SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Applied Research Projects Supporting District Activities

Dean Powell, Director, Watershed Management Department

Why We Do Research

- Sound science serves as foundation for resource decisions
- Better understanding of the ecosystem and informed balancing of often competing water resource objectives (i.e. flood control v. salinity envelope)
- Credibility & Professionalism
  - 130 plus peer-reviewed publications over the past 3 years
- Legal Challenges

Some Examples of Applied Science

- Weekly operations meetings
  - Scientific information supports informed decision-making for:
    - Protection of wading bird nesting
    - Estuary salinity levels
    - STA management
- Torpedo grass treatment
- Everglades phosphorus criterion

Watershed Management Department

- Majority of research is through the Watershed Management Department
- Work cooperatively within and outside the District to address water management issues
- FY08 research budget $15.8 million (excluding staff time)
- Approximately 98% of work is conducted through partnerships and/or contracts
- Staff involved in research, project implementation, planning support , adaptive management, assessment

Kissimmee River Restoration

Project Goal

- Reestablish “ecological integrity” to the central portion of the river/floodplain ecosystem

Objective

- Monitor response of ecosystem-level attributes to restoration to evaluate project success

Mandate

- Project Cooperative Agreement with USACE

Kissimmee River Restoration

- Before spending an estimated $600 million on restoration, needed to know if project would work:
  - Hydrologic modeling
  - Floodplain delineation
  - Seed bank studies
- Research served as basis for decision to move forward with Kissimmee River Restoration

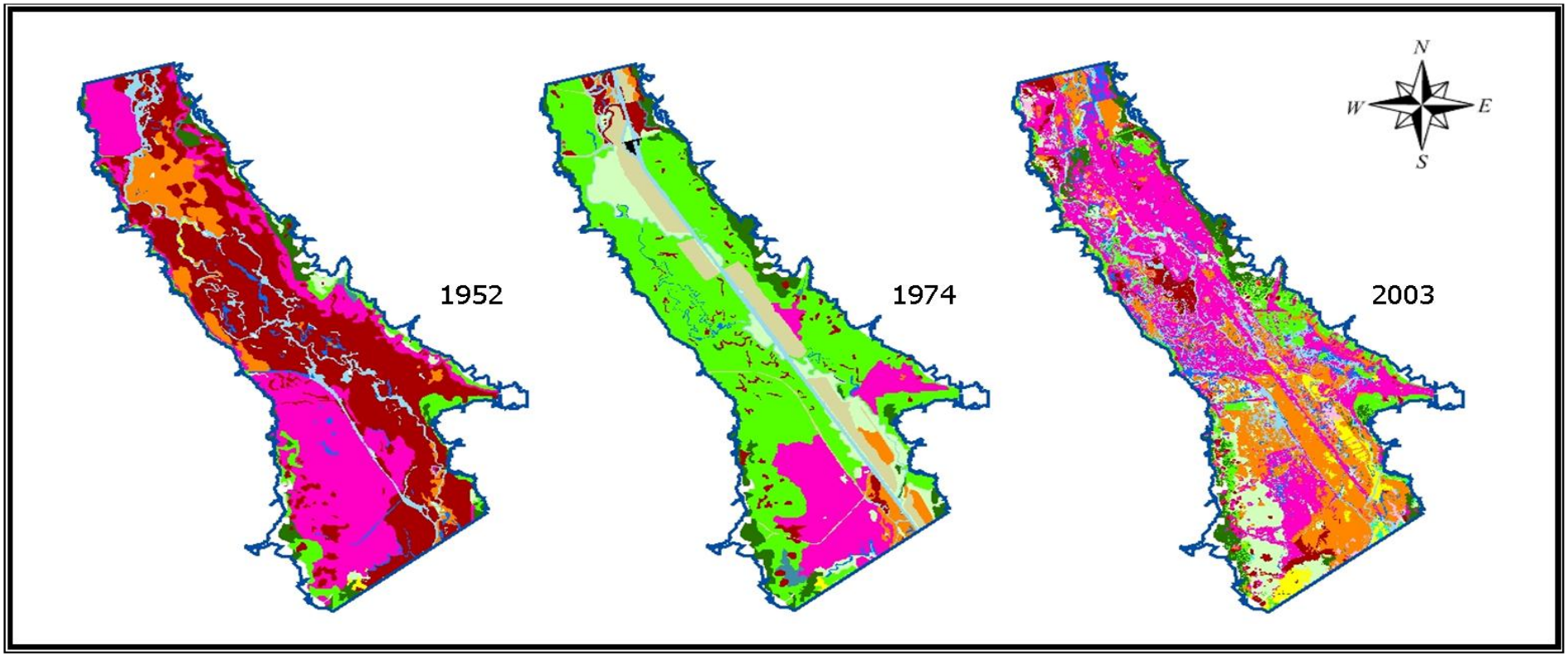
KRR Comprehensive Restoration Evaluation Program Components

- Hydrology
- Geomorphology
- Dissolved Oxygen and Water Quality
- Plant communities
- Invertebrate communities
- Reptile and Amphibian communities
- Fish communities
- Bird communities
- Threatened and Endangered species

Restoration Evaluation

Evaluation Type	Duration	Output
Baseline Restoration	2-3 years	Data for performance measure development
Hydrologic	Continuous	Operations decision making
USACE Construction	1-2 years	Evaluate construction impacts
Initial Response	3-10 years	Adaptive management
Post-Restoration	5 years	Evaluate project success

