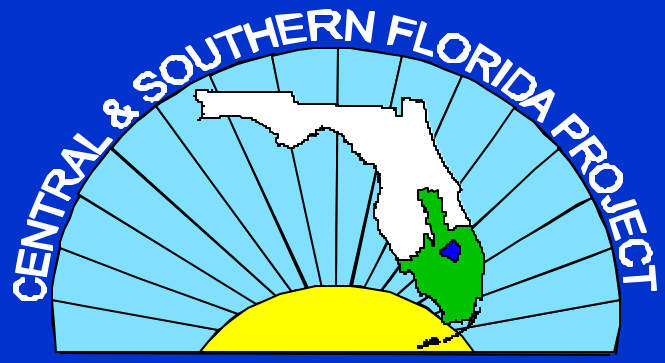
C&SF Project Comprehensive Everglades Restoration Plan

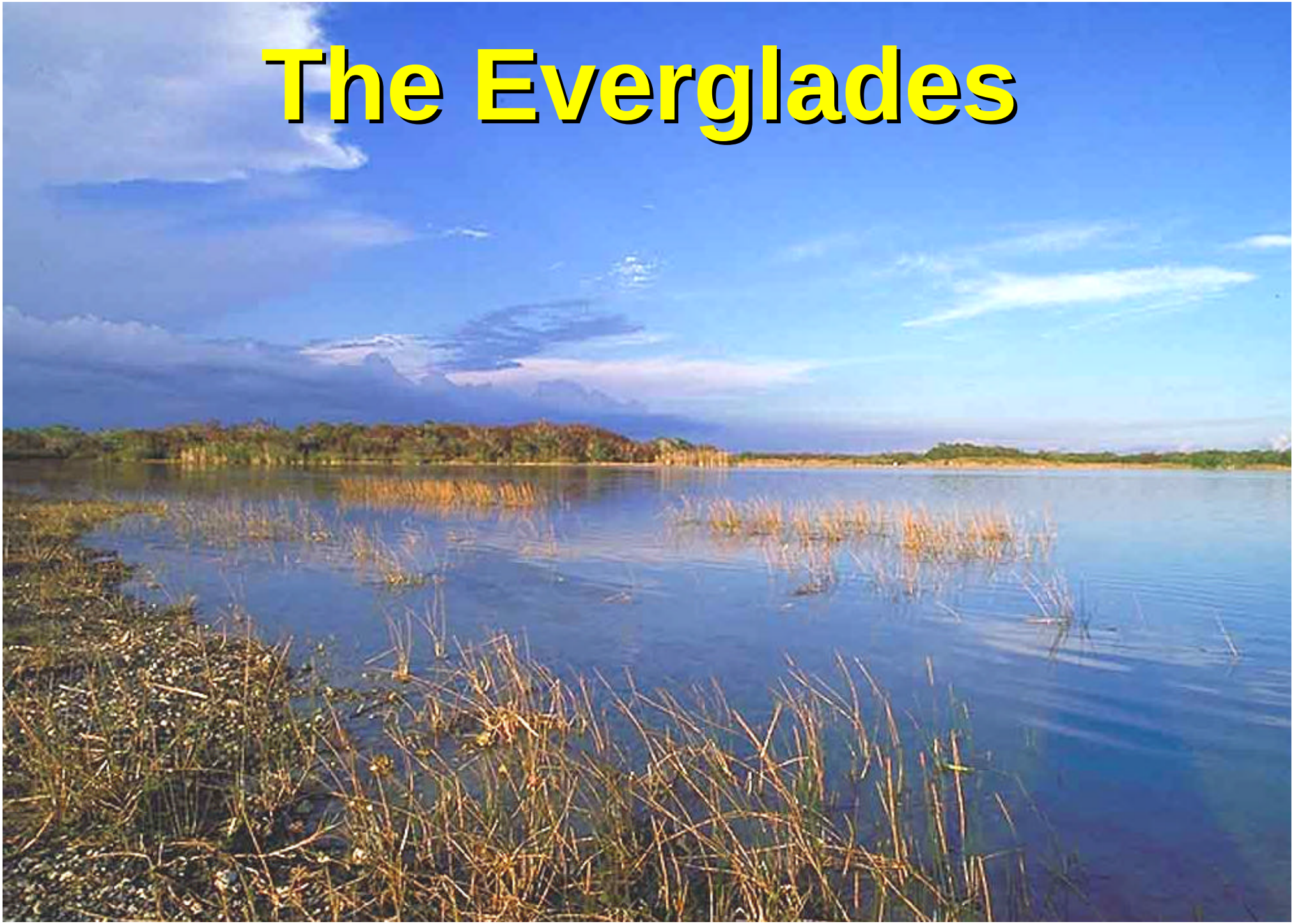
A Monitoring and Assessment Plan



COMPREHENSIVE EVERGLADES RESTORATION PLAN

John C. Ogden,
South Florida Wat
Management Distr

The Everglades



South Florida Ecosystem

- ✓ Area - 18,000 square miles
- ✓ Population today ~ 6 million

How has the Everglades Changed?

1) 50% reduction in extent of true Everglades
2) Sea level rise
3) Degraded water quality (nutrients, mercury)
4) Loss of organic soils
5) Reduced water storage capacity
6) Compartmentalization (loss of sheet flow)
7) Introduction of exotic plants and animals
8) Altered salinities

Everglades Problems - A Sampler

1) Collapse in production & survival of aquatic organisms
2) 90% reduction in nesting wading birds
3) Die-off of seagrasses
4) 65 listed species
5) Collapse in L. Okeechobee & estuarine fisheries
6) Die-off of Everglades tree islands
7) Restructuring of Everglades marsh communities
8) Increased urban water restrictions

A Mission Statement for Everglades Restoration

“The overarching objective of the Comprehensive Plan is the restoration, preservation and protection of the south Florida ecosystem while providing for the water related needs of the region.”

“The Yellow Book”

Everglades Restoration

SOME KEY QUESTIONS

- What is restoration?

- What are the physical and ecological characteristics of the natural system that we should be measuring to define success ?

