by upstream and adjacent biogeochemical gradients





Water Quality and Nutrient Transport

Monthly means of continuous TN concentration
Shark River Slough transect

Florida Bay Restoration: Evidence for Concern

- **Seagrass die-off preceded the occurrence of large-scale algal blooms**
- **Bioassays of phytoplankton production in central and western FL Bay often demonstrated N limitation**
- **N concentrations in Everglades' runoff is high, relative to coastal waters**
- **Phytoplankton blooms occur in FL Bay region where P from Gulf of Mexico mixes with N from southeast Everglades**
- **Correlation of flow and bloom magnitude**

A Trip down the Shark River Estuary

SRS-4: Freshwater ecotone, farthest from marine influence

A Trip down the Shark River Estuary

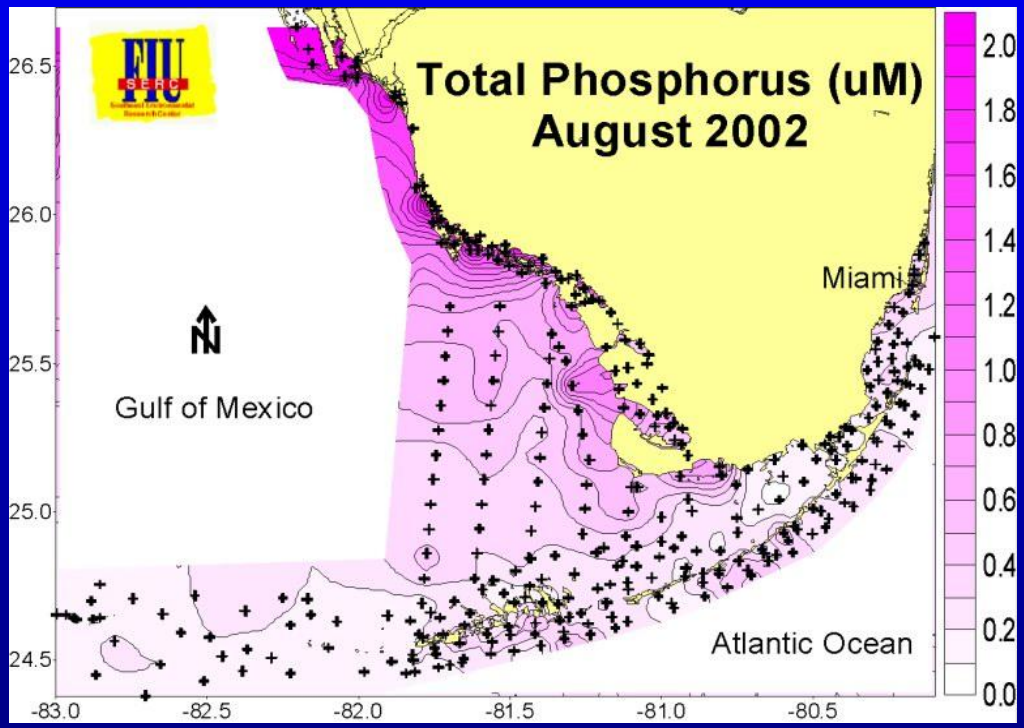
SRS-5: Intermediate site

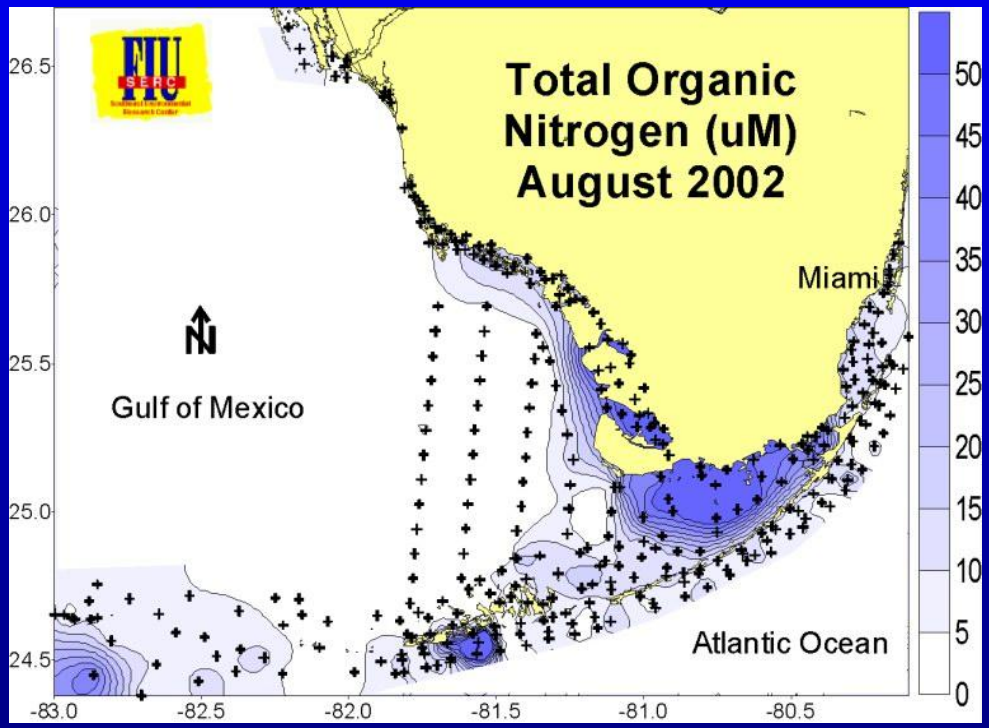
A Trip down the Shark River Estuary

SRS-6: Closest to marine influence

Water Quality and Nutrient Transport

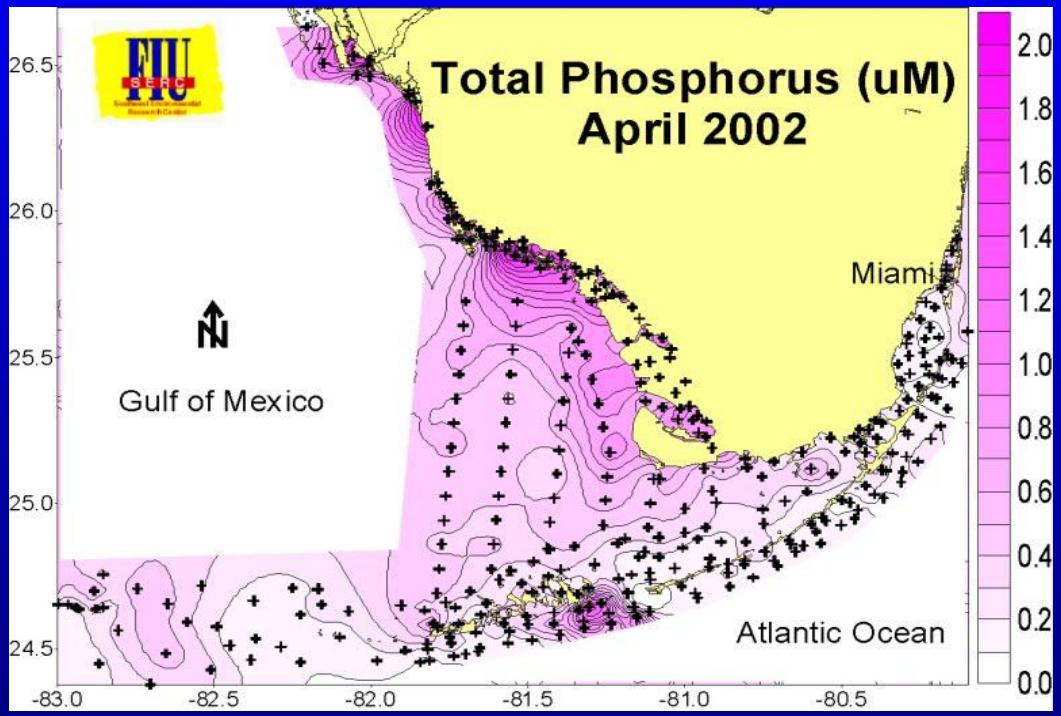
Total nutrient concentrations
Florida Bay estuary & adjacent Gulf of Mexico
Wet Season (2002)