Floodplain Vegetation Mapping



1 0.5 0 1 Miles

sfwmd.gov

Vegetation Types

- Aquatic Vegetation
- Broadleaf Marsh
- Human-made Structures
- Miscellaneous Wetlands
- Non-vegetated Bare Ground
- Open Water
- Unclassified and Unknown
- Upland Forest
- Upland Herbaceous
- Upland Shrub
- Vines
- Wet Prairie
- Wetland Forest
- Wetland Shrub

Real-time Dissolved Oxygen Monitoring in the Kissimmee River

Fish Sampling in the Restored Kissimmee River

Lessons Learned & Applied through the Kissimmee River Restoration Process

- Modification of construction methods
  - Increased turbidity control by backfilling “isolated cells” on C-38
- Adaptive management
  - Importance of ascension rates relative to levels of dissolved oxygen in the river
  - Management of flow rates to achieve appropriate floodplain recessions rates and levels of dissolved oxygen in the river
- Project changes made as a result of science/monitoring
  - Phase II/III Integrated Study

Kissimmee FY08 Research Budget

Project Name	Schedule (year x of y)	FY08 Budget	Partners
Geomorphic Monitoring	Baseline 2 of 3 years	$207,000	SFWMD $100,000/USGS $50,000 SFWMD $57,000/UF – No match
Kissimmee River floodplain vegetation mapping	Initial response 1 of 2 years	$240,000	
Phase II/III Integrated Ecosystem Study	Baseline 1 of 3 years	$900,000	

Lake Okeechobee - Three Primary Problems

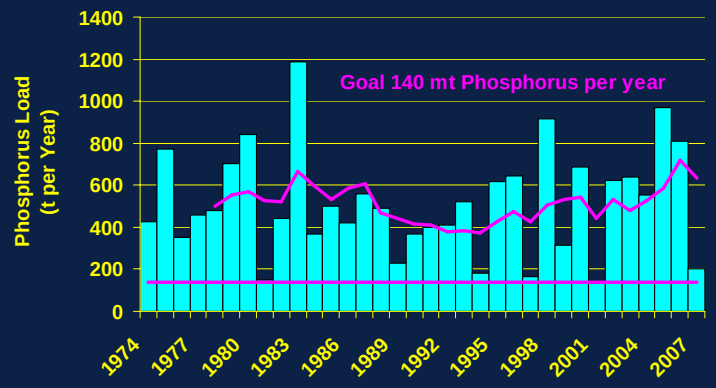
High and Low Lake Levels

Excess Nutrients

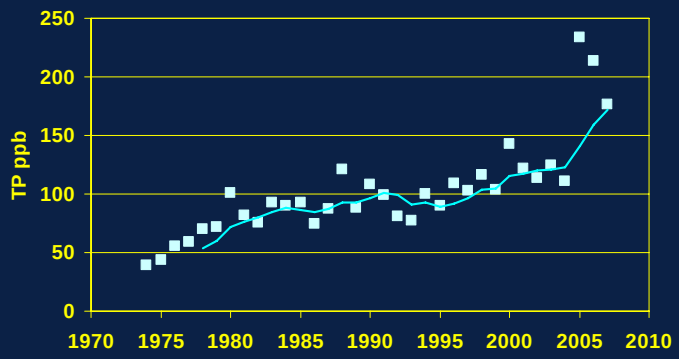
Exotic and Invasive Species

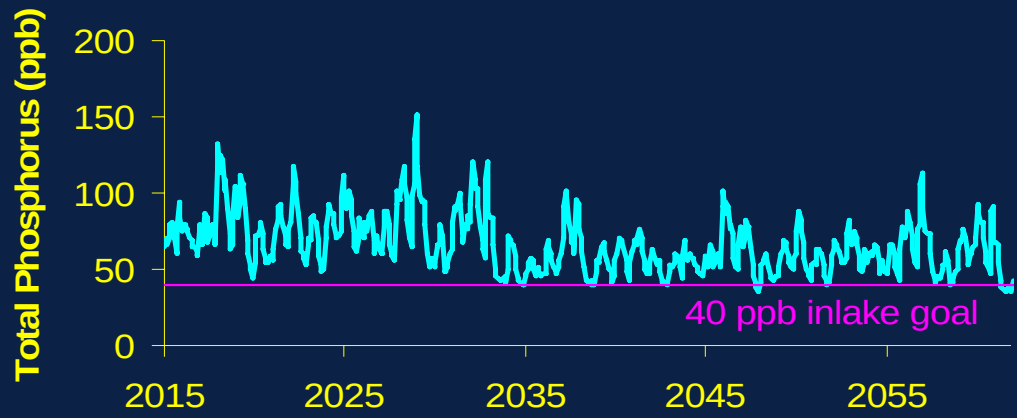
Problem: What is an acceptable yearly load of phosphorus?

