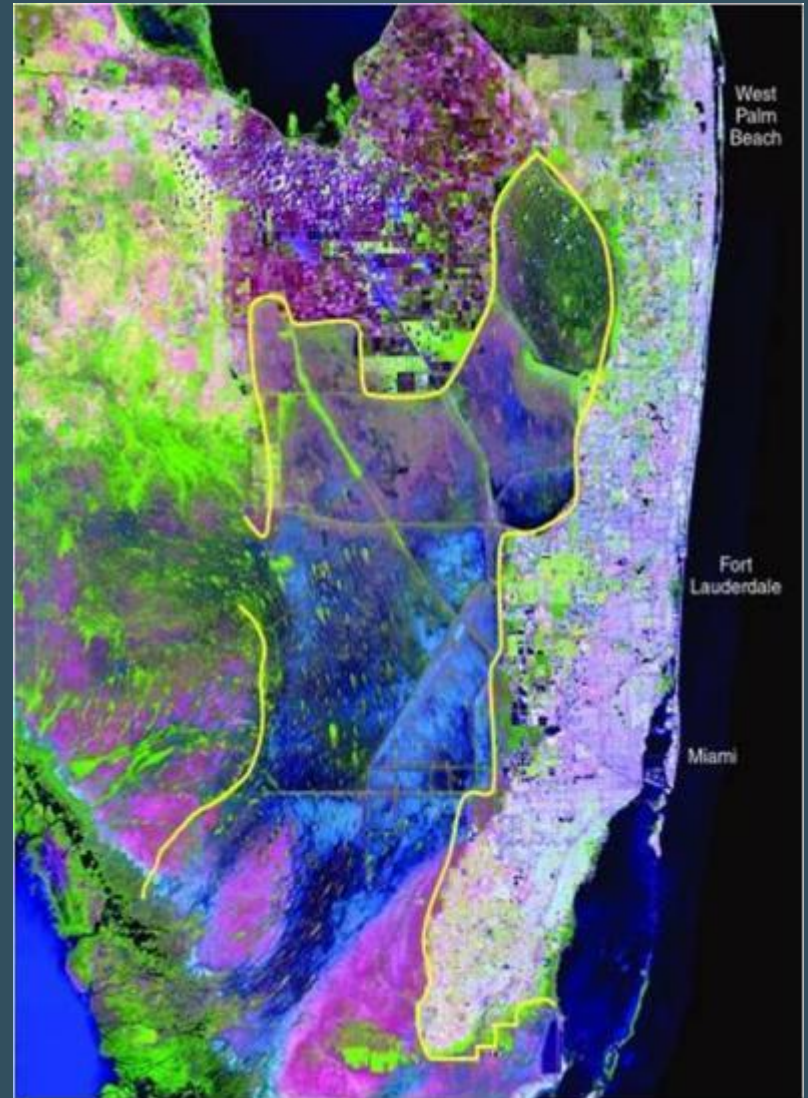
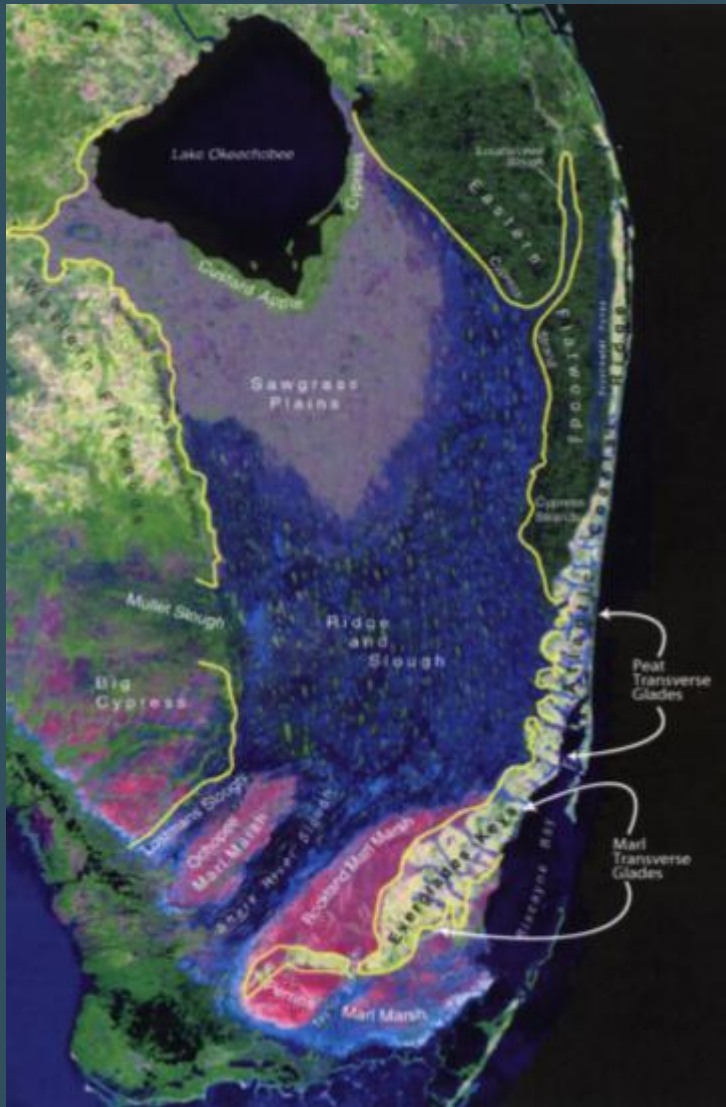


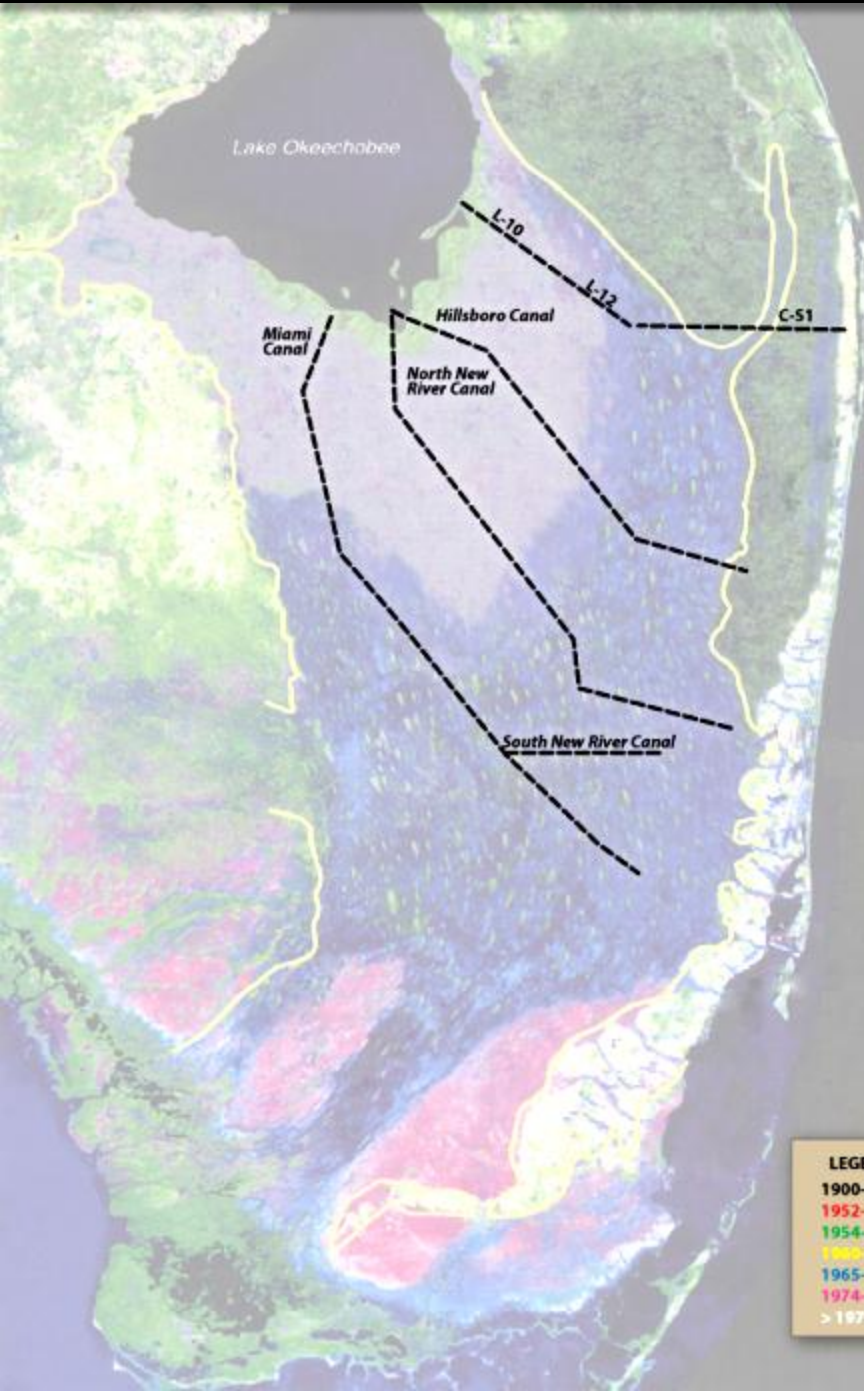
## EVERGLADES RESTORATION: LESSONS LEARNED VOL. II