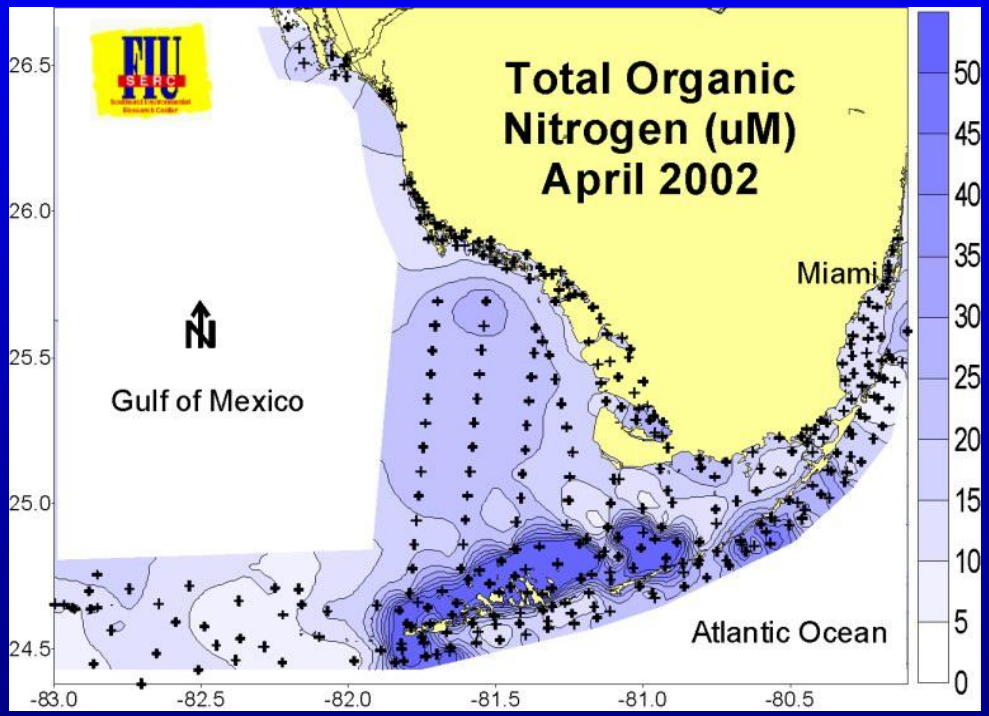




Water Quality and Nutrient Transport

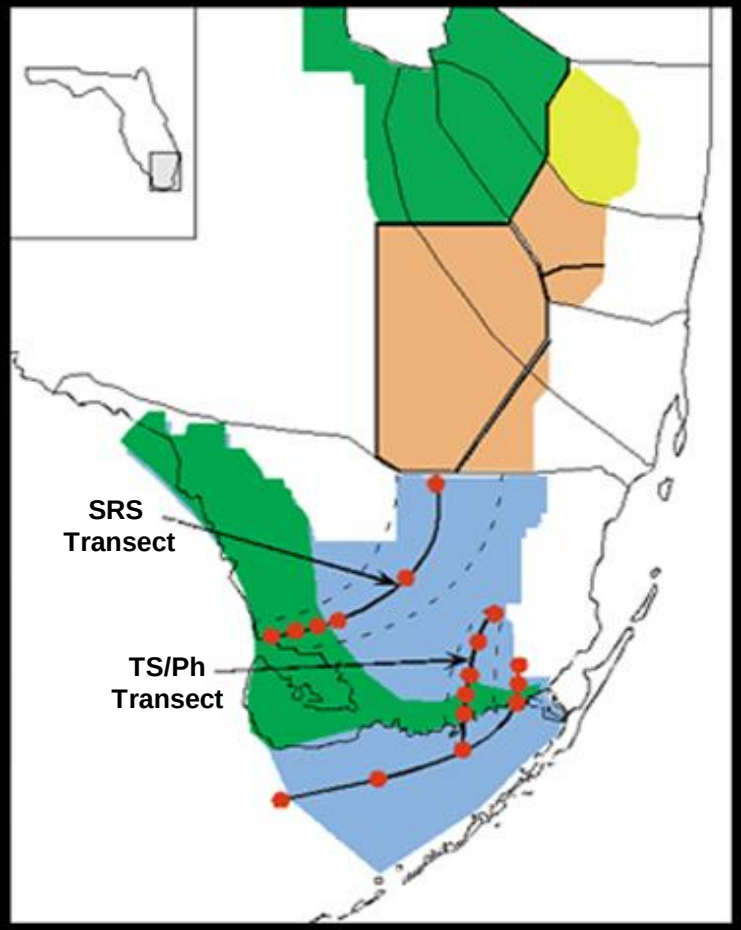
Total nutrient concentrations
Florida Bay estuary & adjacent Gulf of Mexico
Dry Season (2002)