Measured loads to the lake



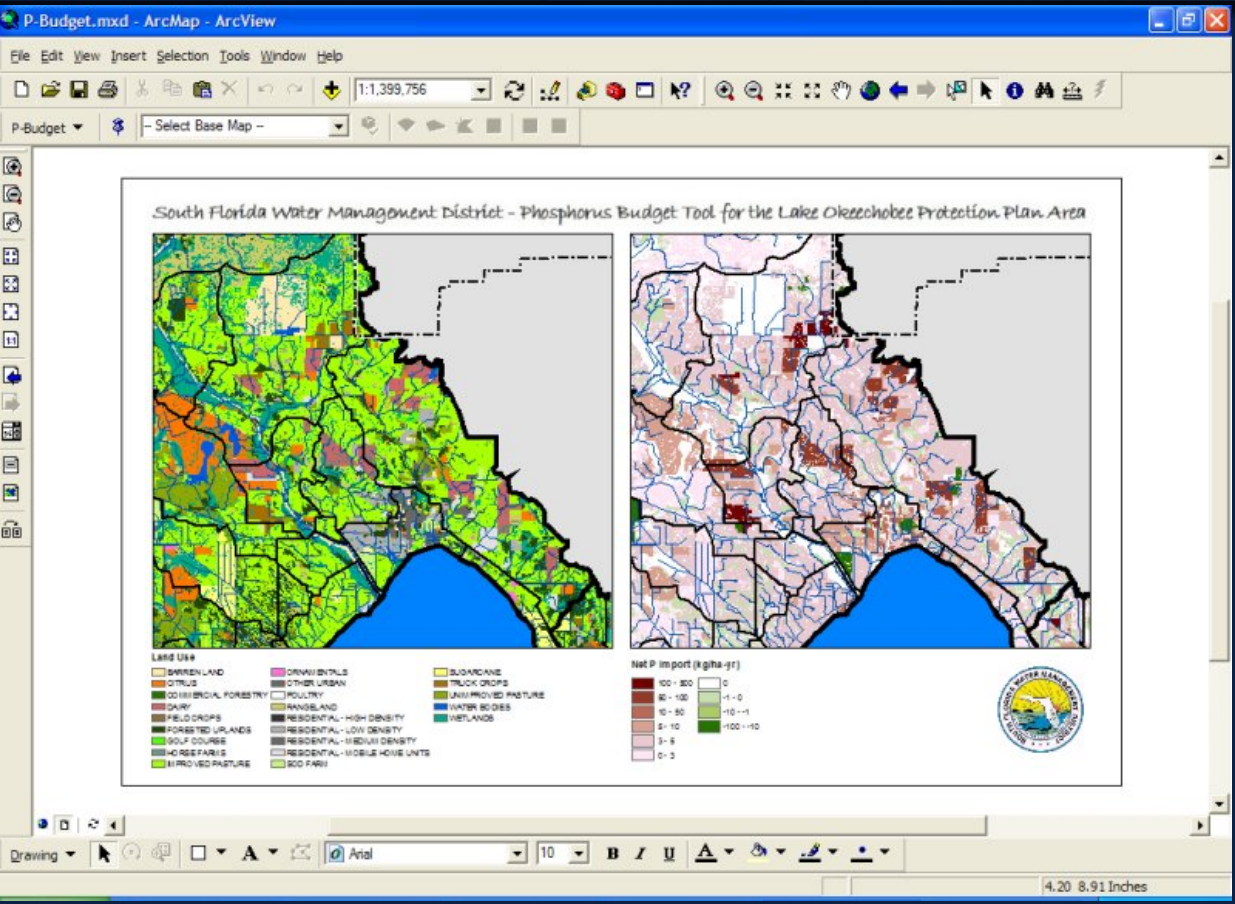
Measured in-Lake Phosphorus

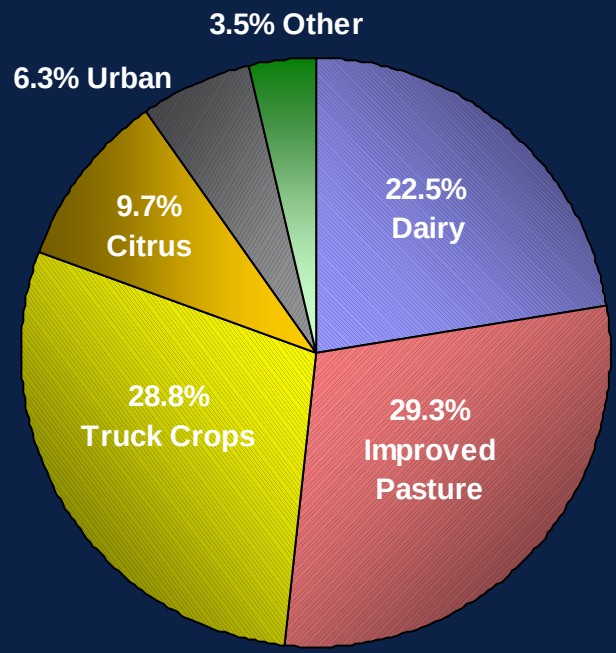




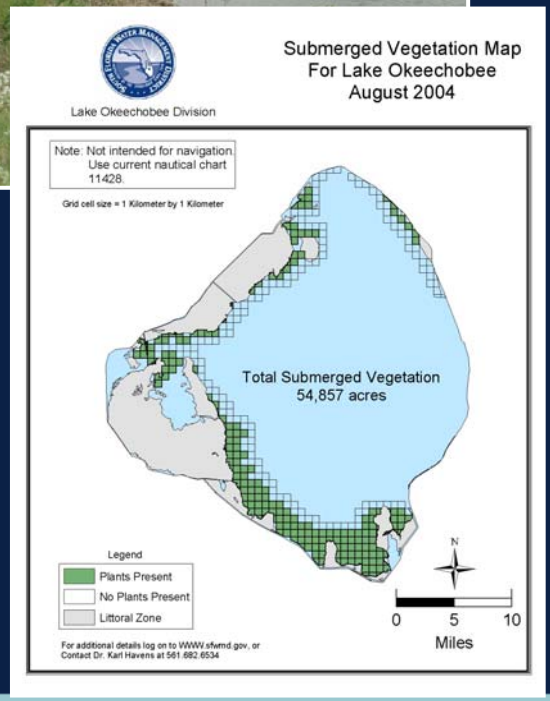
Model prediction if load goal is met

Problem: How Much and Where is the Phosphorus Coming From?