Fred H. Sklar, Director  
Everglades Systems  
Assessment

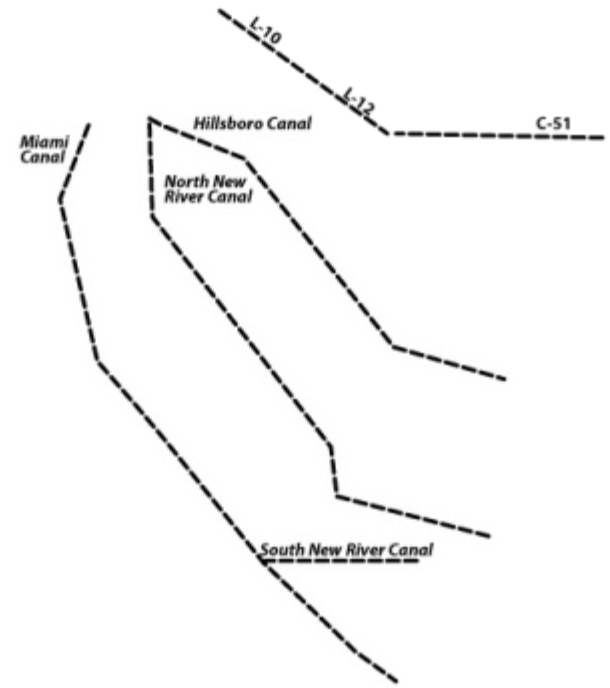


# EVERGLADES RESTORATION: LESSONS LEARNED VOL. I 1900 – 1979 (THE FORMATIVE YEARS)





## 1900-1929



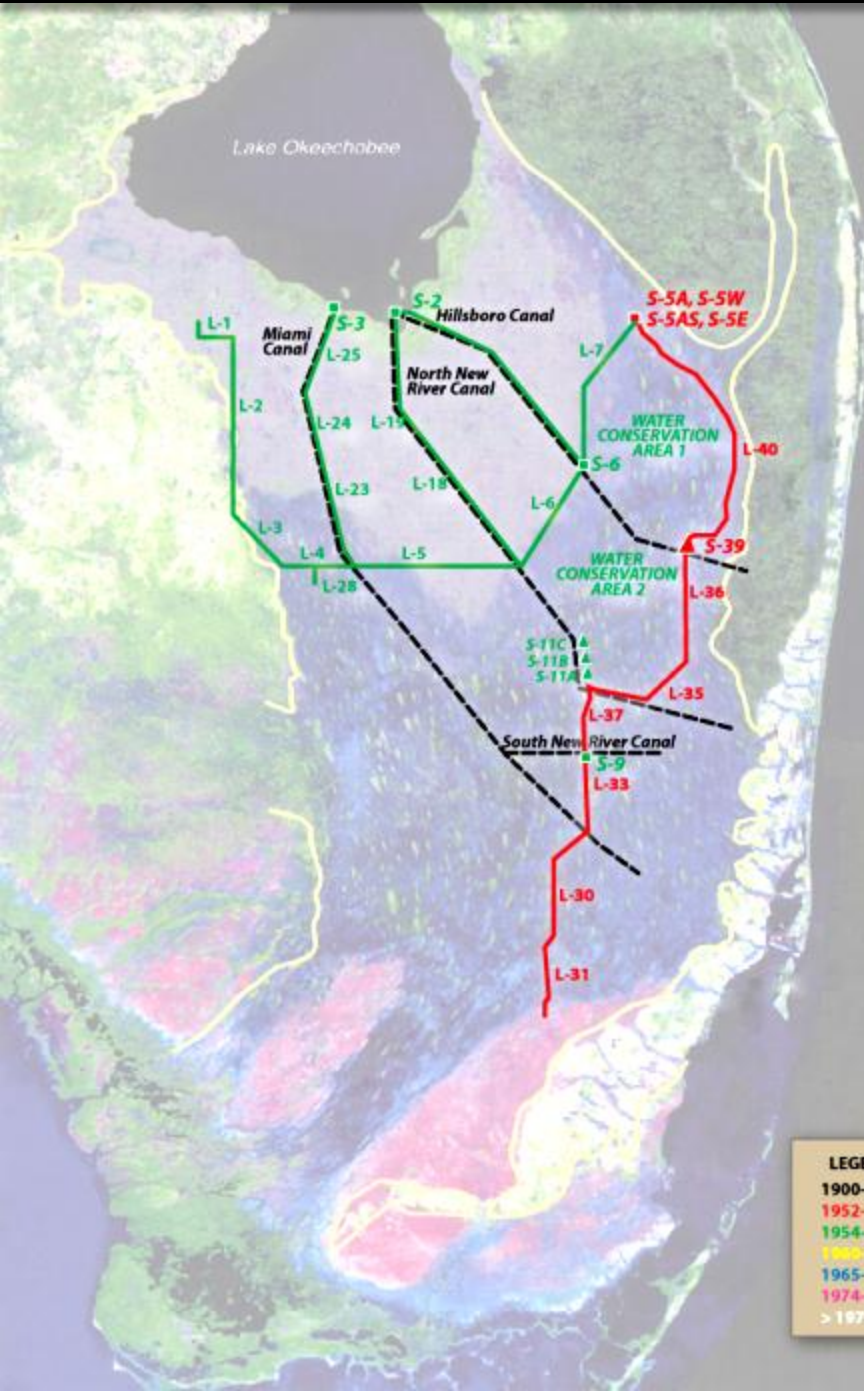
### LEGEND

- 1900-1929
- 1952-1954
- 1954-1959
- 1965-1973
- 1974-1979
- > 1979

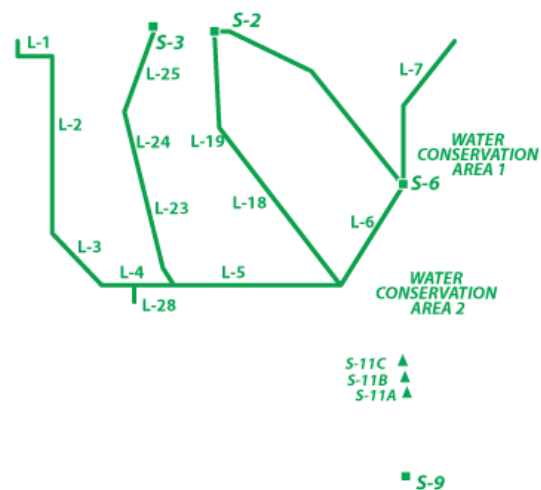


# 1952-1954





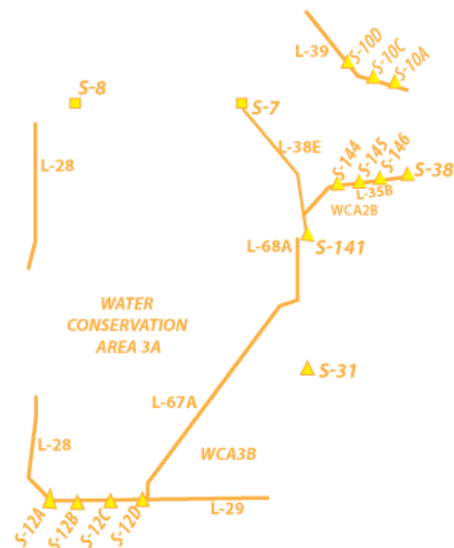
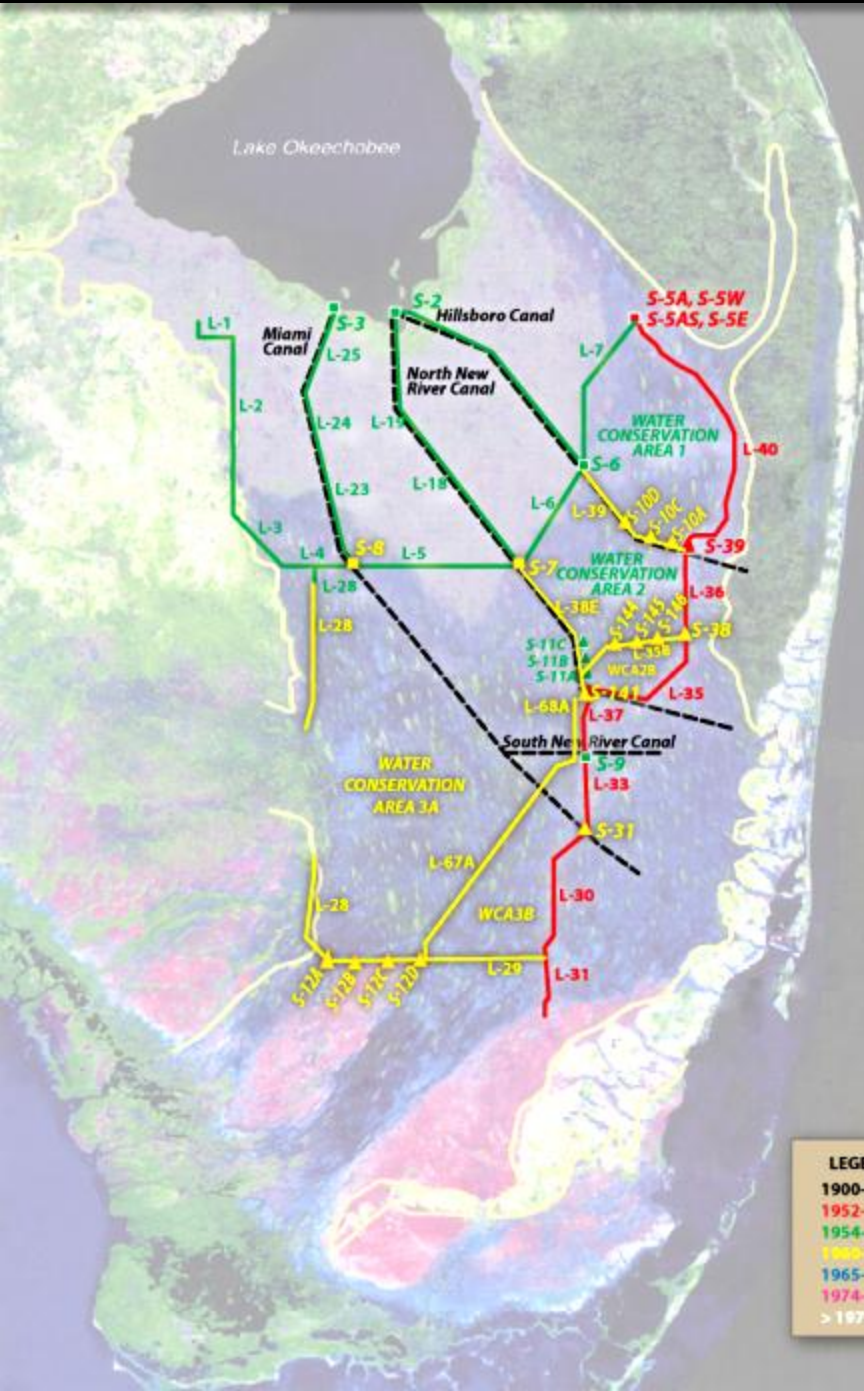
# 1954-1959