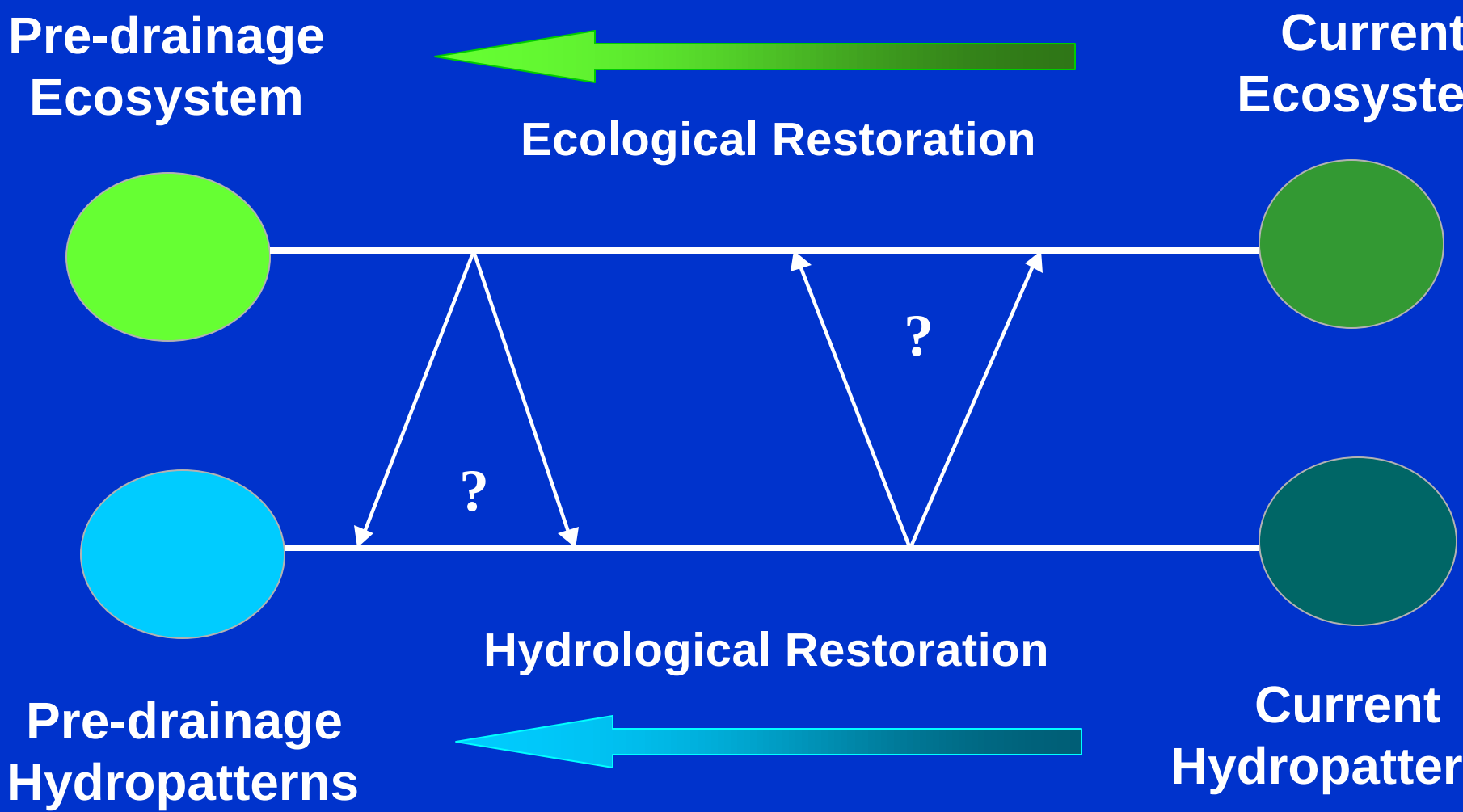
- What should the restored system look like/be like?