Problem: What are the ecological impacts of high lake stage on vegetation?

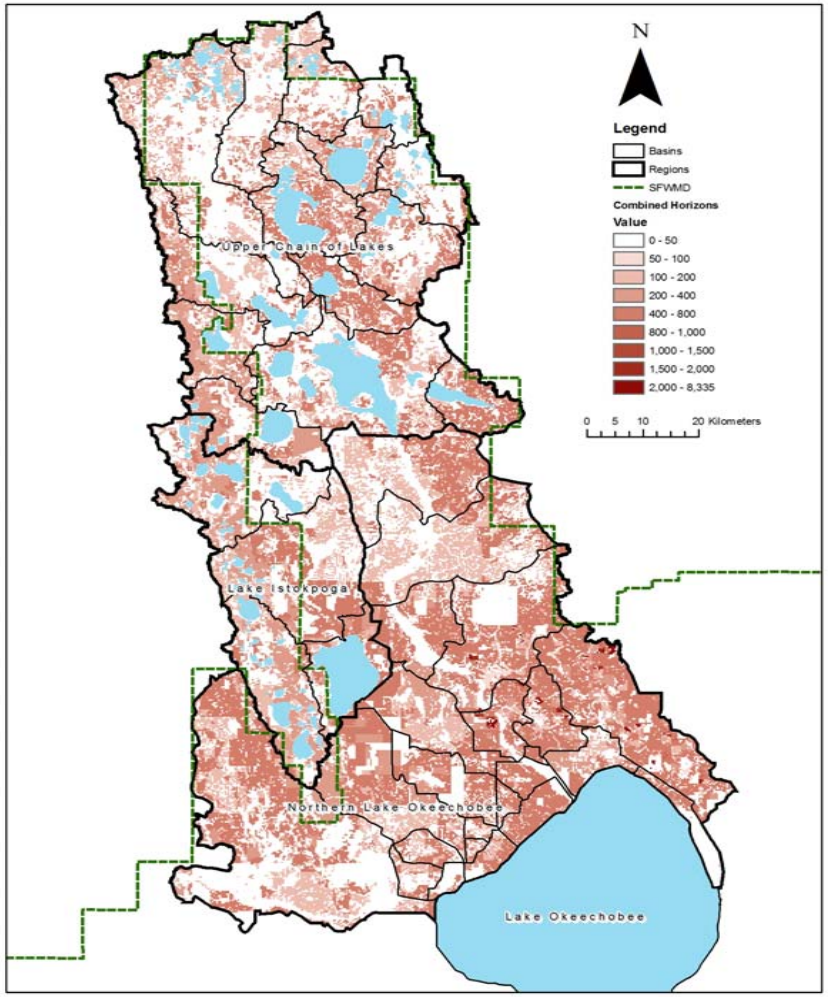


Problem: How do we control exotic species?

Problem: Are native plant seeds still present and viable in impacted areas?

Problem: How long does it take the Lake to recover from natural disturbances?

Problem: How will legacy phosphorus affect the timeline for restoration?



- Legacy Phosphorus estimated at 176,000 MT
- At current loading rate of 500 MT/yr, it would take about 350 years to wash out the existing legacy P
- From prior research, knowledge about transport and abatement strategies is quite good
- P abatement program will be developed

Lake Okeechobee FY08 Research Budget

Project Name	Schedule (year x of y)	FY08 budget	Partners
In-Lake Assessments	On going	$325,000	
Watershed Assessment Model: Enhancement and Application	1 of 2	$135,000	
Legacy Phosphorus Study	2 of 2	$34,000	
Taylor Creek Algal Turf Scrubber Nutrient Recovery Facility	3 of 3	$300,000	Florida Department of Agriculture & Consumer Services Florida Department of Environmental Protection
Pilot Investigation and Design of EAA Algal Turf Scrubber Nutrient Recovery Facility	1 of 2	$495,000	Florida Department of Environmental Protection