The FCE LTER Central Theme:

Following water as it flows from canal to the Gulf of Mexico through 2 different Everglades wetland basins



FCE-LTER CORE QUESTIONS THAT ARE IMPORTANT FOR WATER MANAGEMENT

- **To what extent does the magnitude of freshwater flowing into the mangrove ecotone control water residence time, and thus productivity in this region?**

- **How does water residence time interact with local process rates to determine oligohaline productivity patterns?**

- **Does the mangrove productivity effect Florida Bay, or is the bay largely disconnected from this oligohaline ecotone?**

Examples of FCE-LTER Thinking "outside-the-box"

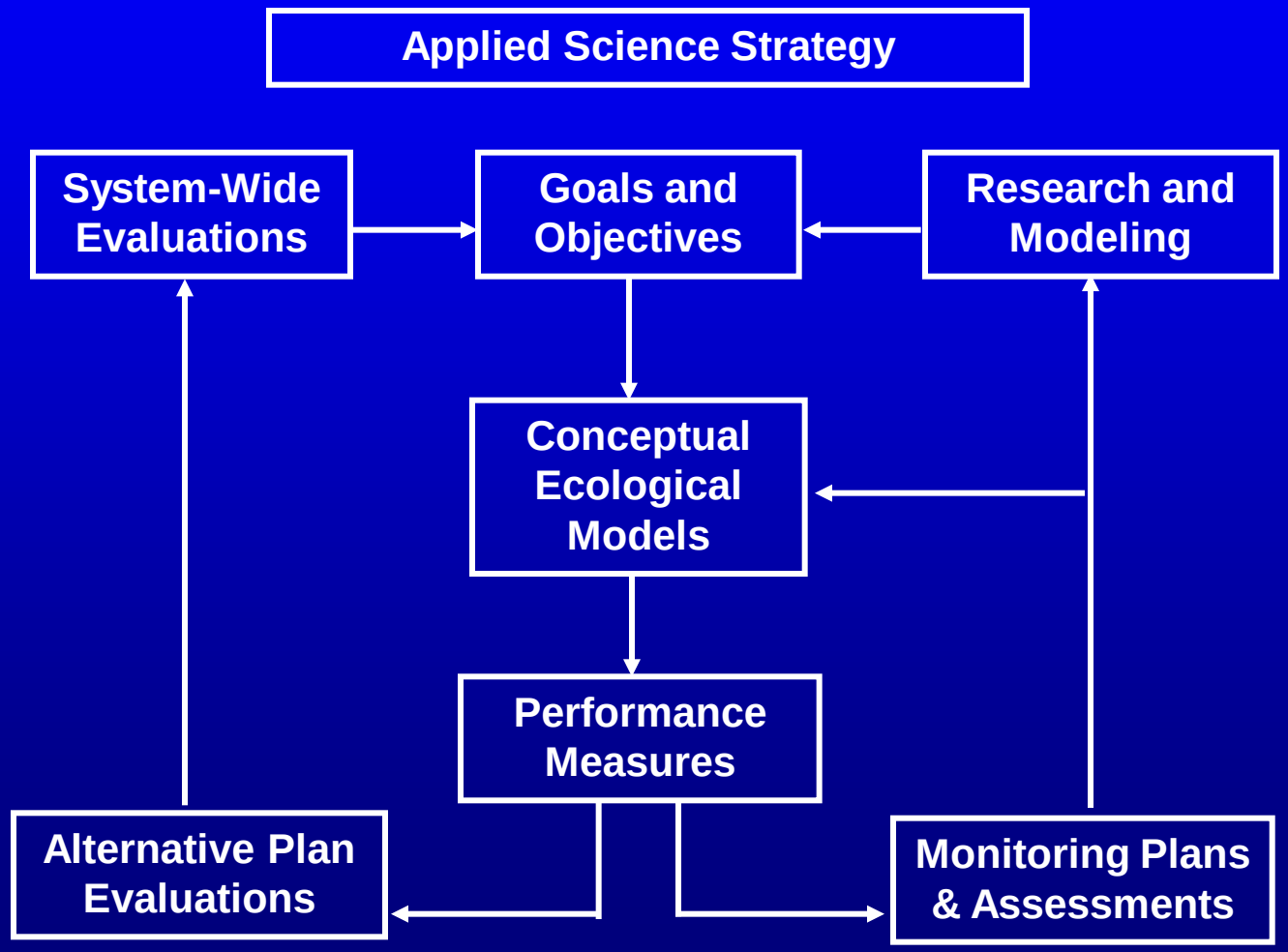
- TN increases down Taylor Slough
- TN from Everglades is in the form of dissolved organic matter
- Distinct DOM chemical composition per region
- The production of labile compounds in the coastal ecotone may influence seagrass restoration