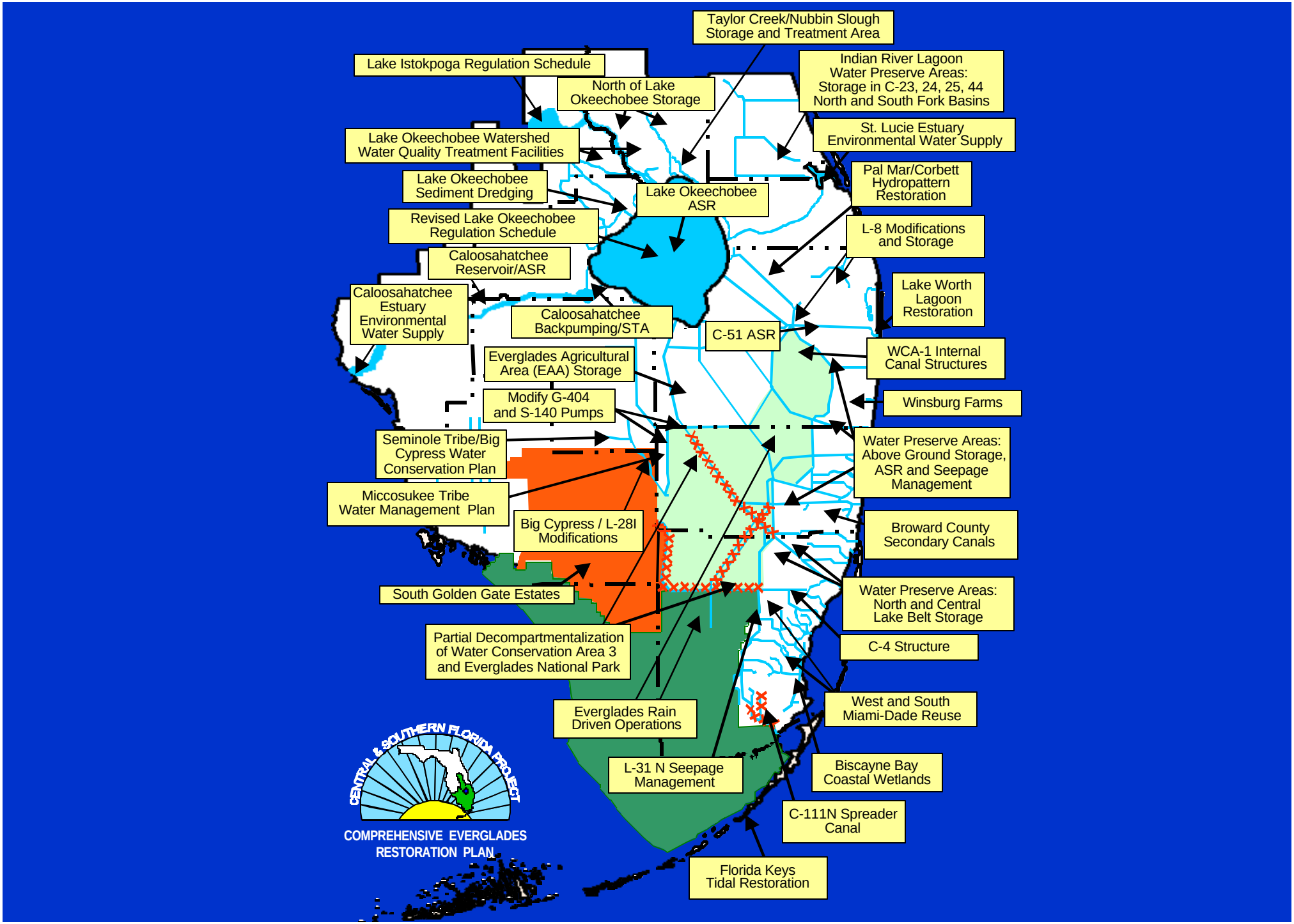
UNCERTAINTY

" A lost world - One that we will never know as well as we would like…"

William B. Robertson, Jr. 1990

What is Restoration?




Taylor Creek/Nubbin Slough Storage and Treatment Area
Lake Istokpoga Regulation Schedule
North of Lake Okeechobee Storage
Indian River Lagoon Water Preserve Areas: Storage in C-23, 24, 25, 44 North and South Fork Basins
St. Lucie Estuary Environmental Water Supply
Lake Okeechobee Watershed Water Quality Treatment Facilities
Pal Mar/Corbett Hydropattern Restoration
Lake Okeechobee Sediment Dredging
Lake Okeechobee ASR
L-8 Modifications and Storage
Revised Lake Okeechobee Regulation Schedule
Caloosahatchee Reservoir/ASR
Lake Worth Lagoon Restoration
Caloosahatchee Estuary Environmental Water Supply
Caloosahatchee Backpumping/STA
C-51 ASR
WCA-1 Internal Canal Structures
Everglades Agricultural Area (EAA) Storage
Modify G-404 and S-140 Pumps
Winsburg Farms
Seminole Tribe/Big Cypress Water Conservation Plan
Water Preserve Areas: Above Ground Storage, ASR and Seepage Management
Miccosukee Tribe Water Management Plan
Big Cypress / L-28I Modifications
Broward County Secondary Canals
South Golden Gate Estates
Water Preserve Areas: North and Central Lake Belt Storage
Partial Decompartmentalization of Water Conservation Area 3 and Everglades National Park
C-4 Structure
West and South Miami-Dade Reuse
Everglades Rain Driven Operations
L-31 N Seepage Management
Biscayne Bay Coastal Wetlands
C-111N Spreader Canal
Florida Keys Tidal Restoration
CENTRAL & SOUTHERN FLORIDA PROJECT
COMPREHENSIVE EVERGLADES RESTORATION PLAN


The Role of Science

The Science of Restoration

How should “science” (i.e., our current understandings of natural systems) be organized to be maximally effective in supporting the Comprehensive Everglades Restoration Plan (i.e.,defining and measuring success)?

This is no small question, where..

1) The temporal and spatial scales of restoration are so large,
2) Knowledge of ecosystem parameters and relationships is incomplete,
3) Uncertainty regarding system responses is a major consideration,
4) Existing information is widely scattered in place and time,
5) Focused efforts are necessary to identify areas of scientific consensus and disagreement.

In spite of these hurdles, science must answer key questions that are prompted by the goals of the restoration plan

1) How are broadly stated restoration goals converted into specific, measurable objectives and performance targets?

2) What constitutes success?

3) How do we convert immense amounts of existing technical and scientific information into formats that effectively support restoration?

Continued...

In spite of these hurdles,...

4) What are the measures, from among thousands of potential components of the natural and human systems, that should be selected as indicators of success?

5) How do we minimize the uncertainties that are inherent in all natural and human systems?

6) How do we assess and improve the restoration plan during the implementation period, as new information becomes available?

Objectives of a system-wide "applied science strategy"

1) Improve the way we collect and synthesize existing information on natural and human systems.

2) Tailor the focus of "science" to better support the restoration processes.

3) Develop a multi-disciplinary consensus on restoration objectives.

Continued...

Objectives of a system-wide "applied science strategy"

4) Respond to existing planning and implementation schedules.