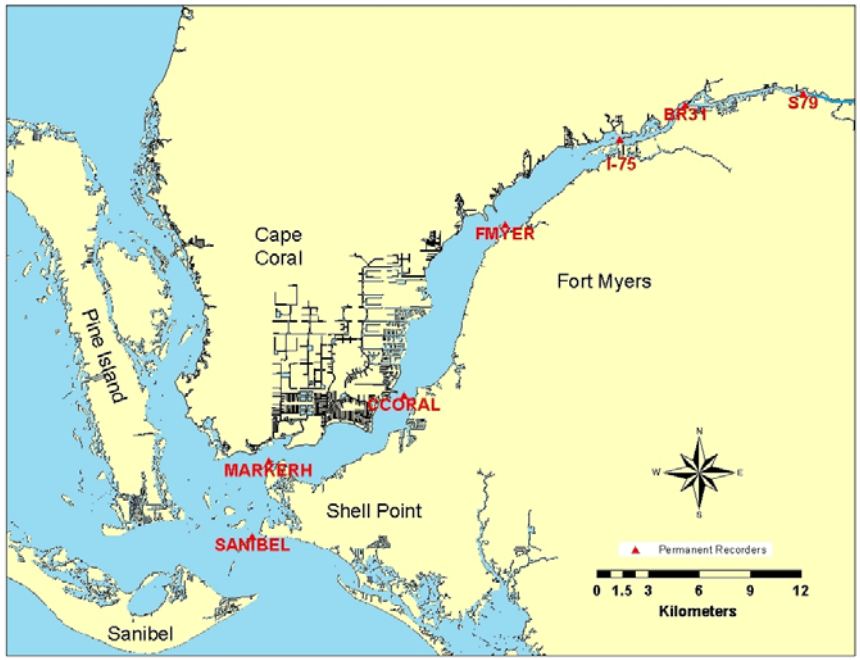
East and West Coast Estuaries

Research Applied to:

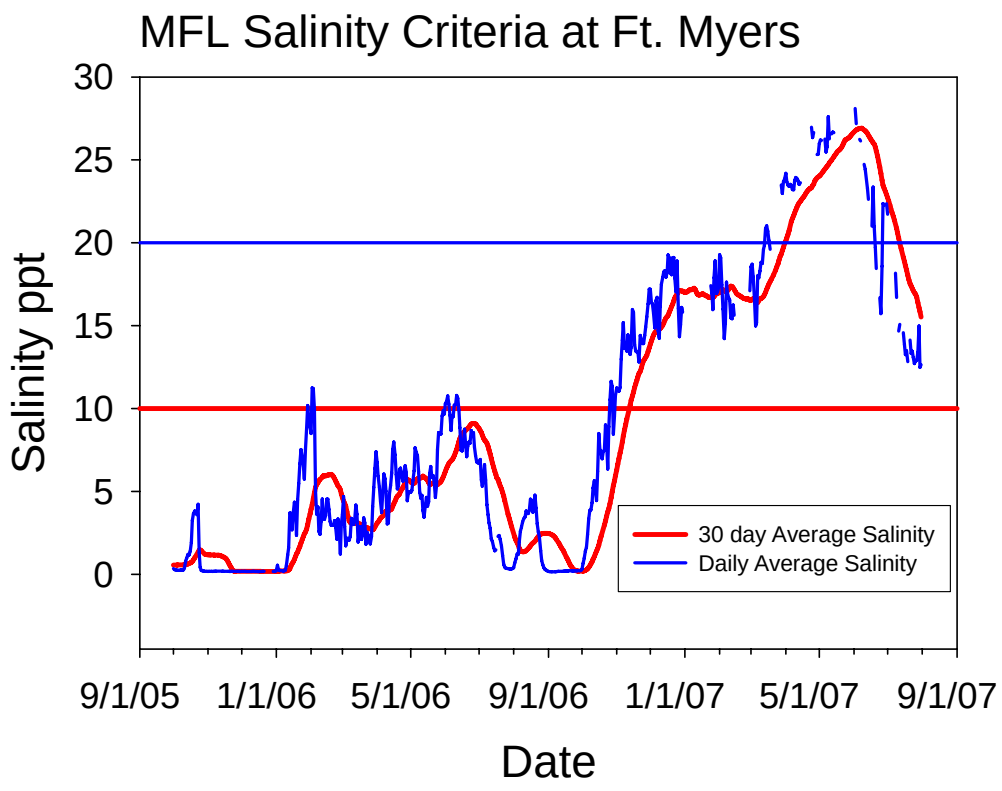
- Management of Freshwater Inflows
  - Minimum Flows and Levels
  - Reservations
  - Restoration Flows
  - Development of Regulation Schedules for Lake Okeechobee
  - Weekly Operations

- Water Quality Improvement
  - Northern Everglades River Watershed Protection Plans
  - Support TMDL
  - SWIM Plan Development

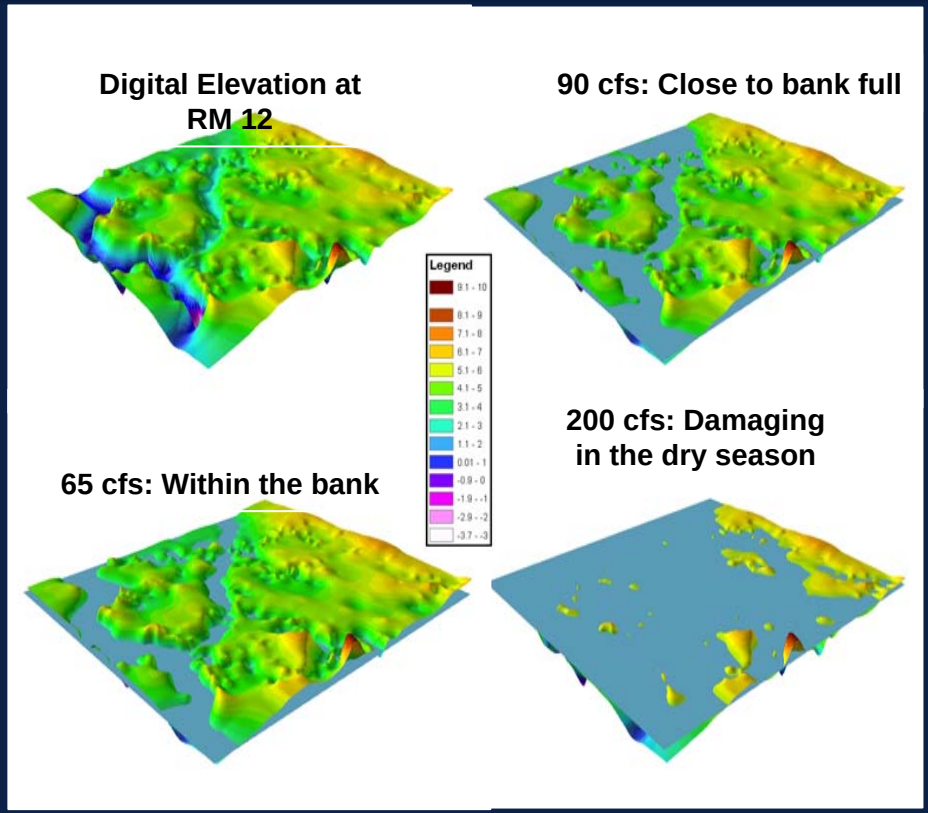
Problem: What are the minimum flows required for a healthy estuary?