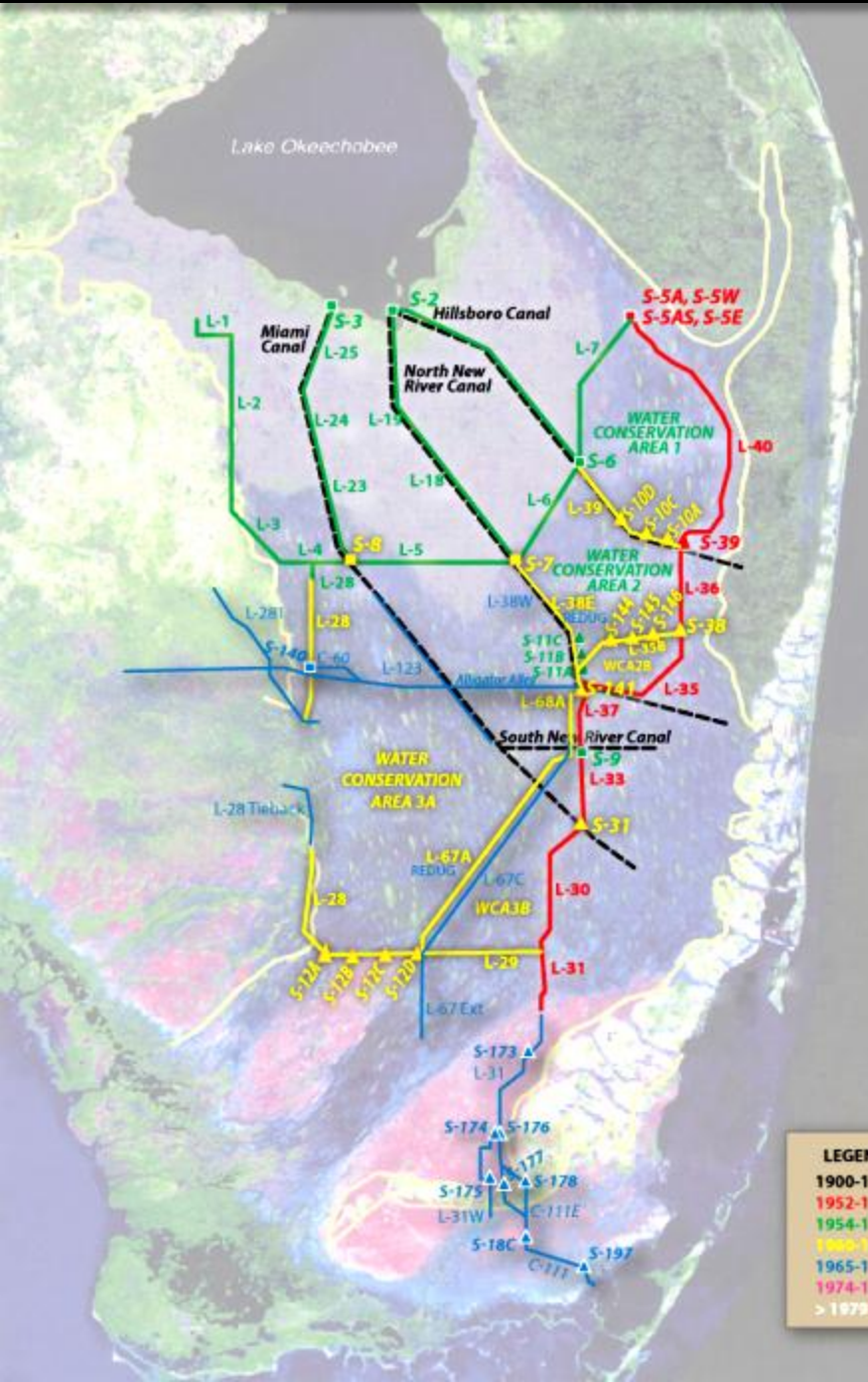
**LEGEND**

1900-1929
1952-1954
1954-1959
1965-1968
1965-1973
1974-1979
> 1979

# 1960-1963

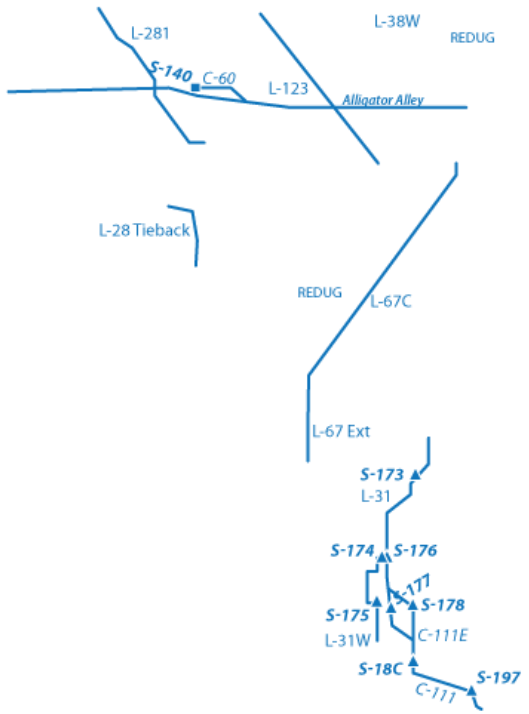


# 1965-1973

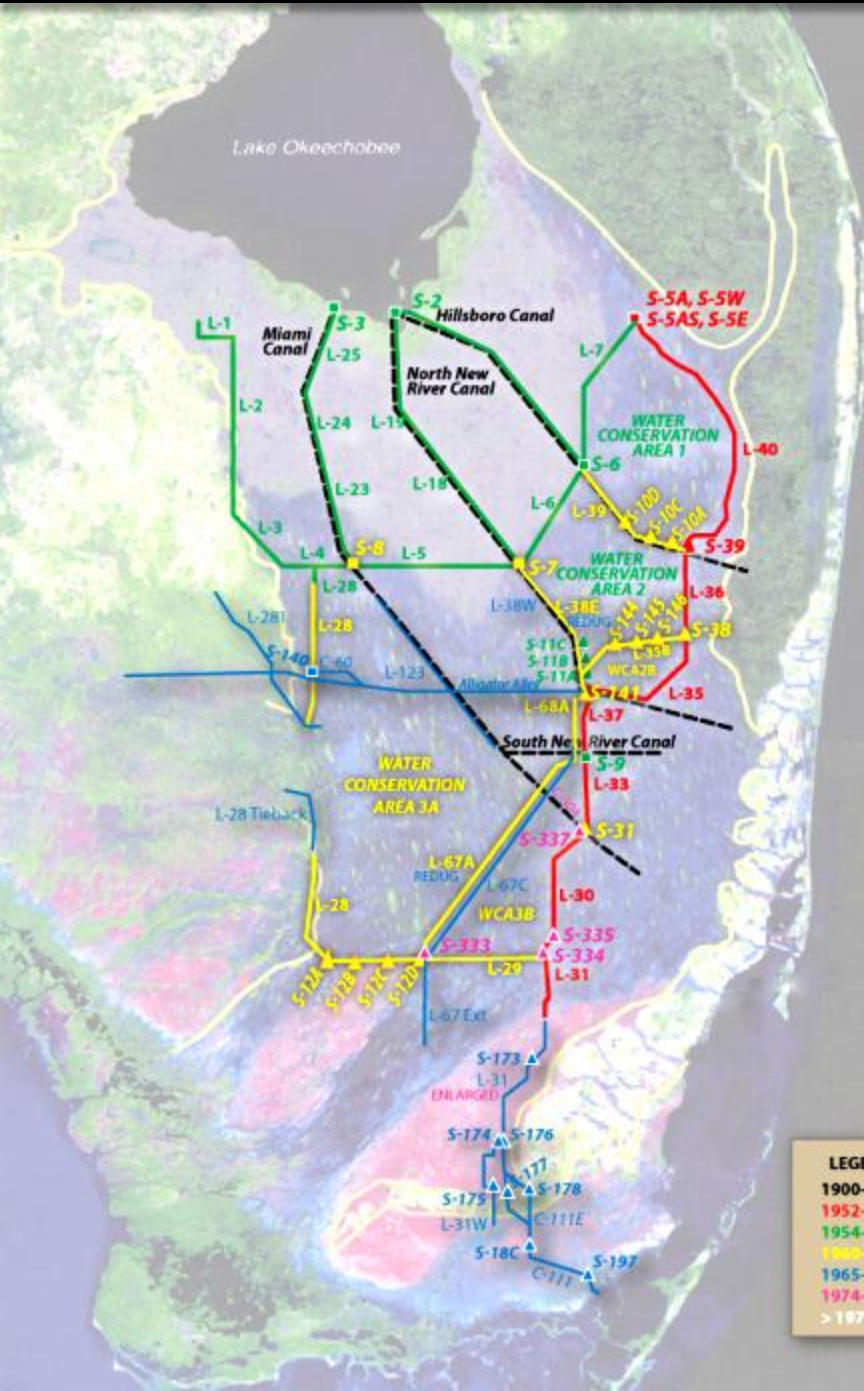


**LEGEND**

- 1900-1929
- 1952-1954
- 1954-1959
- 1965-1968
- 1965-1973
- 1974-1979
- > 1979



# 1974-1979



**LEGEND**

1900-1929
1952-1954
1954-1959
1965-1968
1965-1973
1974-1979
> 1979



ENLARGED

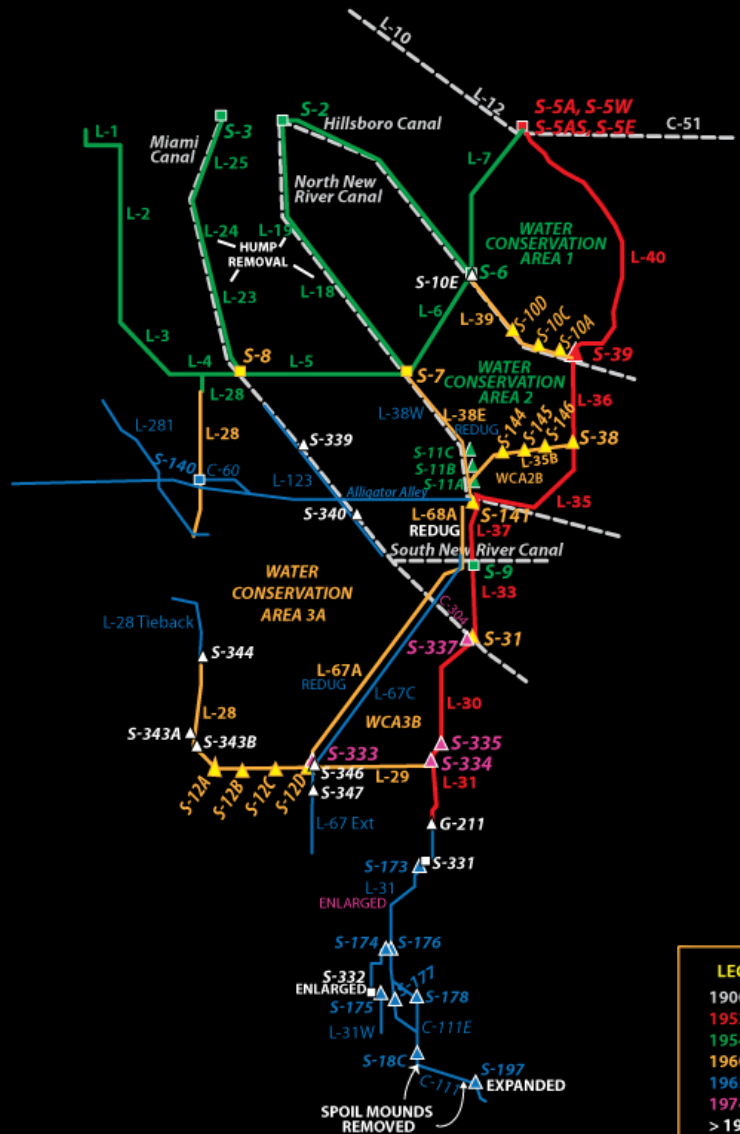
> 1979



**LEGEND**

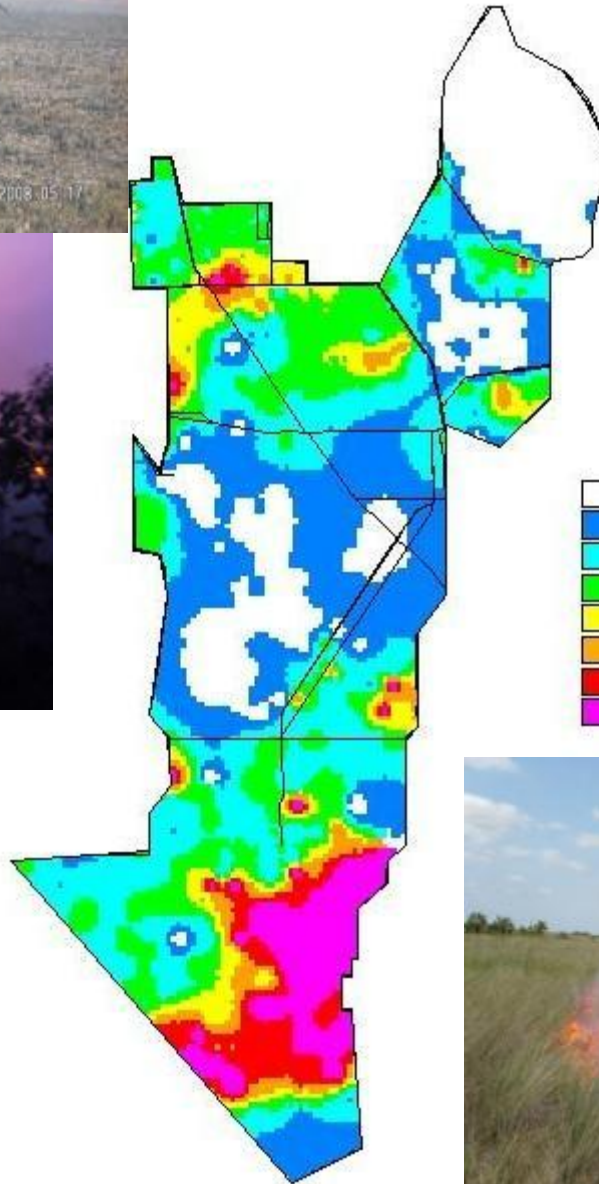
- 1900-1929
- 1952-1954
- 1954-1959
- 1965-1973
- 1974-1979
- > 1979

- HUMP REMOVAL
- S-10E
- S-339
- S-340 REDUG
- S-344
- S-343A S-343B
- S-346 S-347
- G-211
- S-331
- S-332 ENLARGED
- SPOIL MOUNDS REMOVED
- EXPANDED



LEGEND	
1900-1929	(Red)
1952-1954	(Orange)
1954-1959	(Yellow)
1960-1963	(Green)
1965-1973	(Light Green)
1974-1979	(Cyan)
> 1979	(Blue)