The Problem with Restoration: The science that was the basis for CERP was good but mostly hydrologic. The biological and ecological performance measures, used to evaluate alternative plans, were mostly qualitative. We now find ourselves having to conduct scientific "catch-up" to make sure that plans are sound and likely to succeed.

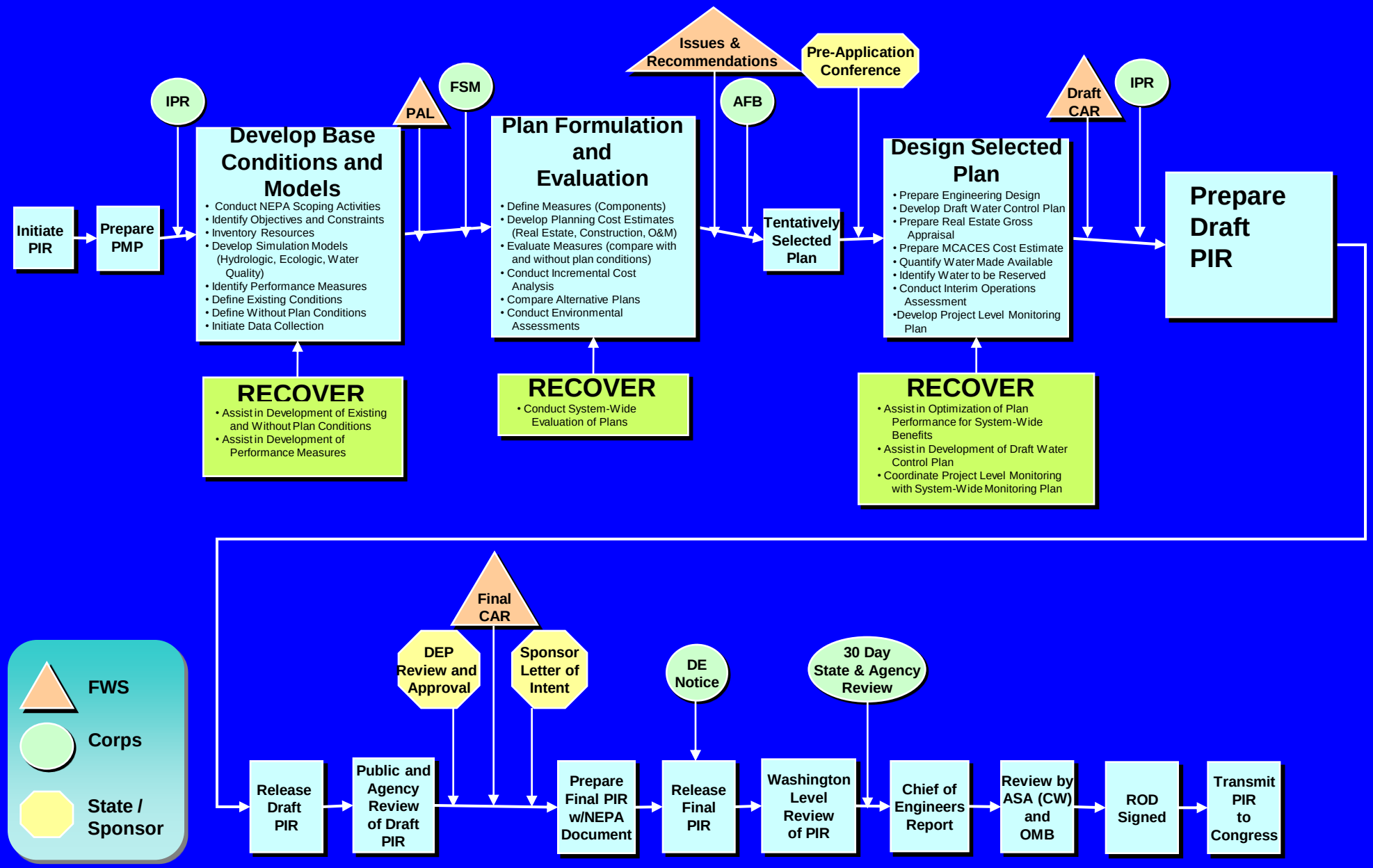
The Solution from LTER: Adaptive resource management is "… learning by doing..." it involves "… large-scale management experiments that directly reveal process impacts..." (Walters 1997).

The Adaptive Management Process

Reduce Uncertainty & Incorporate New Information



TYPICAL PIR PROCESS



Conclusions

Scientific issues that can be resolved by the FCE-LTER for improved Everglades management include:

- –Understanding the downstream impacts of nutrient loads and transformations
- –Defining restoration “targets” for ecological attributes with high temporal or spatial variance
- –Developing freshwater requirements for Florida Bay
- –Developing criteria for the restoration of flow

Conclusions (cont'd)

Adaptive management will ensure that new scientific and technical information developed by the FCE-LTER are incorporated into the restoration efforts.