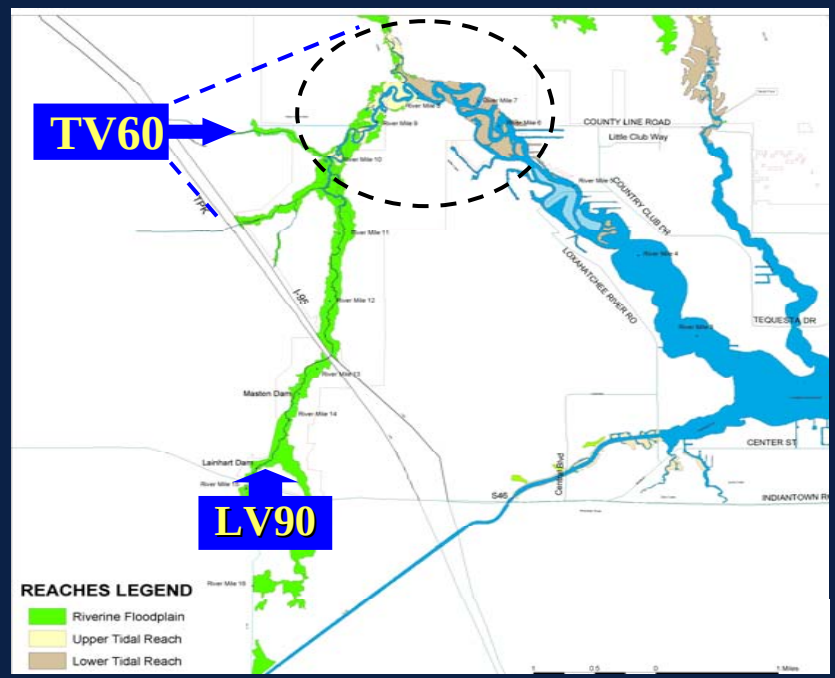
Valued Ecosystem Components
<-> Salinity <-> Flow Targets



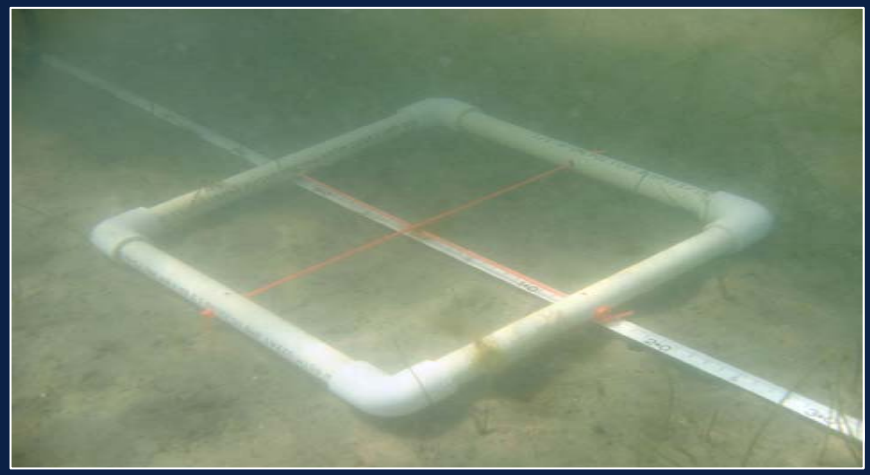
Problem: What are the restoration flow targets for the Northwest Fork of the Loxahatchee River?



Restoration Flow Target:
Provides variable flows over Lainhart Dam with a monthly mean during the dry season ranging from 65 to 90 cfs.



Problem: What water quality conditions are needed for healthy seagrass?



Problem: What flow ranges are needed for a healthy estuary?