# Muck Fire Risk





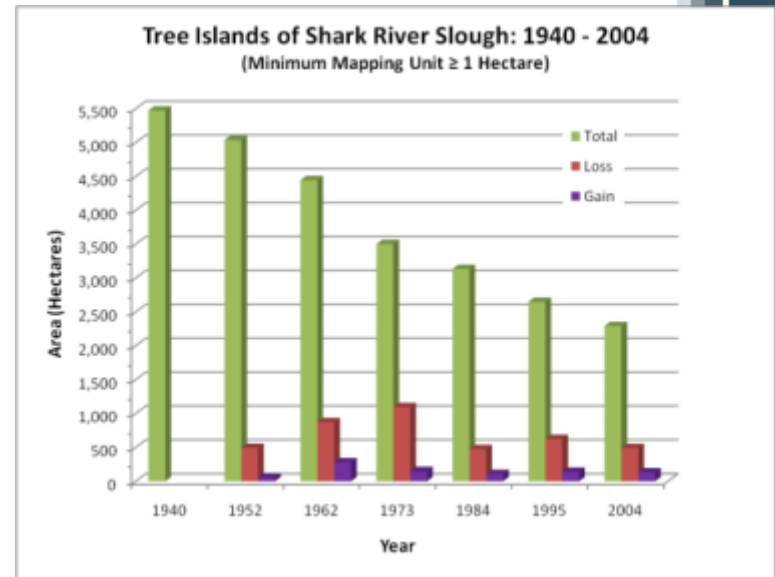
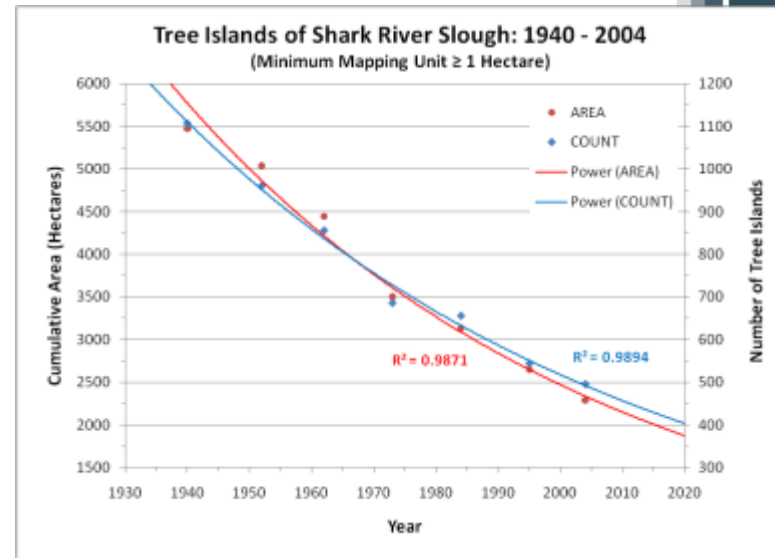
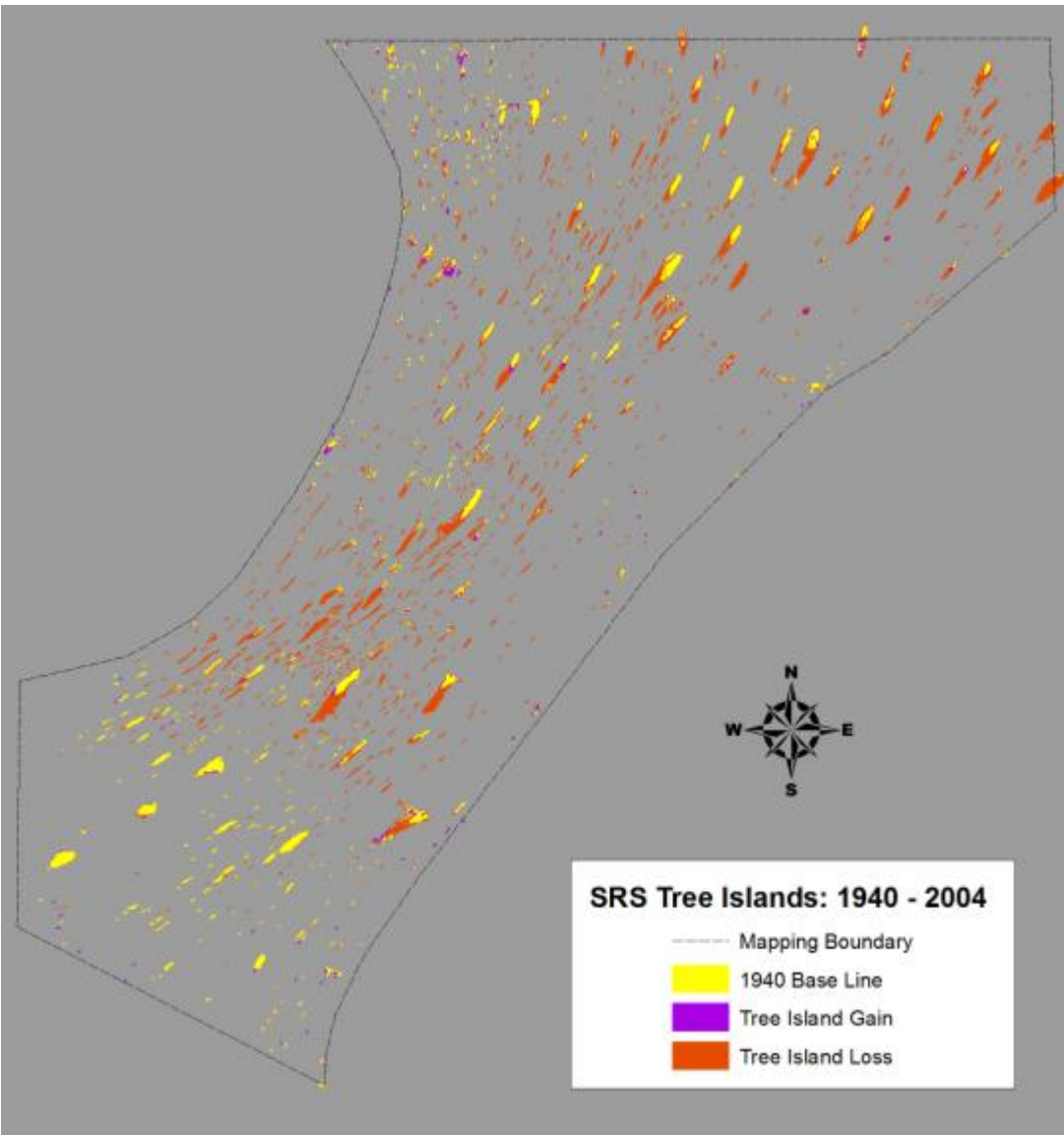
- Figure 3.15. Photograph of drained, dried, and burnt peat of the Everglades, 1930s: “[The photograph] shows some of the white man’s mistakes which are expensive to him and to the Indian. [It] reveals what a fire does to the muck land. The dust I am pouring from my hand is as pure ashes as ever taken from any fireplace. The foreground of the picture is a great bed of it. At my side are the banks of unburned muck. . . . These fires break out in the dry season of the year and rage for weeks, or until some rain puts them out. They usually burn down to wet muck, however deep that may be” (Glenn 1982, pp. 26–30). By permission of the Fort Lauderdale Historical Society, Inc. (James L. Glenn Collection).

# RECOVER Tree Island Mapping – SRS Results

Date: 2004

Count: 496 (-55.2%)

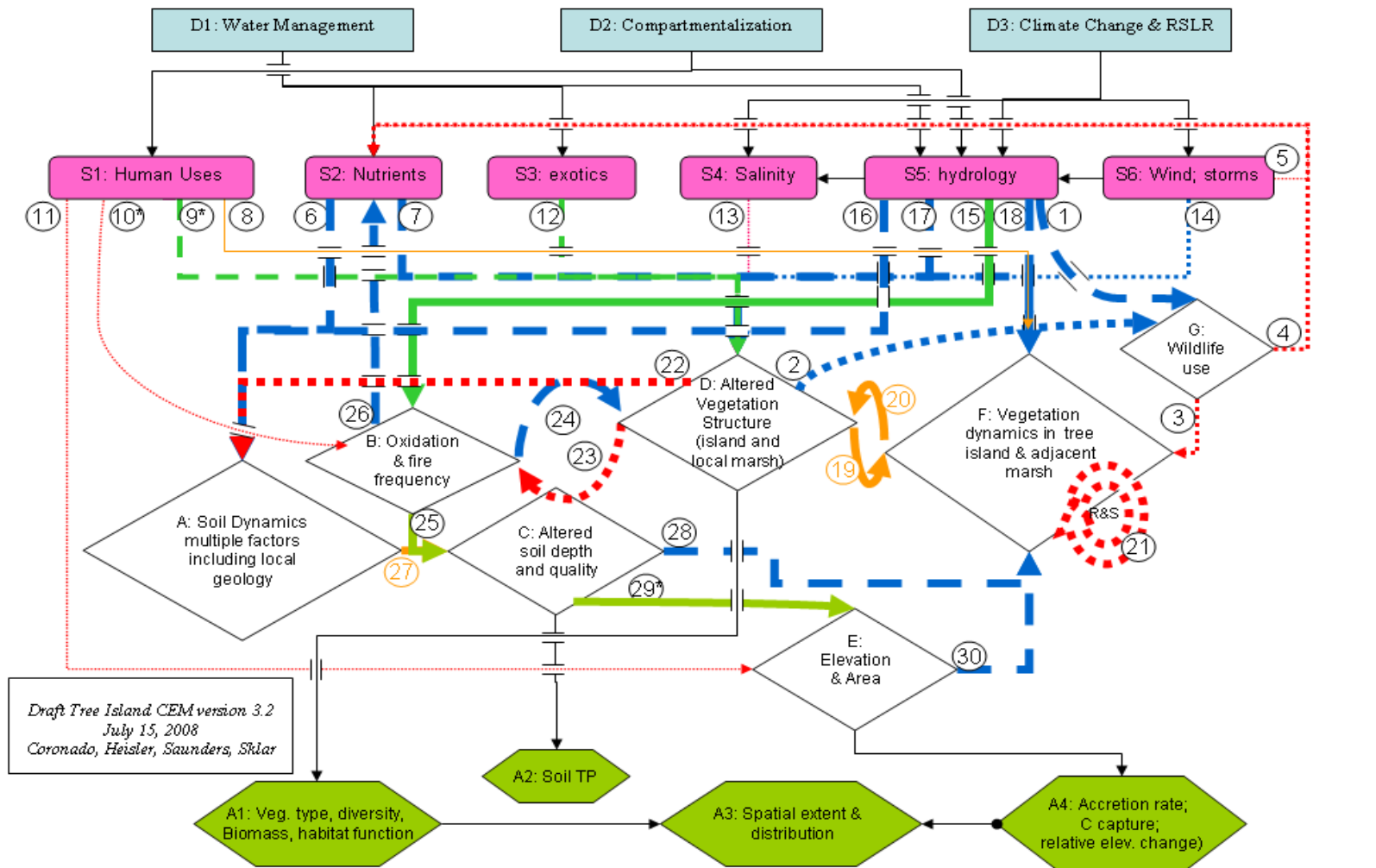
Hectares: 2,291.3 (-58.1%)



# LESSONS LEARNED VOL. II: BUILDING A RESTORATION PROGRAM

- **Finding Solutions**
  - Conceptual Models
  - Simulation Models
- **Implementation**
  - Partnerships
  - Communication
- **Monitoring and Assessment**
  - Adaptive Management
  - Managing Adaptively





**Importance: (Line Thickness)**

- High – thick line
- Med – medium line
- Low – thin line

**Understanding: (Line Color)**

- High – Green line
- Med – Blue line
- Low – Red line

**Predictability: (Line Type)**

- High – Solid line
- Med – Dashed line
- Low – Dotted line

# 1. LESSONS LEARNED: FINDING SOLUTIONS

## CONCEPTUAL MODELS

### Pros (Restoration Ecology)

1. Facilitates inclusive scientific debate and helps Management appreciate what is and is not well understood about the system.
2. Sets priorities for research, modeling and adaptive management.
3. Highlights key performance measures for modeling and monitoring restoration.
4. Highlights key performance measures that should be used to simulate restoration plans (scenario testing and cost estimations).

### Cons (Ecological Restoration)

1. Lacks political, cultural and social realism (can be seen as too academic)
2. Does not capture the most relevant spatial scales needed by Management for decision-making and scheduling.
3. Cannot be used to evaluate restoration plans.