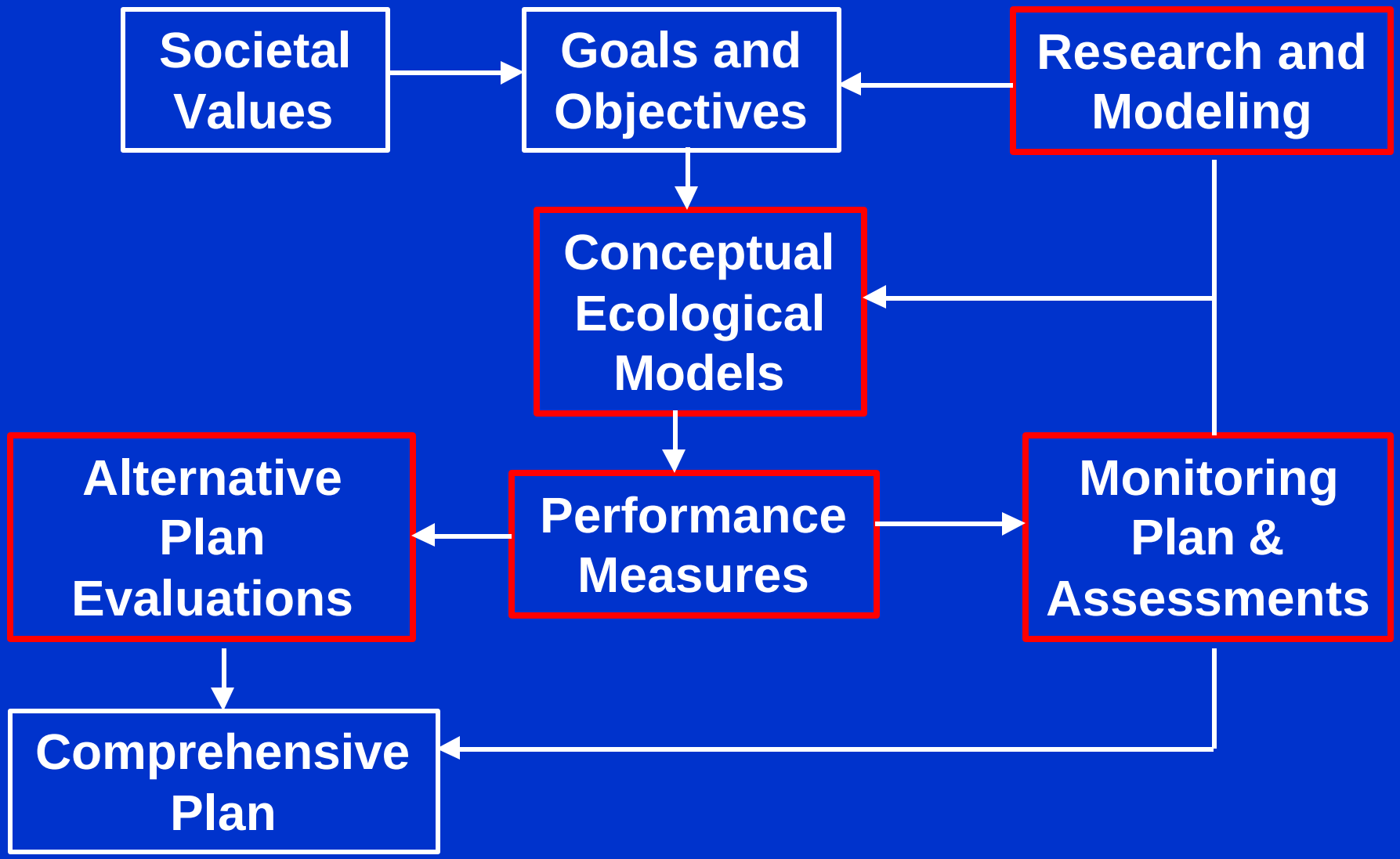
5) Improve communication among scientists and managers.

6) Attract additional scientists to the process.

Applied Science Strategy - Major Components

- Conceptual Ecological Models
- Hydrological and Ecological Simulation Models
- Performance Measures and Targets
- Regional Monitoring Program
- Adaptive Assessment Protocol

Applied Science Strategy



Conceptual Ecological Models

Conceptual Ecological Model

A conceptual model is a diagram of a set of relationships among certain factors that are believed to impact or cause a certain result. A good conceptual model shows how you think specific situations [stressors] affect the status of some other situation [attribute] that you are ultimately interested in influencing.

Conceptual Ecological Model

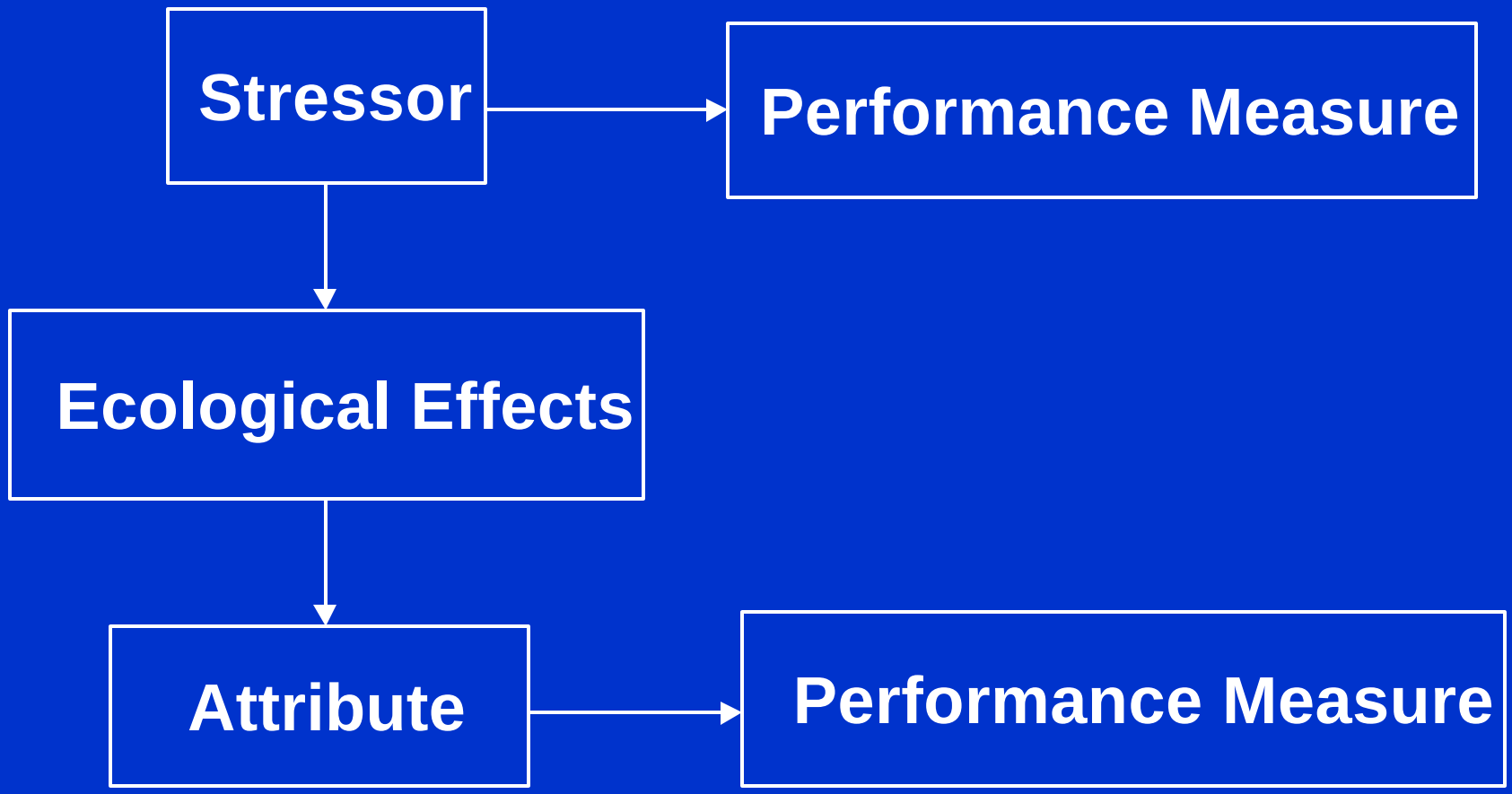
For the Comprehensive Everglades Restoration Plan the conceptual models are used to:

1) convert broad policy-level goals into specific, measurable indicators of the "health" of natural and human systems (performance measures), and
2) develop a suite of "testable" assumptions that explain the cause and effect (ecological) linkages among stressors and attributes, as a basis for identifying restoration and research priorities.