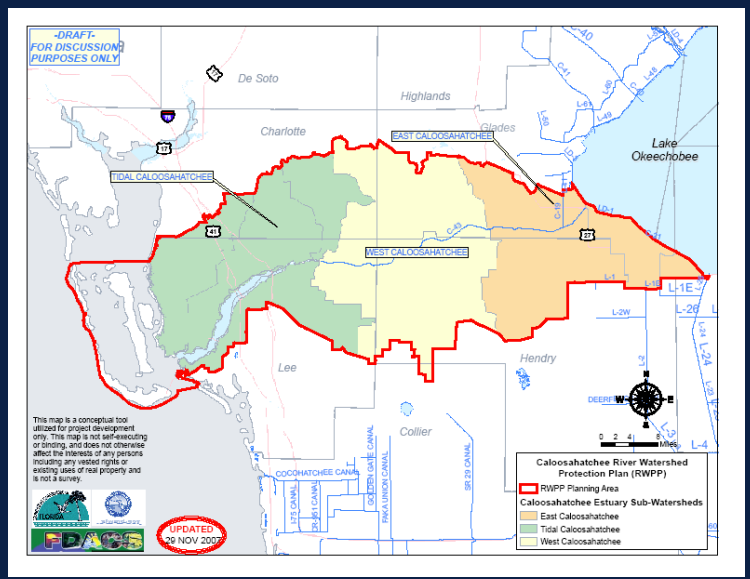
Water Quality: Nutrient Studies

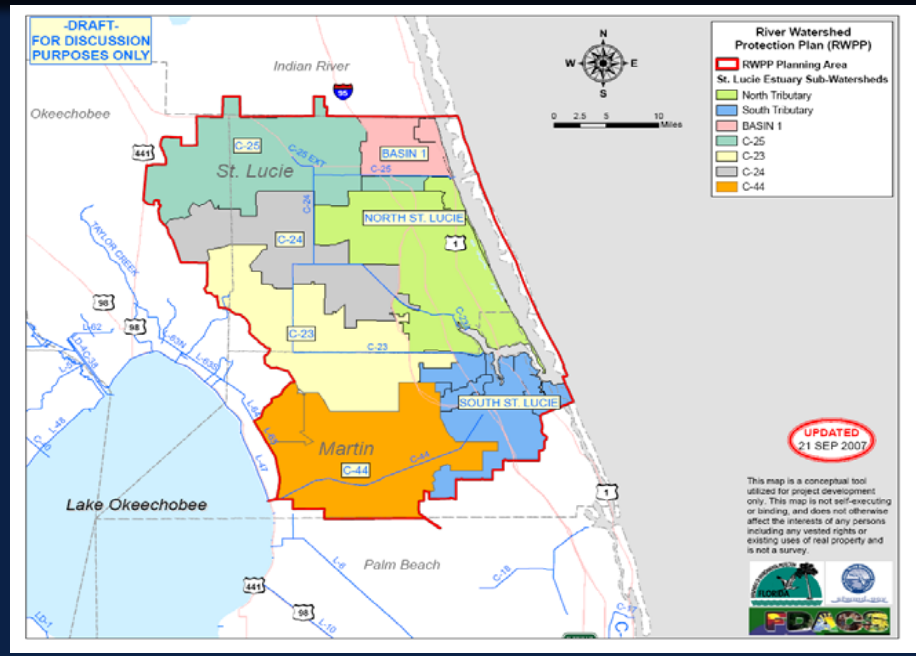
High nutrient loading condition

Low nutrient loading condition

Water Quality: Research and Water Quality Monitoring Plans

- Caloosahatchee and St. Lucie River Watershed Research and Water Quality Monitoring Plans under development





Partners include:

- Florida Department of Environmental Protection
- Florida Dept of Agriculture and Consumer Services
- local governments

East & West Coast Estuaries FY08 Research Budget

Project Name	Schedule (year x of y)	FY08 budget	Partners
St. Lucie River Research and Water Quality Monitoring Plan Studies	1 of 1	$340,500	FDEP, FDACS and Local Governments
St. Lucie River Modeling	1 of 1	$360,000	AEE and UF
Loxahatchee River Restoration Projects (Oyster Reef Enhancement, WQ Bio Monitoring, Wildlife Utilization)	1 of 1	$134,000	LRD, JDSP – All partners providing funding
Loxahatchee River Integrated Modeling	1 of 1	$48,000	UF
Biscayne Bay Seagrass and Water Quality Data Analyses	1 of 1	$90,000	CHNEP and UF
Caloosahatchee River Research and Water Quality Monitoring Plan Studies	1 of 1	$312,500	FDEP, FDACS and Local Governments
Caloosahatchee Fisheries Data Collection and Analysis	2 of 2	$70,000	FFWCC
Naples Bay Hydrologic and Salinity Data Collection, Estero Bay Fisheries Independent Monitoring, Lower Charlotte Harbor Aerial Mapping and Imaging	1 of 1	$337,850	USGS, FDEP, FFWCC and SWFWM

Stormwater Treatment Areas (STAs)

- Optimizing phosphorus removal performance
- Rehabilitation in response to
  - Nutrient overloading, Hurricanes, Drought
- Receiving areas downstream of STA discharges
  - Rotenberger Wildlife Management Area
  - Water Conservation Area 2A
- Mandated by Everglades Forever Act

Problem: What controls the establishment and persistence of submerged aquatic vegetation?

Problem: What is the mechanism for long term storage of phosphorus?