# Location of Gages in WCA3 A and iModel Targets

Target of 92% of a fully-restored Slough PM time series

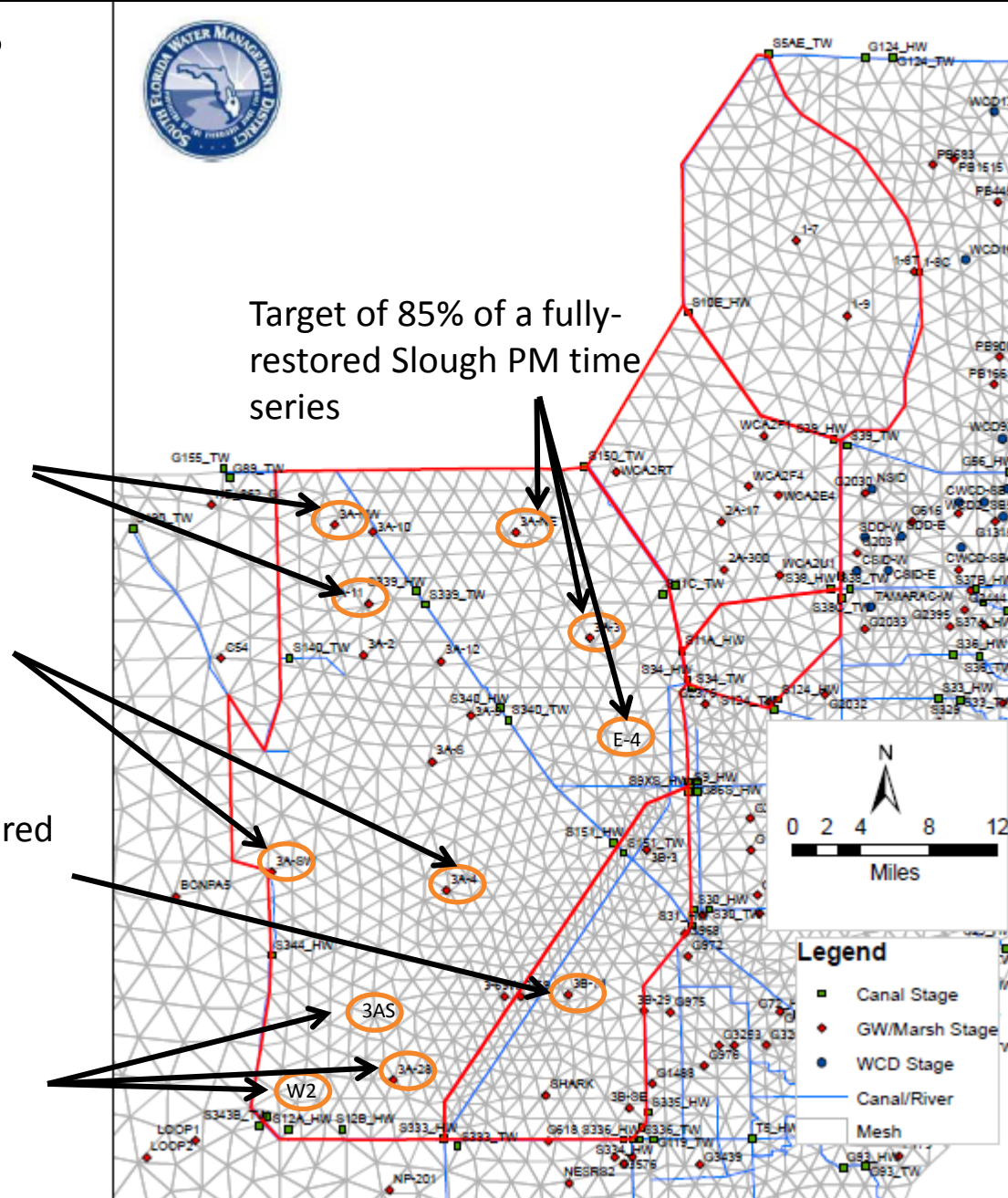
Target is a fully-restored Slough PM time series

Target of 88% of a fully-restored Slough PM time series

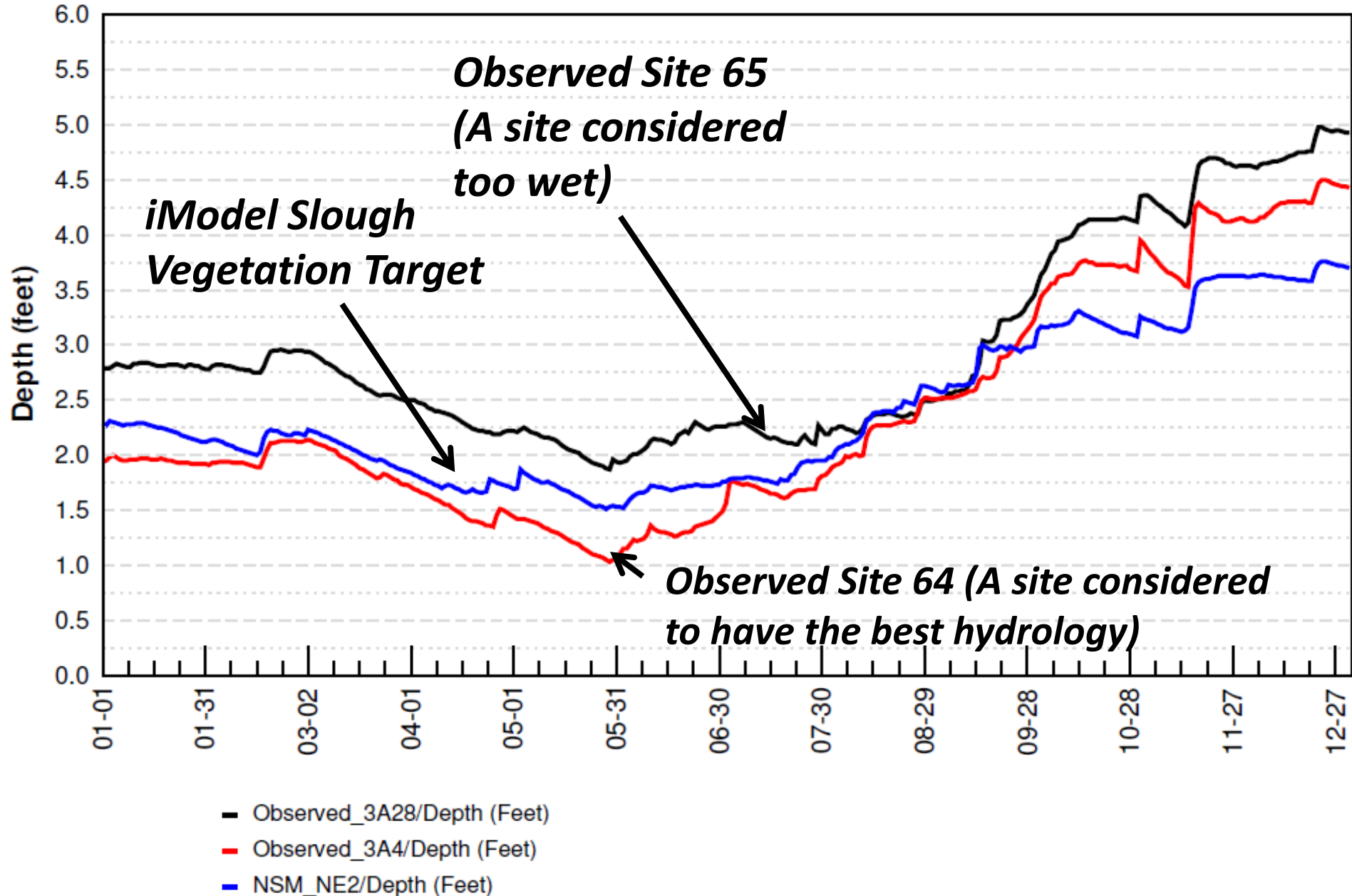
Target is a fully-restored Slough PM time series



Target of 85% of a fully-restored Slough PM time series



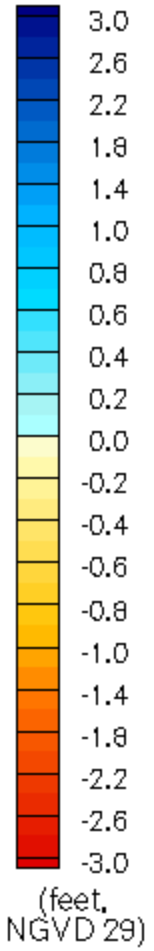
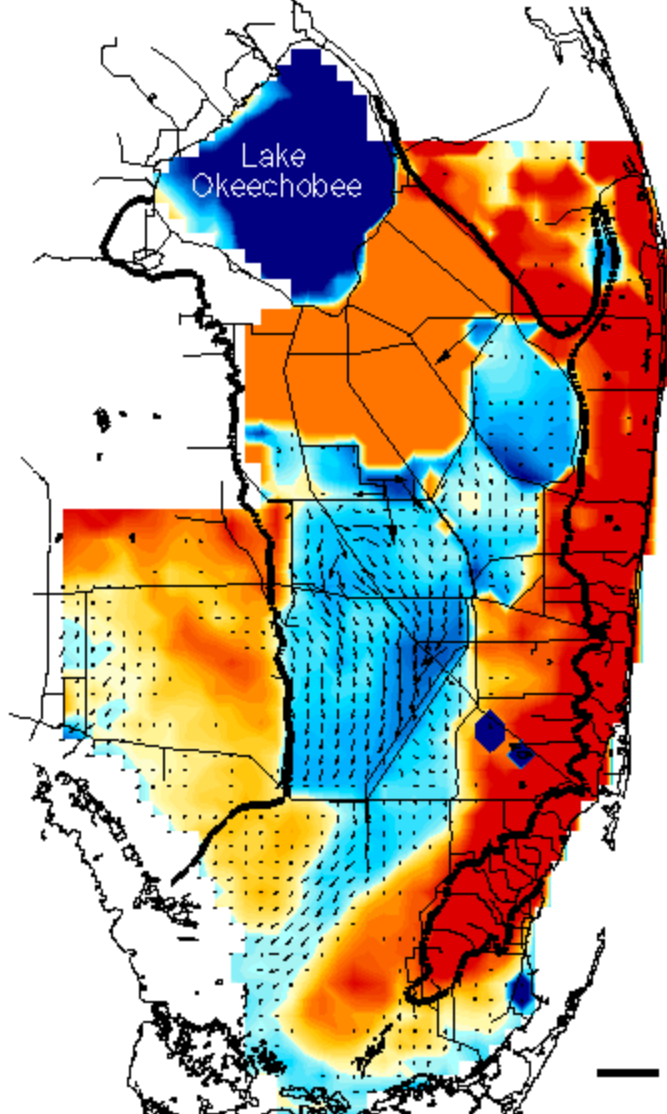
# Daily Observed Water Depths and Modeled Slough Vegetation Targets for 1994 (a wet year)



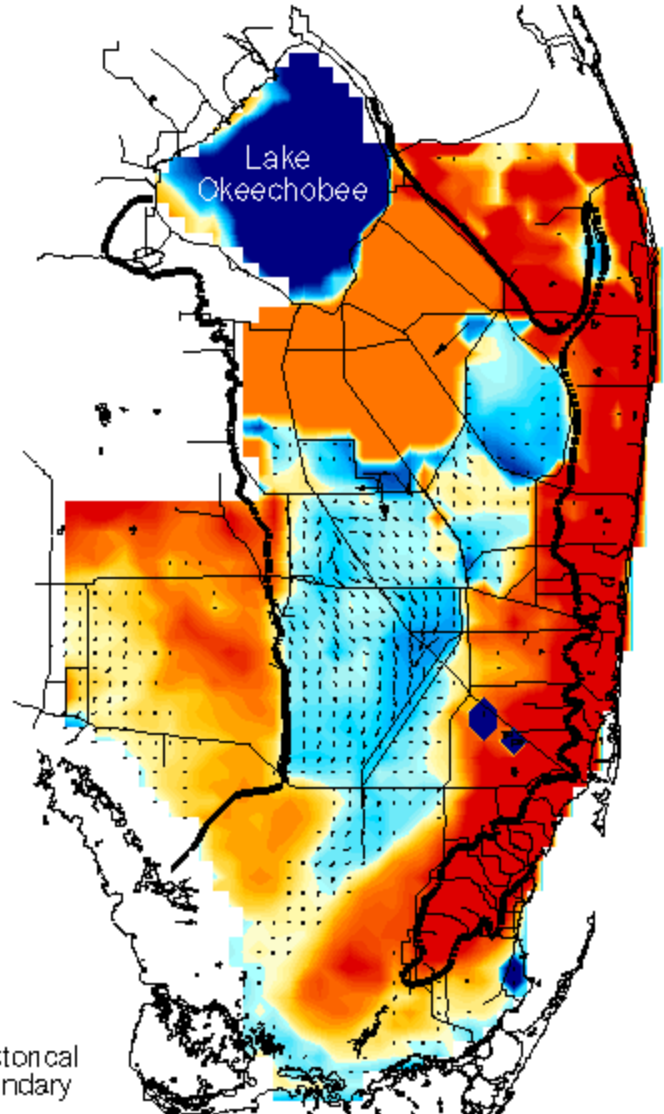
SFWMM v5.5.1 - 2005EC  
 Mean Annual Stage and Overland Flow  
 1965-2005 Simulation Period

SFWMM v5.5.1 - Climate Change ALT1  
 Mean Annual Stage and Overland Flow  
 1965-2005 Simulation Period

1965



— Generalized Historical Everglades Boundary



# 1. LESSONS LEARNED: FINDING SOLUTIONS

## SIMULATION MODELS

### Pros (Restoration Ecology)

1. Can screen out poor and ineffective restoration designs.
2. Establishes scientific expectations.
3. Provides spatial and temporal dependencies for scheduling and creating project “portfolios.”
4. Numeric, quantitative, testable, flexible, the list is extensive...