More Specifically, Conceptual Models are used to...

- Identify the major sources of stress on natural systems,
- Identify the ecological effects (linkages) of these stresssors,
- Identify the best set of indicators (attributes) of these ecological effects,
- Create restoration performance measures based on the stressors & attributes.

Conceptual Ecological Models



A Definition of Performance Measures

Performance measures are the indicators of conditions in natural and human systems that have been selected as targets for restoration. Collectively, a well-selected set of performance measures provides a quantitative representation of the overall environmental health of these systems.

A Definition of Performance Measures

Each performance measure identifies:

- An element to be measured (e.g., alligator nesting)
- The appropriate parameter (e.g., number of eggs that hatch per nest)
- The restoration target (e.g., 75% average hatching rate)

Evaluation and Assessment

- Evaluation - Analysis of proposed plans or projects to determine expected performance (pre-construction modeling)
- Assessment - Analysis of actual performance of projects (post-construction monitoring)

Categories of Performance Measures

- **Biological: Healthy living systems**
- **Water quality: Clean water**
- **Hydrological:**
  - **NSM restoration (Everglades, Big Cypress, Florida Bay)**
  - **Enhancement (L. Okeechobee, St. Lucie, Caloosahatchee, Biscayne Bay)**
- **Water supply: Urban/Agr. water supply**

Existing Conceptual Models

- Lake Okeechobee
- Caloosahatchee Estuary
- St. Lucie Estuary
- Everglades Ridge and Slough
- Everglades Marl Prairies
- Big Cypress Basin
- Southern Mainland Mangrove Swamps
- Florida Bay
- Biscayne Bay
- Total System (in prep.)

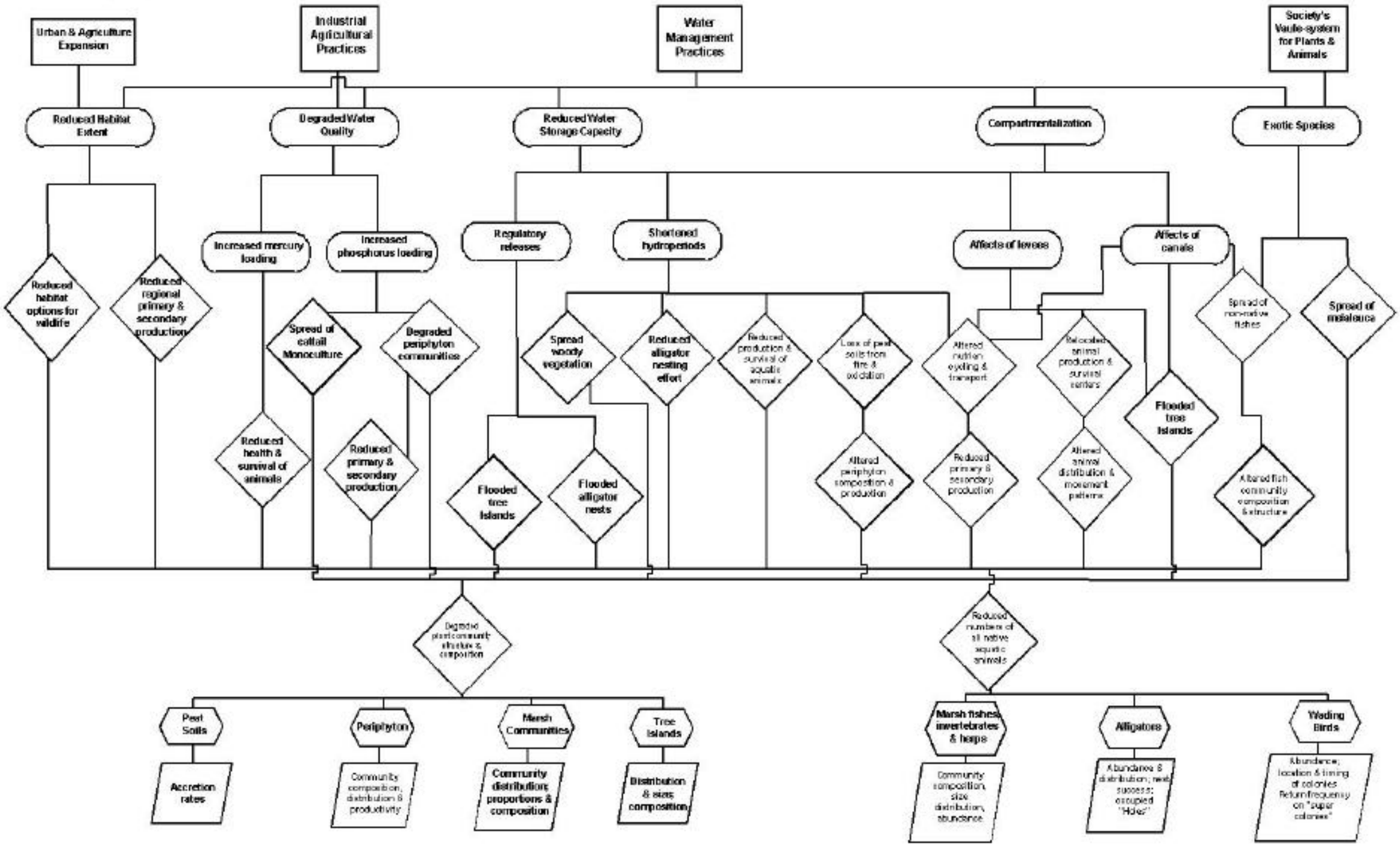
The Ridge and Slough Everglades

- Expansive, long-hydroperiod, freshwater marsh
- Low velocity sheet flow & deep organic soils
- Sawgrass strands, open sloughs, tree islands
- Deeper, central portion of Everglades basin
- Center of freshwater production & inter-annual survival for aquatic animals (fishes, frogs, crayfish, prawns, etc.)