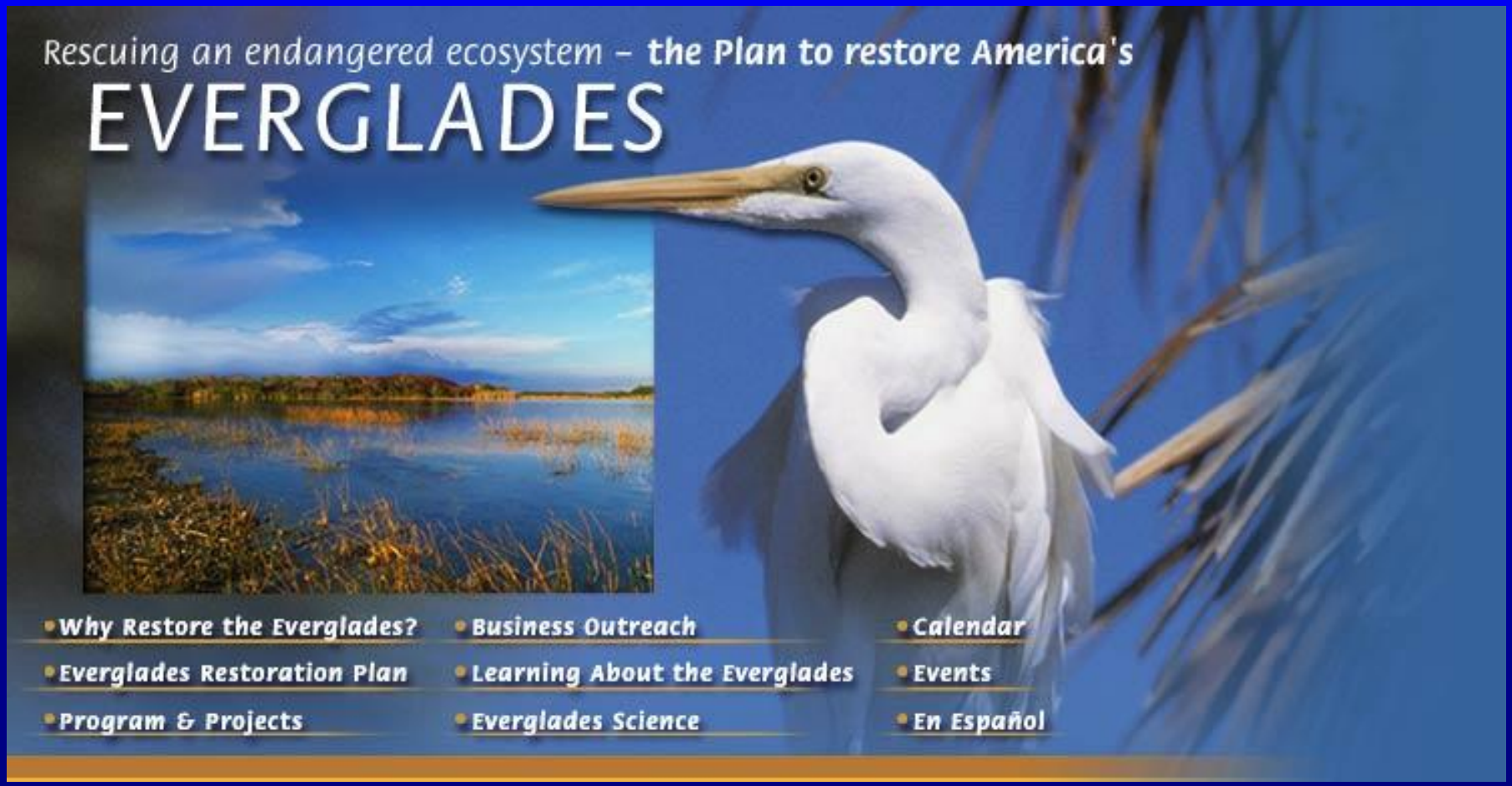
Water management and Everglades restoration provide a framework for long-term science and a unique feedback to the FCE-LTER for the testing of ecological and landscape hypotheses.

The Real Conclusions!

1. True applicability of LTER science depends upon fiscal integration with management science… Money Talks!

2. True integration will require management scientists to collaborate with LTER scientists… Peer-review!

www.evergladesplan.org



RECOVER - REstoration COordination and VERification

A multi-agency, multi-disciplinary team of scientists, modelers, planners & resource specialists that are organized to apply the Adaptive Management process in support of the system-wide goals of CERP

RECOVER Leadership Group

Operations Planning Team

1. Assist in design of operational criteria for plan components
2. Recommend interim operational improvements during plan implementation

Model Development and Refinement Team

1. Develop, review, and revise predictive models
2. Coordinate system-wide and project models

Comprehensive Plan Refinement Team

1. Recommend Refinements to Comprehensive Plan
2. Provide Comprehensive Plan Updates for PIRs and Plan Modification Reports

Adaptive Assessment Team

1. Design & Revise Conceptual Models
2. Design & Revise Regional Monitoring
3. Annual Adaptive Assessment Report
4. Science Peer Review