### Cons (Ecological Restoration)

1. Can screen out valuable and effective restoration designs.
2. Lacks cultural and socioeconomic vision.
3. Is not understood by Management and Stakeholders
4. Misses important elements, too complex, poor validation, not enough data, the list is extensive...

Bottom Line: Wacky ideas abound, individuals believe strange things, use the models to teach what is known, and allow culture to influence the vision.



# LESSONS LEARNED: IMPLEMENTATION

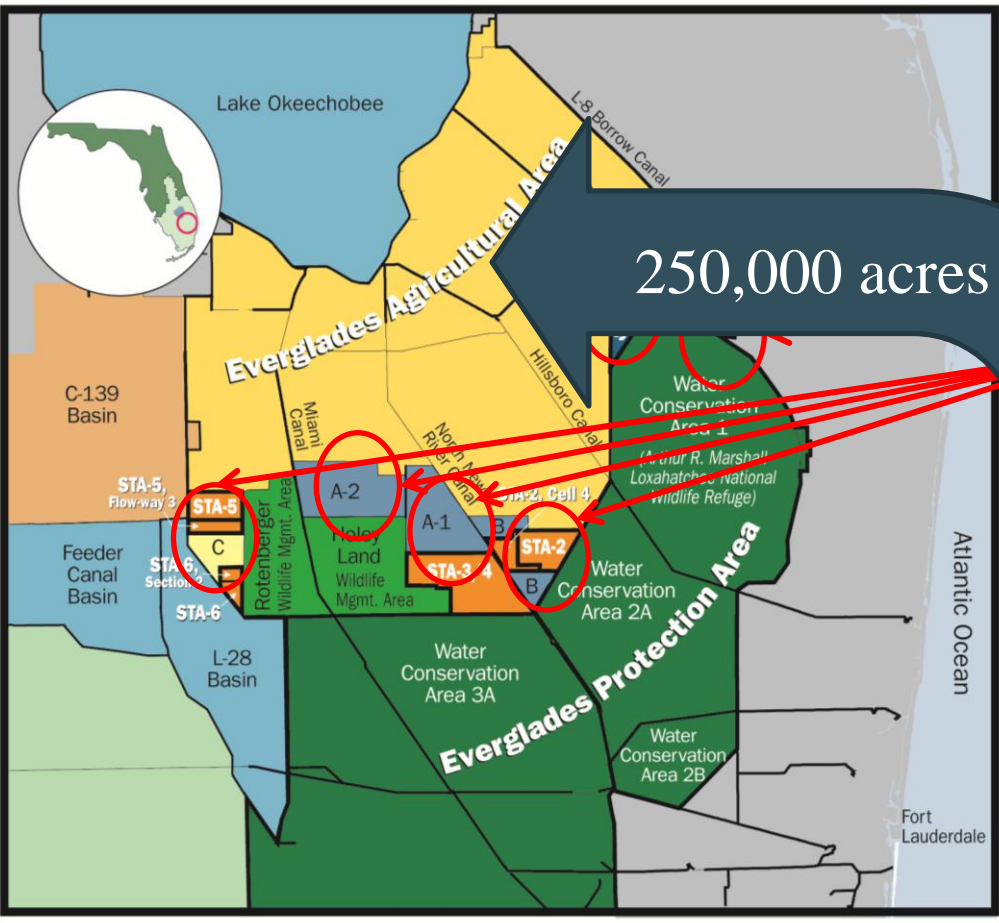
## Partnerships

1. Culture: No restoration program is an island, unless of course you are trying to restore an island. 😊 But, even then...
2. Legal: Obey the law and make all decisions in the “sunshine.” However, enlist an army of lobbyists and lawyers to protect your plan from political power plays, malicious intentions, and greed.
3. Institutional: Agencies are territorial and have institutional egos. Use diplomacy to avoid litigation.
4. Funding: There is a big difference between partners that regulate restoration and those that share costs and the responsibility of implementation. (Florida example: EFA vs. CERP)

Partners (EPA and SFWMD): In 1997 EPA required that the SFWMD find a TP concentration that causes an ecological imbalance and clean up Everglades inflows. Funding was not shared.



*Mesocosm dosing experiments*



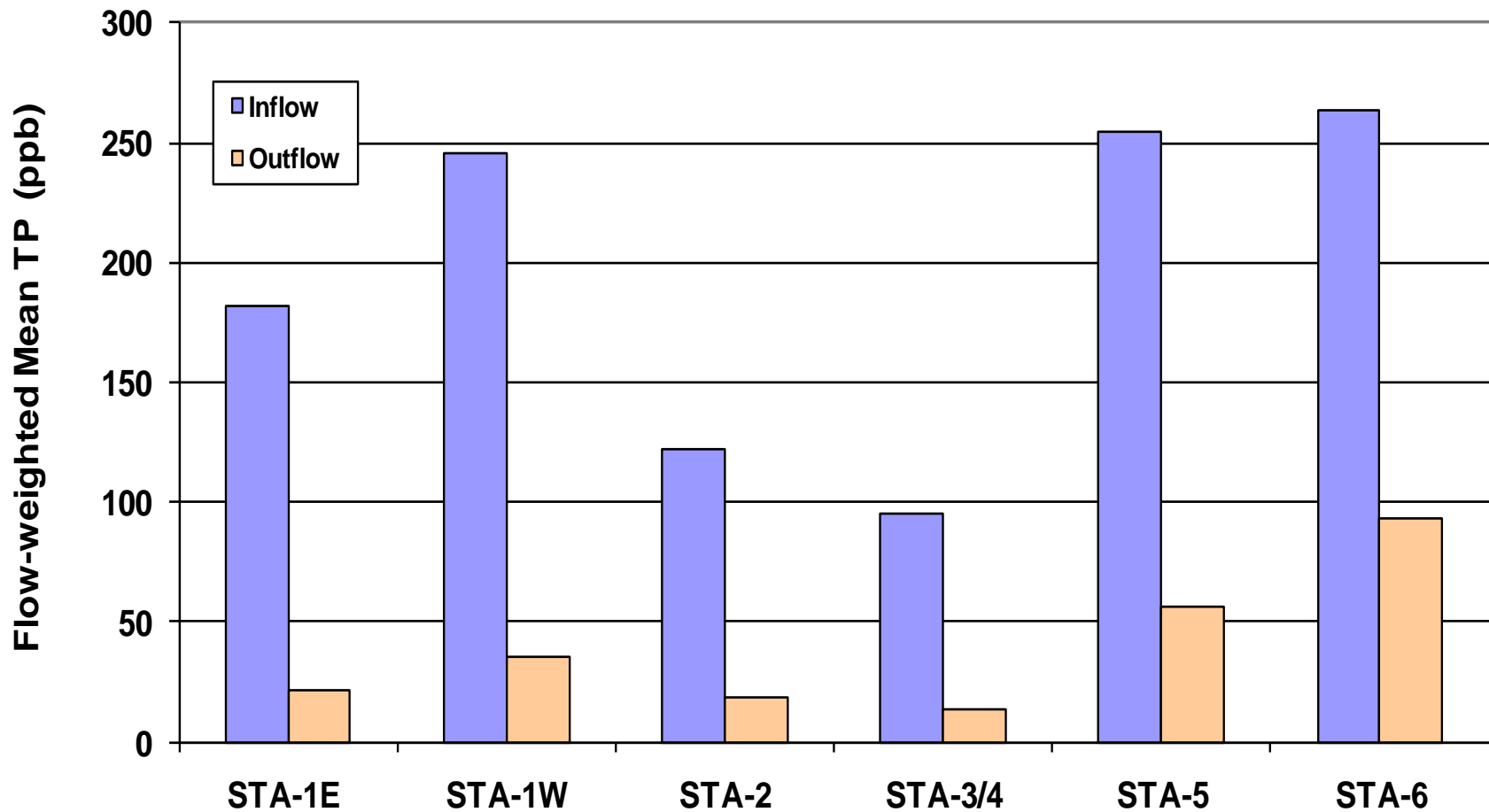
**Stormwater Treatment Area (STA)  
Total = 45,000 acres**

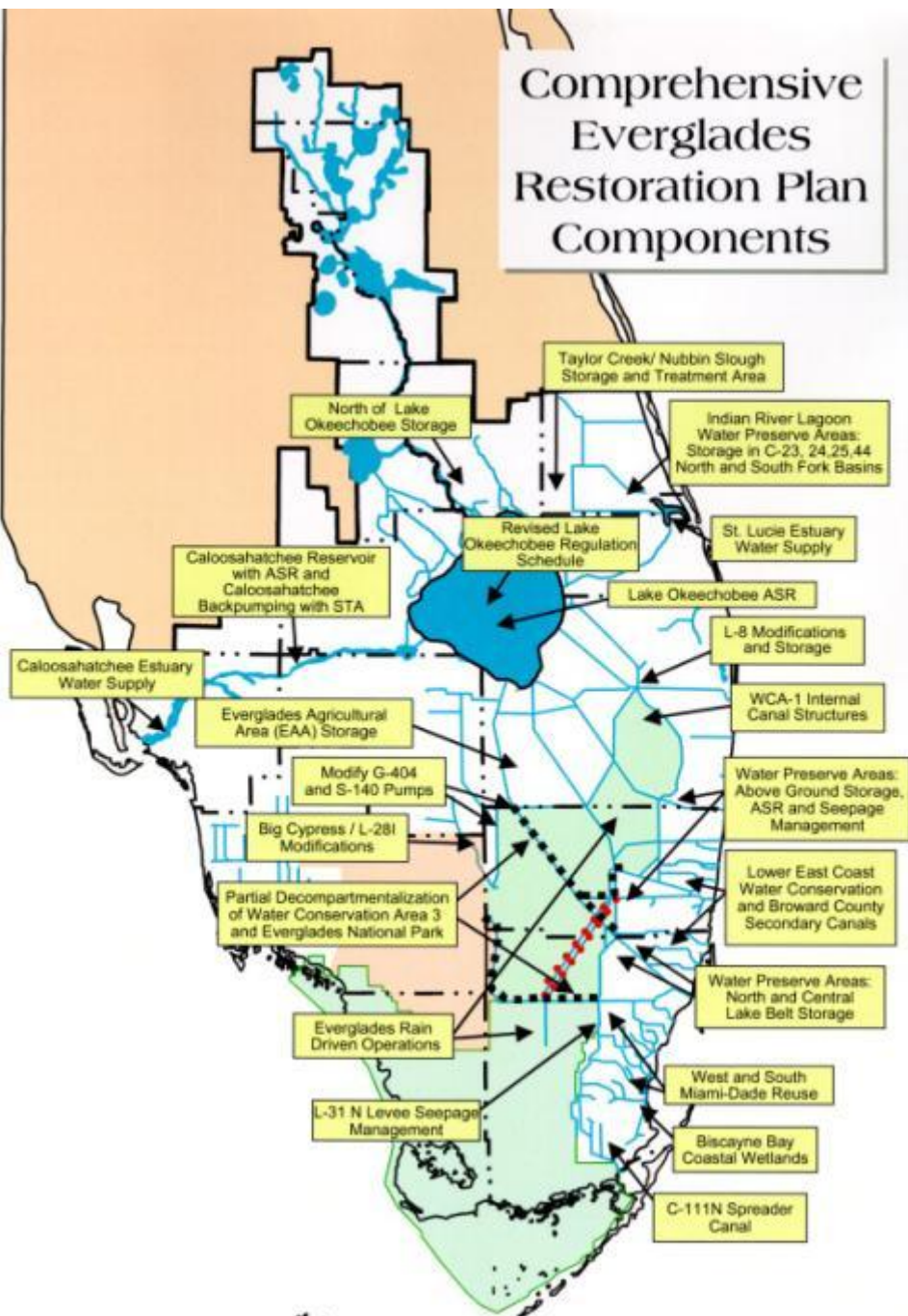
**Florida increased property taxes to pay for restoration.**

**Sugarcane**



Total P Concentrations are reduced by approx. 80% for about \$2 billion over 10 years.