Everglades Ridge & Slough

Conceptual Model

(Feb 99)



Ridge and Slough Conceptual Model

STRESSORS

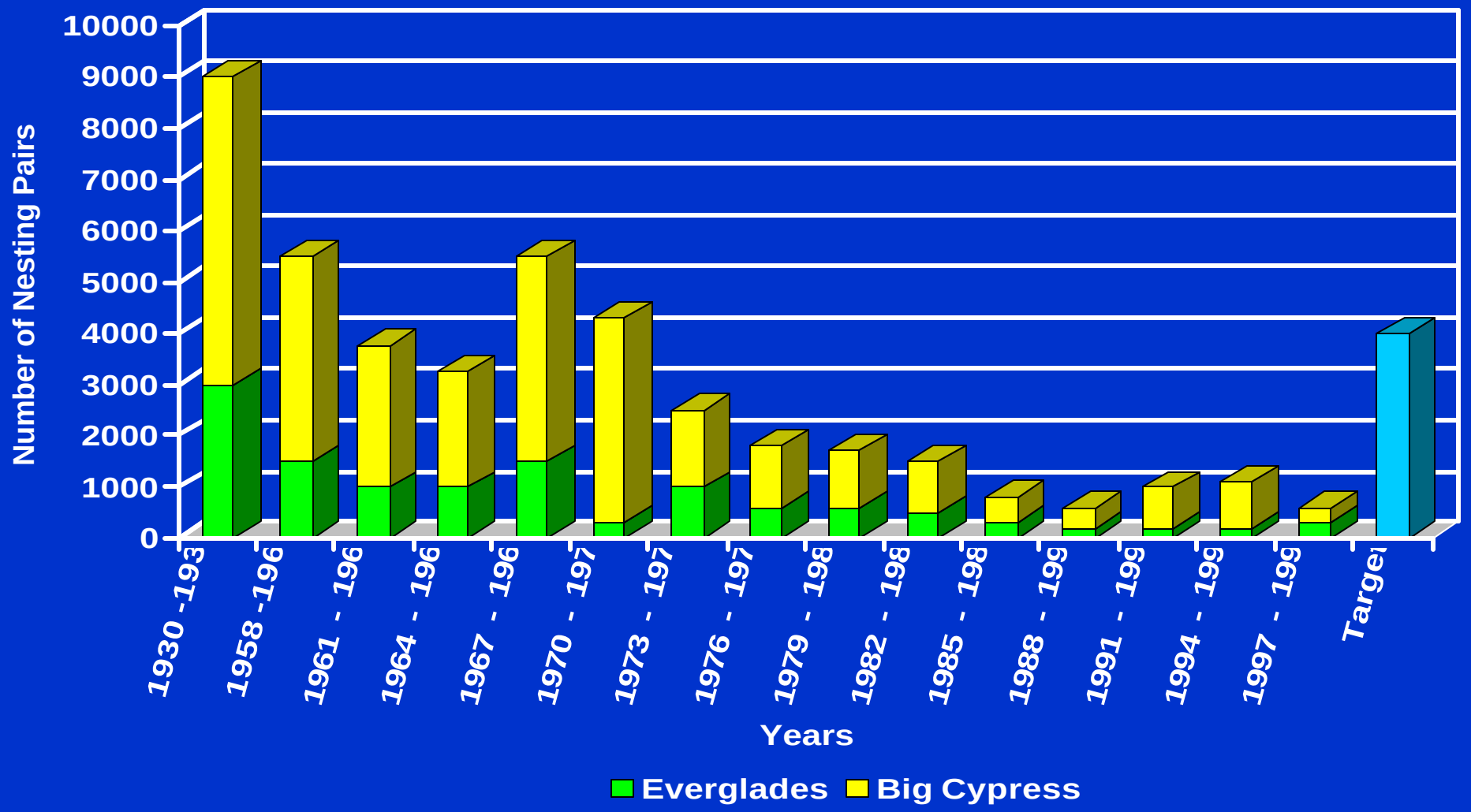
- Reduced spatial (habitat) extent
- Degraded water quality
- Reduced water storage capacity
- Compartmentalization
- Exotic species

Ridge and Slough Conceptual Model

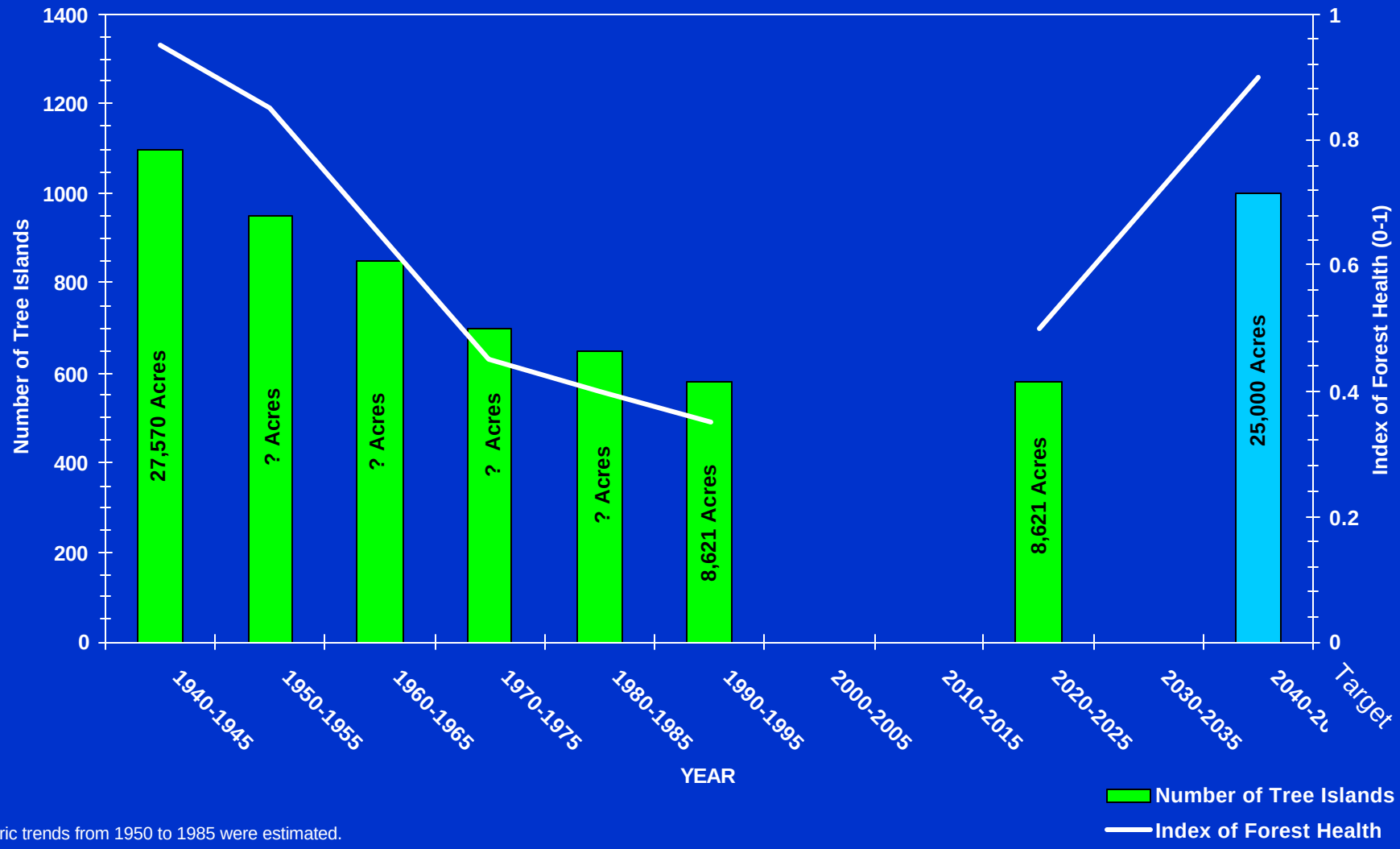
Attributes (Measures)