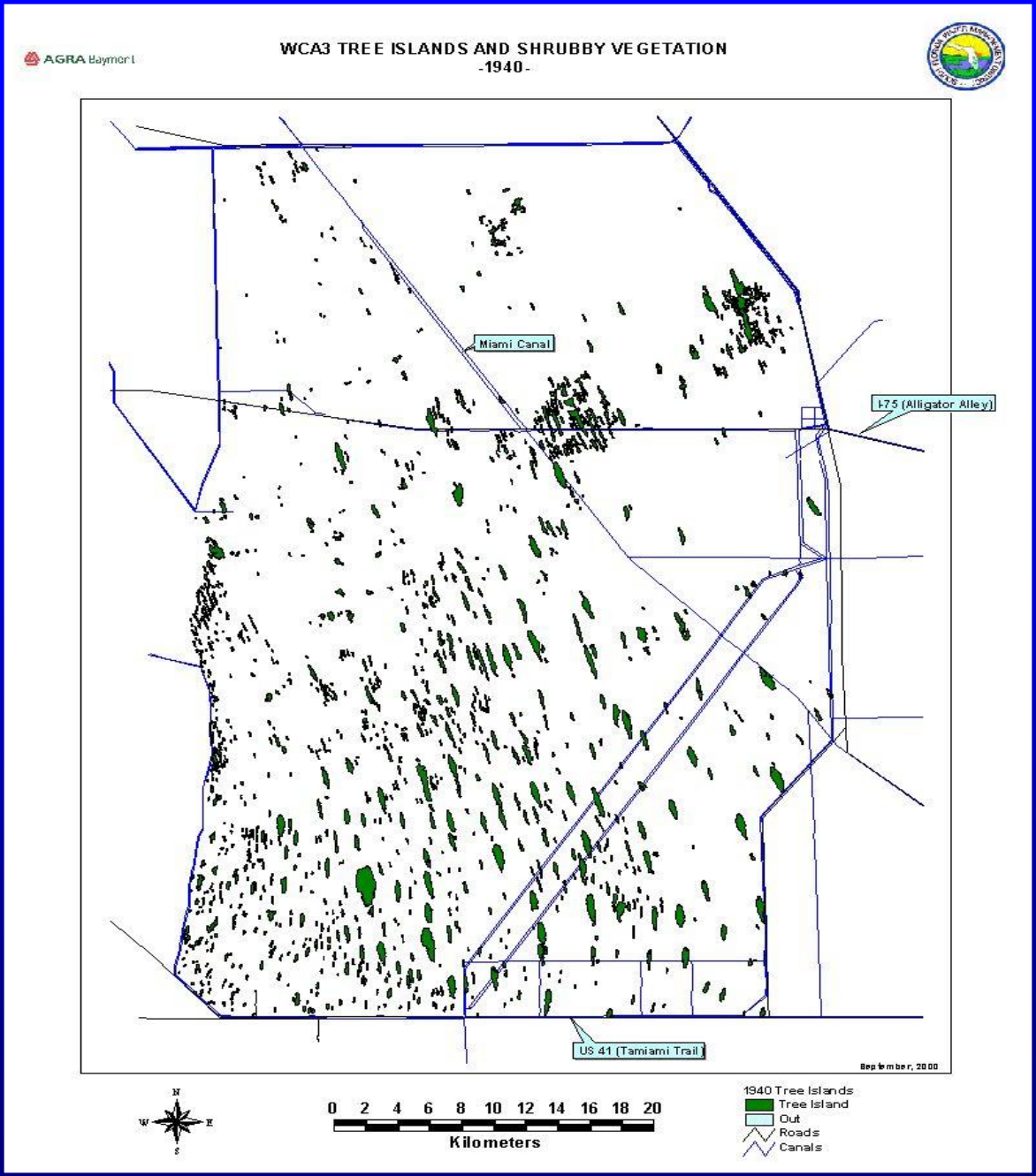
Regional Evaluation Team

1. Design & Revise Performance Measures
2. Conduct Evaluations of Comprehensive Plan Components
3. Technical Issue Resolution

1940

Tree Island Map

1940 aerial photos were used to identify tree islands (green) in WCA3; Tree islands equal 22,000 acres.



1995

Tree Island Map

1995 aerial photos were used to identify tree islands (green) in WCA3; 60% of the 1940 islands have been lost.