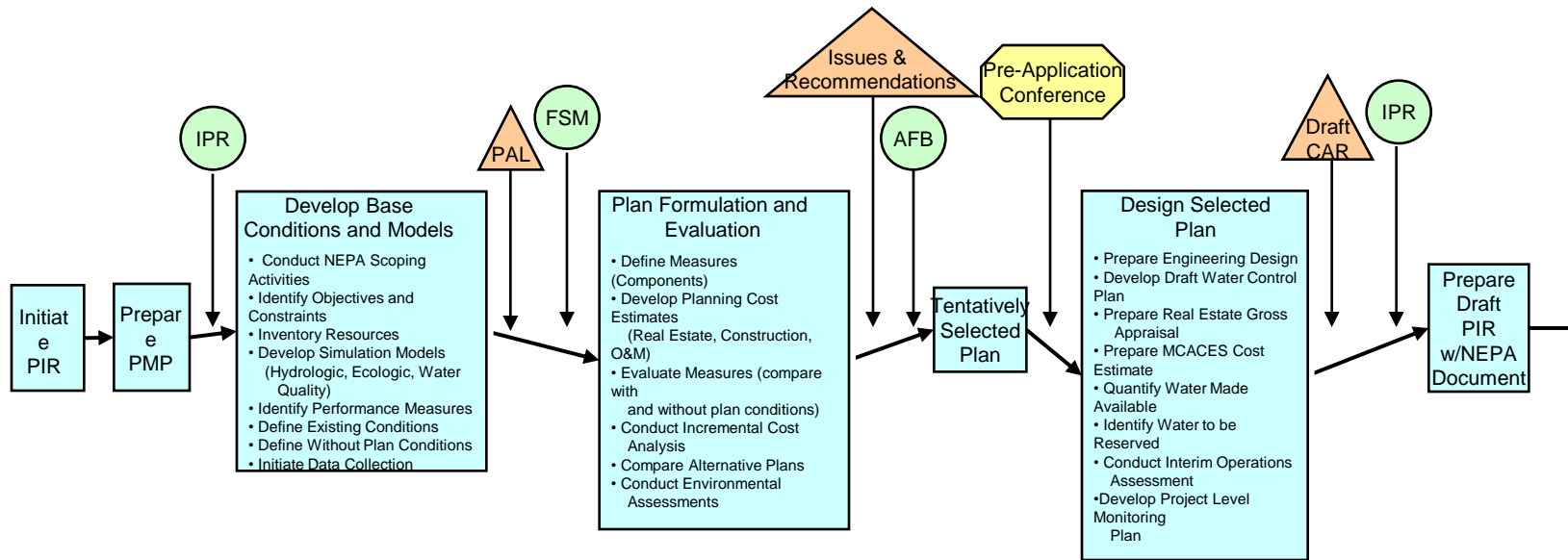


Partners (USACOE and SFWMD): Hydrological restoration is a State and Federal responsibility. Funding is shared.

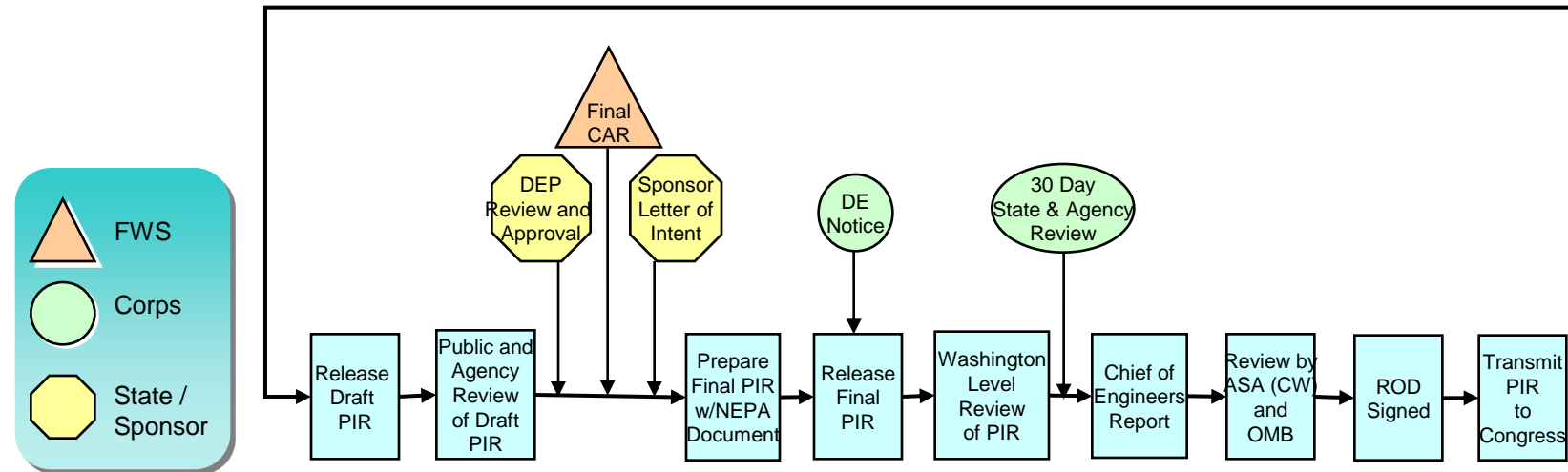
In 2000 when CERP was signed by President Clinton, CERP was comprised of 68 projects, estimated to cost \$8 B. The cost is now estimated to be approx. \$15 billion and all work revolves around 7 pilot studies and 18 restoration projects where FL has spent \$3.1 B (unauthorized), the COE has spent \$900 M, but Congress has approved funding for the construction of only three projects.



# The Comprehensive Everglades Restoration Plan (CERP) is more difficult to implement than the EFA. Why?



This PIR Process is very time consuming, expensive and has to be approved by Congress .



## 2. LESSONS LEARNED: IMPLEMENTATION

### Communication (Our Achilles' Heel)

#### 1. Leadership:

- a. Collaboration: The Ogden - Applebaum Story
- b. Honesty: Gov Chiles vs. USA
- c. Must communicate on many levels

#### 2. Public Relations:

- a. Support “translators”
- b. Be prepared to re-justify restoration every four years
- c. Use facilitators and diplomacy to fight “terrorism”

#### 3. Team work:

- a. Simple, clear and effective communication
- b. Accountability: Make all Government Reports list the authors and reviewers.

Theorem: The more cost-sharing-agencies involved in restoration, the longer restoration will take.

Corollary: The older the agency, the more likely it will have a “rich and complex” bureaucratic culture.



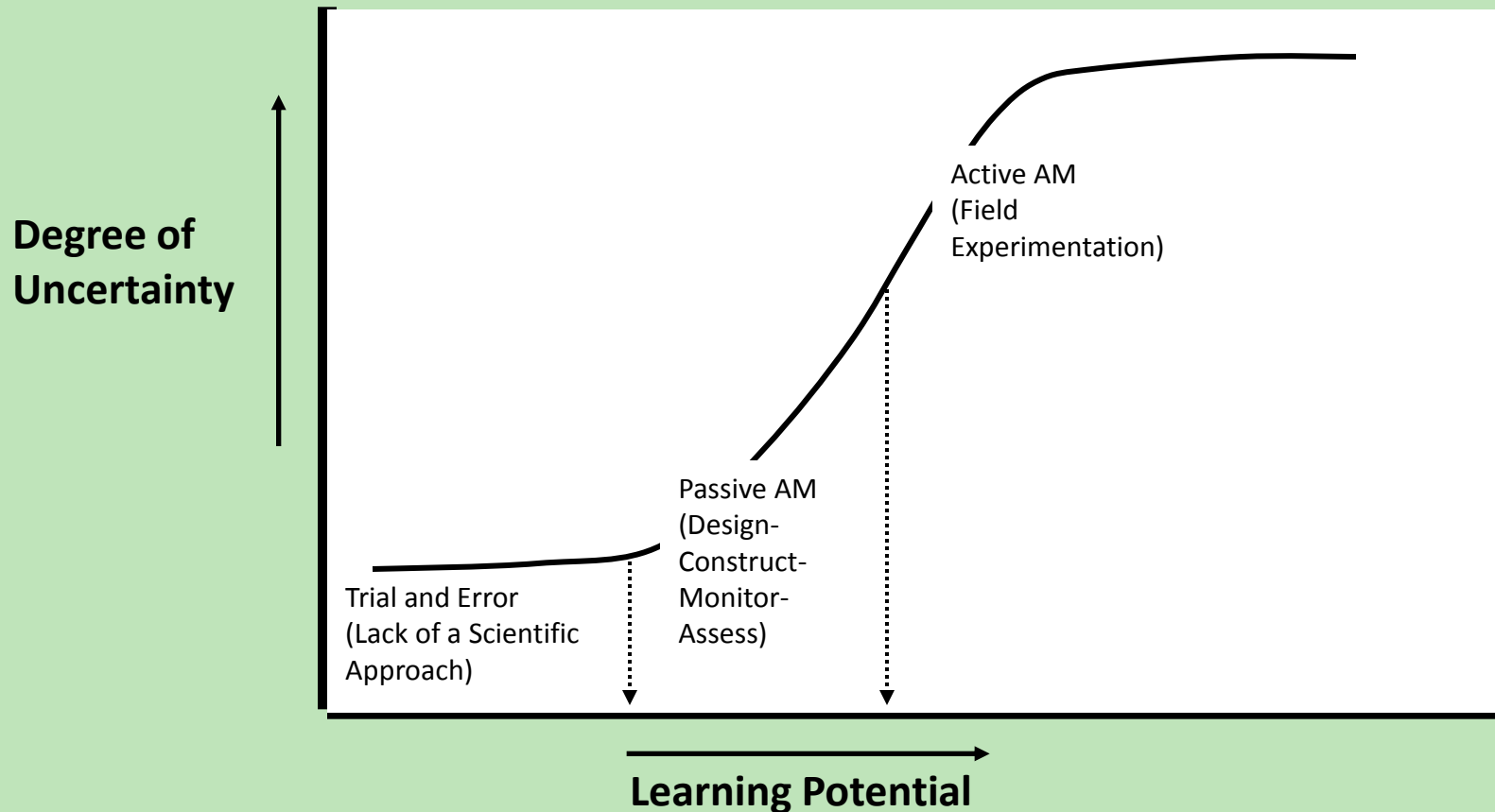
### 3. LESSONS LEARNED: MONITORING & ASSESSMENT

Goal: Evaluate the parameters of the natural and human systems that should be measured in order to determine the progress and success of restoration. Needed every election cycle!