- Peat soil accretion rates
- Periphyton community composition & distribution
- Marsh community composition & distribution
- Tree island numbers & composition
- Marsh fishes & invertbrates - abundance & composition
- Alligator abundance, distribution, & nesting success
- Wading bird abundance; location & timing of nesting

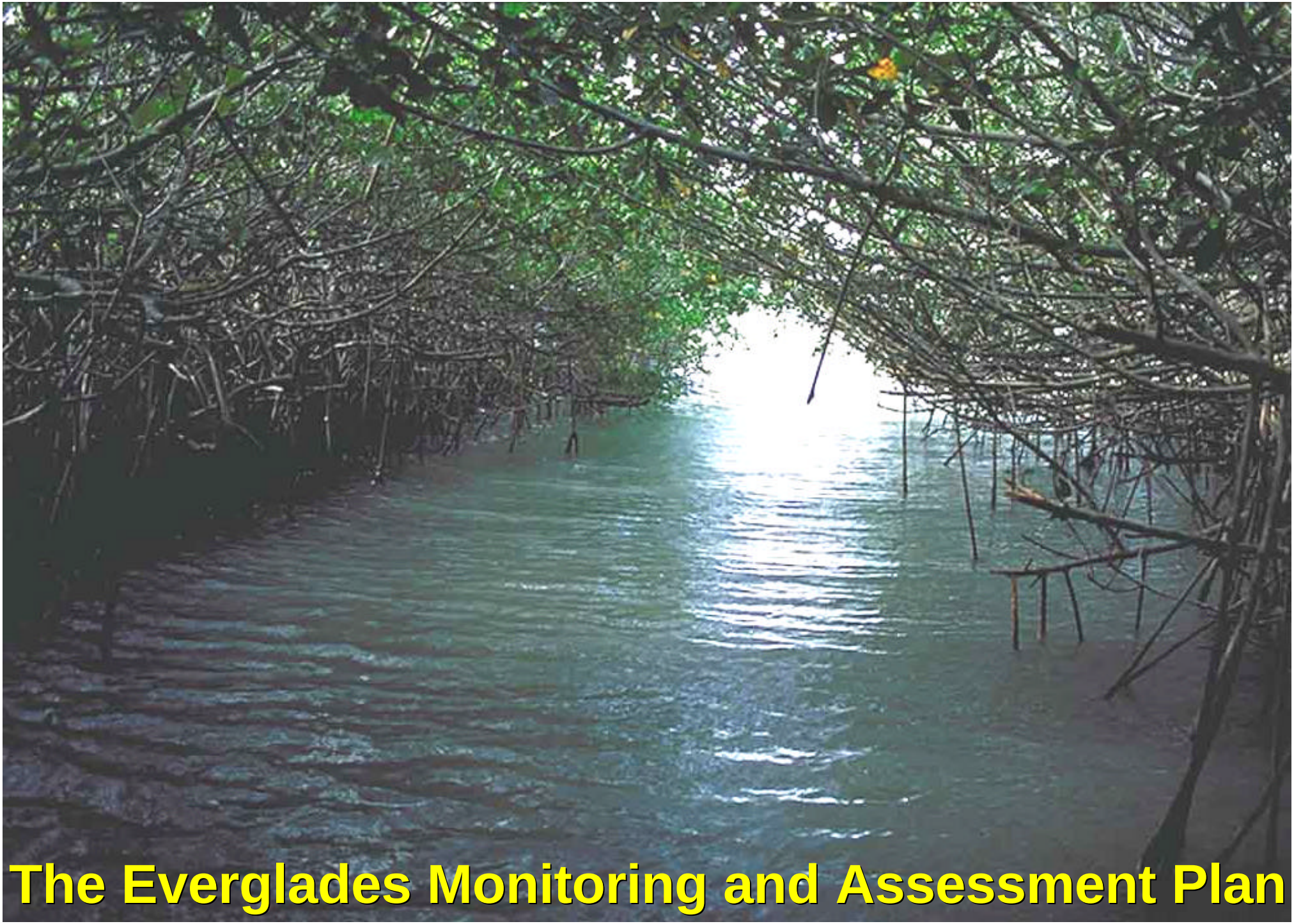
Trends in South Florida Wood Storks



Trends in Health, Number and Acres of Tree Islands in WCA-2A and WCA-3



Note: Historic trends from 1950 to 1985 were estimated.


The Everglades Monitoring and Assessment Plan

What is RECOVER?

- RECOVER - Restoration Coordination and Verification.
- Role - Organize and apply scientific and technical information to support the objectives of CERP; i.e, implement the applied science strategy .