#### Adaptive Management

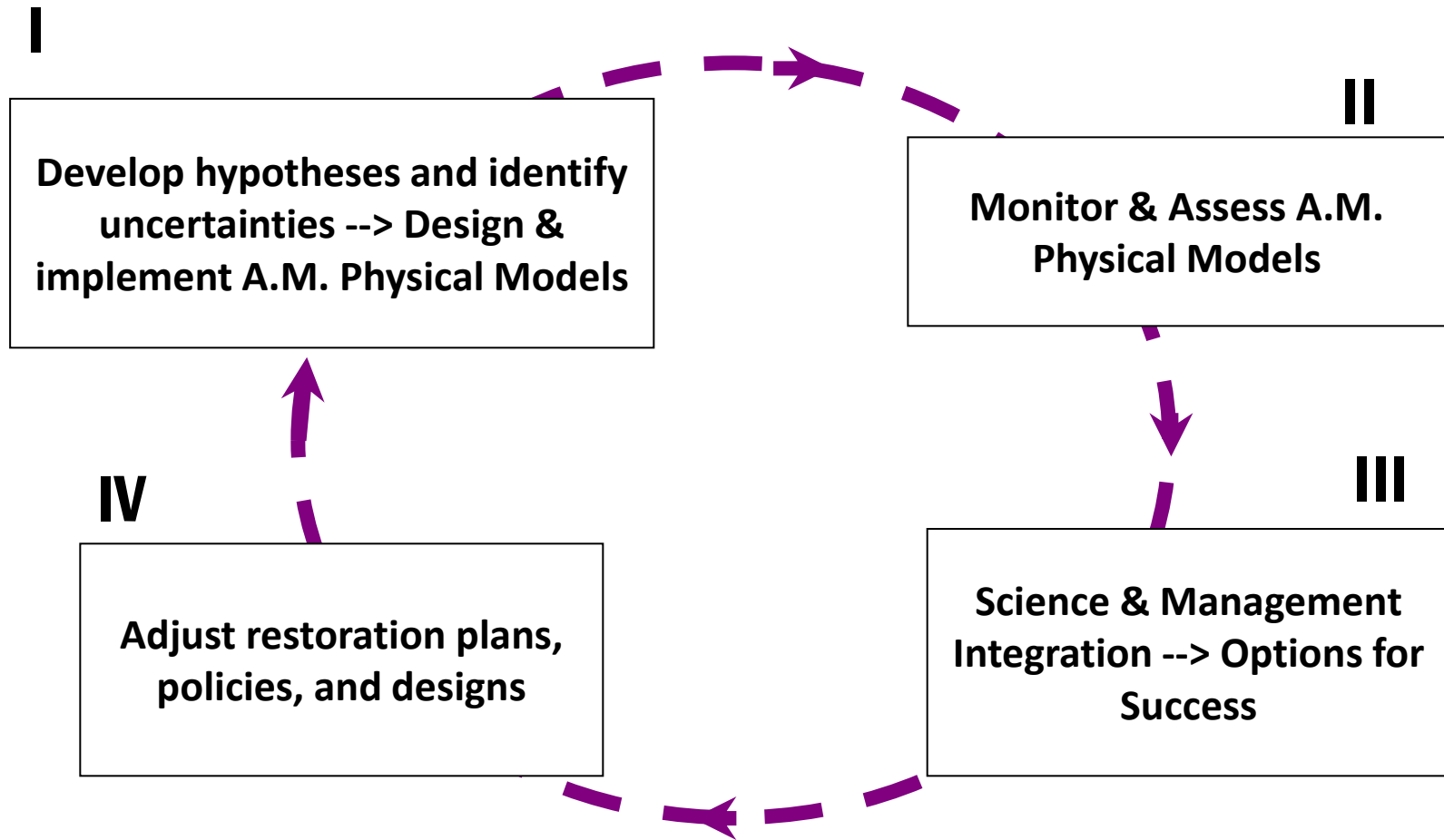
- It is an organized , scientific and inclusive means for identifying and addressing key uncertainties (often an alternative to numerical models), allowing managers to move forward in the face of inadequate knowledge.
- It is “learning by doing” - it involves the scientific analysis of natural resources and environmental impacts of large-scale restoration or management plans, designs, constructions, and operations.

# Passive and Active AM



**Active AM involves actual field testing and experimentation addressing high levels of uncertainty.**

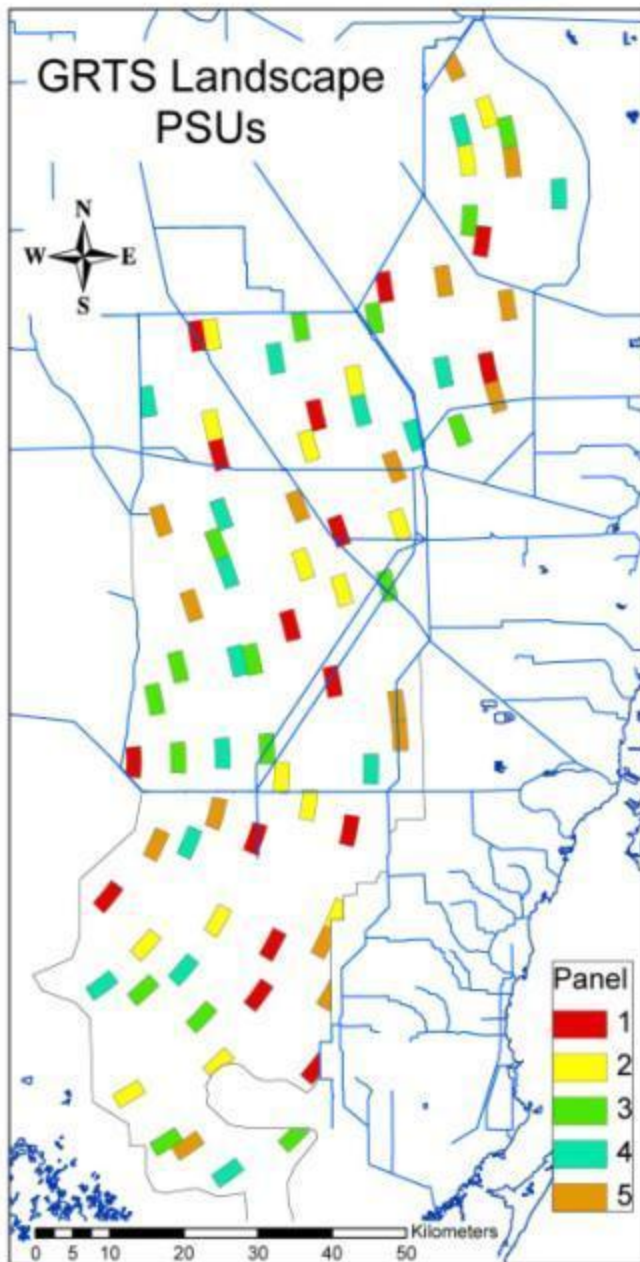
# **How should Adaptive Management work? (Holling, Gunderson, Light, Ogden)**

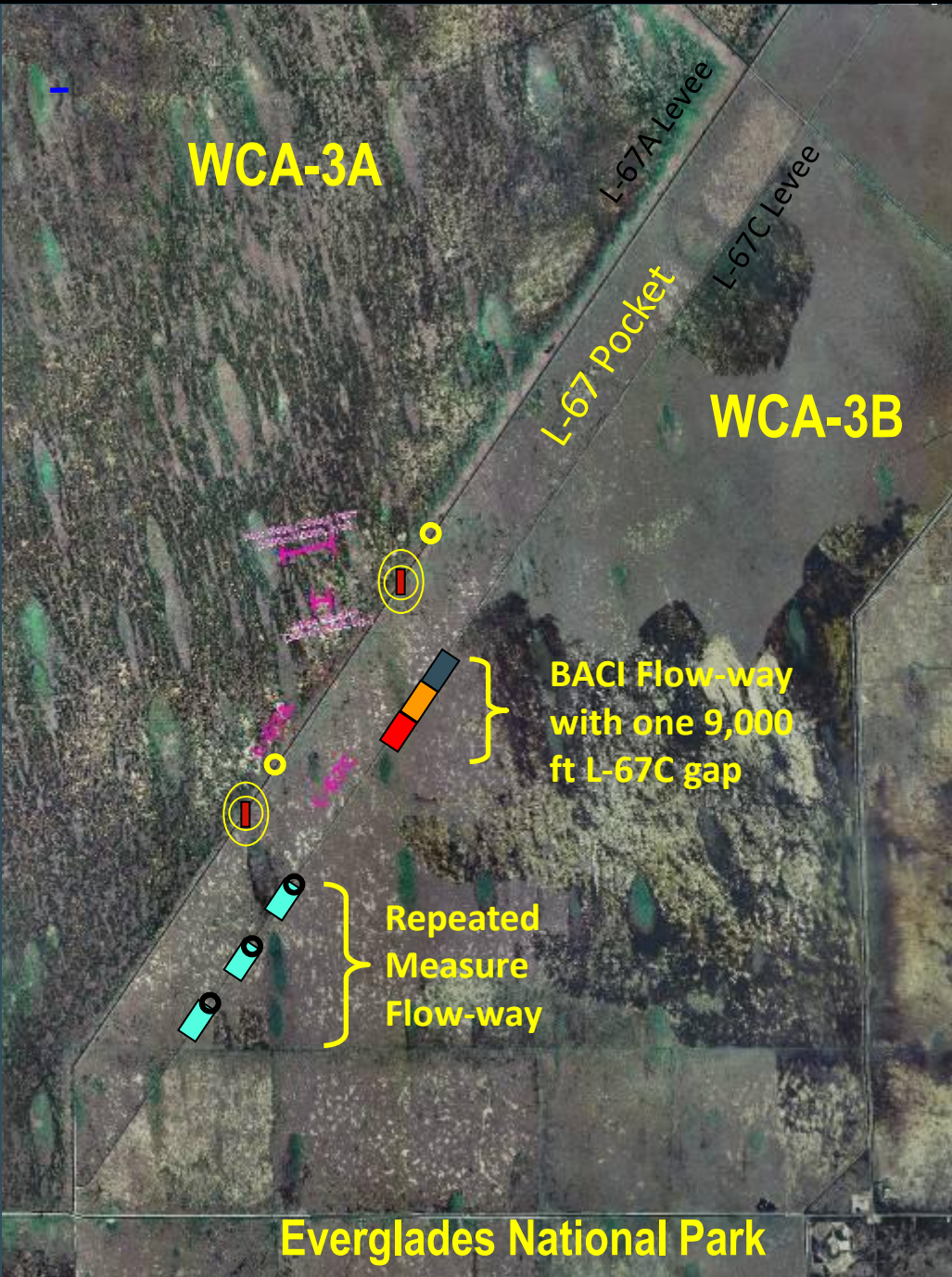


# Passive Adaptive Management

## Generalized Recursive Tessellation Sampling (GRTS)





- Probability sample
- Spatially-balanced
- Any subset 1-N is also spatially balanced
- GRTS yearly panels are each spatially-balanced
- Intense measures (decomposition / root growth) can be made on spatially-balanced subsets
- Allows unequal inclusion probabilities





# Active Adaptive Management

## Proposed Prius Model v3.

-  3000 ft gap (complete backfill)
-  3000 ft gap (canal plug with boat channel)
-  3000 ft gap (partial backfill)
-  3000 ft gap (no fill)
-  L-67A 100-200 ft Gap
-  Canal plug with boat channel



### 3. LESSONS LEARNED: MONITORING & ASSESSMENT

#### Managing Adaptively

- Historically, it has been an unscientific and exclusive operational adjustment to a resource for addressing unintended or sub-optimal environmental conditions.
- It is “managing by doing” - it involves a trial-and-error monitoring approach to evaluate natural resources and environmental impacts of constructed management features and their operations.

# How does *Managing Adaptively* work?



“Confusion Corner” in the NW corner of the Greater Everglades

Bottom Line: Agencies prefer to fund “simple” monitoring and no assessment... Solution: Couple clear and fundamental performance measures (monitoring) with process-based assessment tools (models).



# LESSONS LEARNED: BOTTOM-BOTTOM-LINE, VOL. II

There are no perfect solutions for fixing the mistakes of the past, instead there are conflicting societal visions. These visions need to be shaped by ecosystem science and driven by sustainable environmental engineering towards an integrated suite of solutions.



# Management vs. Science

- 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 a biologist.”
- The woman says: “I am, how do 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.”
- The woman says: “You must be a manager.”
- The man says: “I am, how do 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.”