Why RECOVER

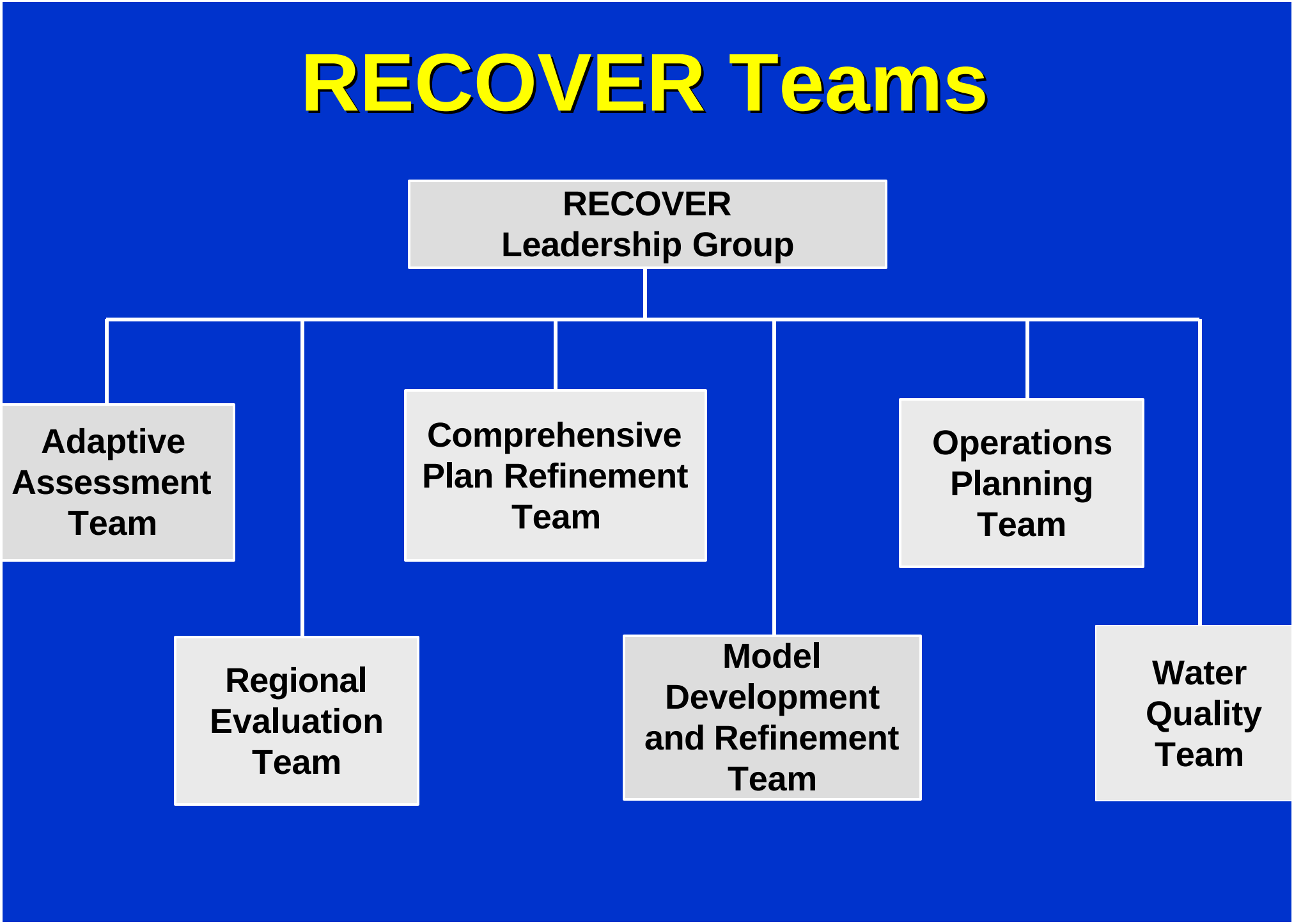
OVERALL Purpose-

- **Insure that the best available science is applied to CERP**
- **Insure that Adaptive Assessment practices are followed during the implementation of CERP**
- **Promote interagency collaboration on scientific and technical issues and tasks in support of CERP**
- **Insure that system-wide perspectives and goals are maintained**

RECOVER OBJECTIVES

- Evaluate and assess Comprehensive Plan performance
- Recommend refinements and improvements in design and operations of CERP components
- Review effects of other restoration projects on Comprehensive Plan performance
- Ensure that system-wide focus is maintained
- Provide a forum for communication among agencies regarding scientific and technical aspects of the Comprehensive Plan

RECOVER Teams



RECOVER Agency Members

- **Sponsoring Agencies**
  - Army Corps of Engineers
  - South Florida Water Management District
- **Participating Agencies**
  - National Park Service
  - Fish & Wildlife Service
  - NOAA, National Marine Fisheries
  - U.S. Geological Service
  - Environmental Protection Agency
  - Florida Department Environmental Protection
  - Florida Fish & Wildlife Conservation Commission
  - Dade, Broward, Palm Beach, Lee Counties

CERP System-Wide Monitoring and Assessment Plan

OVERALL GOALS -

- To identify the parameters of the natural and human systems that should be measured to determine the progress and success of CERP,
- To implement an integrated system-wide monitoring and assessment program that will be used and supported by all agencies as the primary means of tracking the success of CERP.
- To support an adaptive assessment protocol for making improvements in CERP.

Comprehensive Plan
System-Wide Monitoring Program

OBJECTIVES -

- Determine baseline variability for performance measure targets
- Measure status and trends for targets
- Identify unexpected non-target responses
- Improve understandings of cause and effect relationships among key ecological linkages
- Create a single, integrated data management system

Summary of CERP Performance Measures

Total Measures - 156

- **Biological & Soils - 5 soils, 23 animal, 31 plant measures**
- **Hydrological - 24 (natural & water supply)**
- **Water Quality - 73**

Adaptive Assessment

- A process for measuring how well a restoration plan achieves its predicted targets or desired objectives, and for using these assessments as a basis for making improvements in the design or operations of the plan.
- Provides a means for continually reducing the levels of uncertainty, and for adjusting to unexpected responses, by refining the design of the restoration plan in response to improving information databases (including the learning that comes from monitoring and researching actual system responses).

Adaptive Assessment Flow Chart