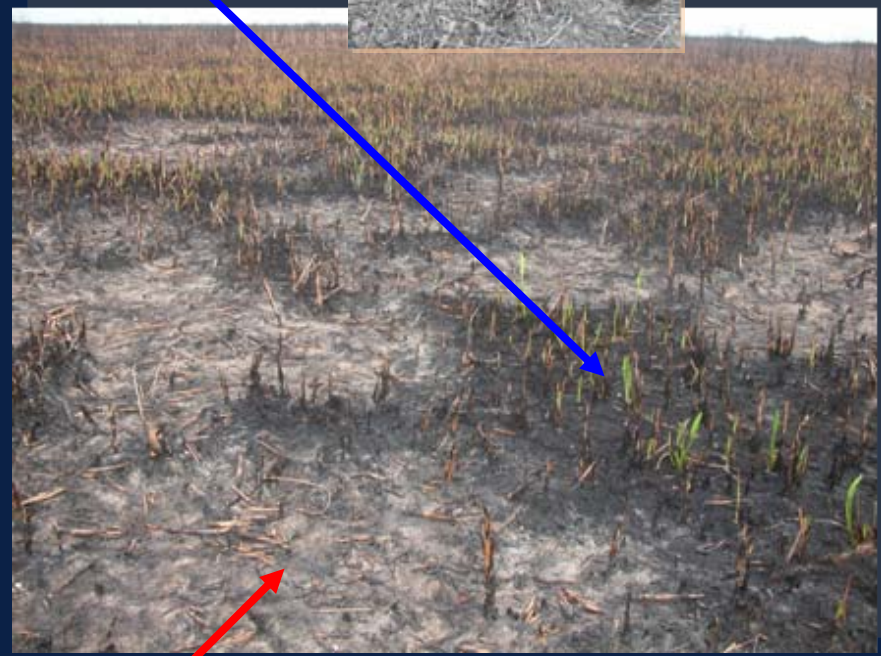
Problem: What are the effects of water depth and flooding duration on cattails?

Problem: What are the effects of drought on STA vegetation?

Problem: What methods can be used to re-habilitate STAs?

Problem: How does fire affect phosphorus release and vegetation recovery?

Surface Burn



Muck / Peat Burn

Peat fire (muck burn) and surface burn at the RC3 site (5/22/06).

Problem: How do the vegetation patterns change downstream from STA discharges?

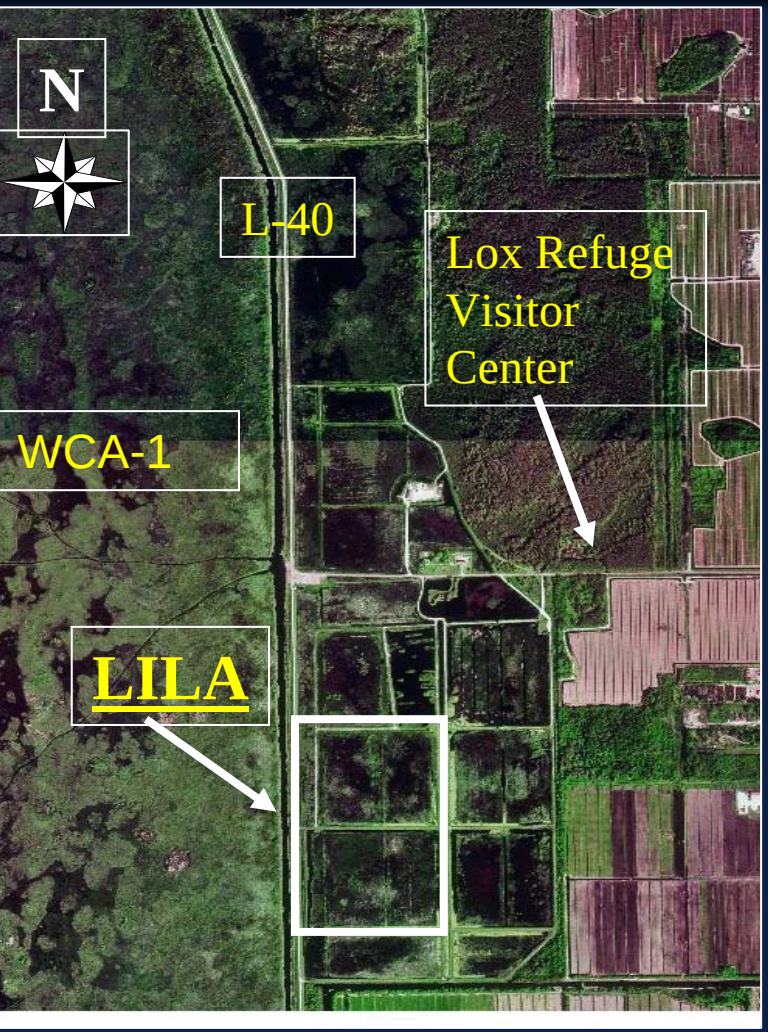
STA FY08 Research Budget

Project Name	Schedule (year x of y)	FY08 budget	Partners
SAV Performance and Analysis	Annually through 2014	$120,000	Everglades Agricultural Area (EAA) Environmental Protection District (EPD)
Soil Biogeochemical Characterization	Every 3 years through 2014	$110,000	Everglades Agricultural Area (EAA) Environmental Protection District (EPD); University of Florida
Effects of Flooding Depth and Duration on Cattails	Year 2 of 3	$60,000	Everglades Agricultural Area (EAA) Environmental Protection District (EPD)
Effects of Drought in STA Vegetation and the Rate of Recovery Post Drought	Year 1 of 2	$60,000	Everglades Agricultural Area (EAA) Environmental Protection District (EPD)
Vegetation Strategies (i.e. bulrush planting, rice planting)	Annually through 2010	$250,000	Combination of in-house and contractor staff
Receiving Areas Downstream of STA Discharges: Rotenberger & WCA-2A	Annually through 2009	$75,000	Combination of in-house and contractor staff

Everglades Ecosystem

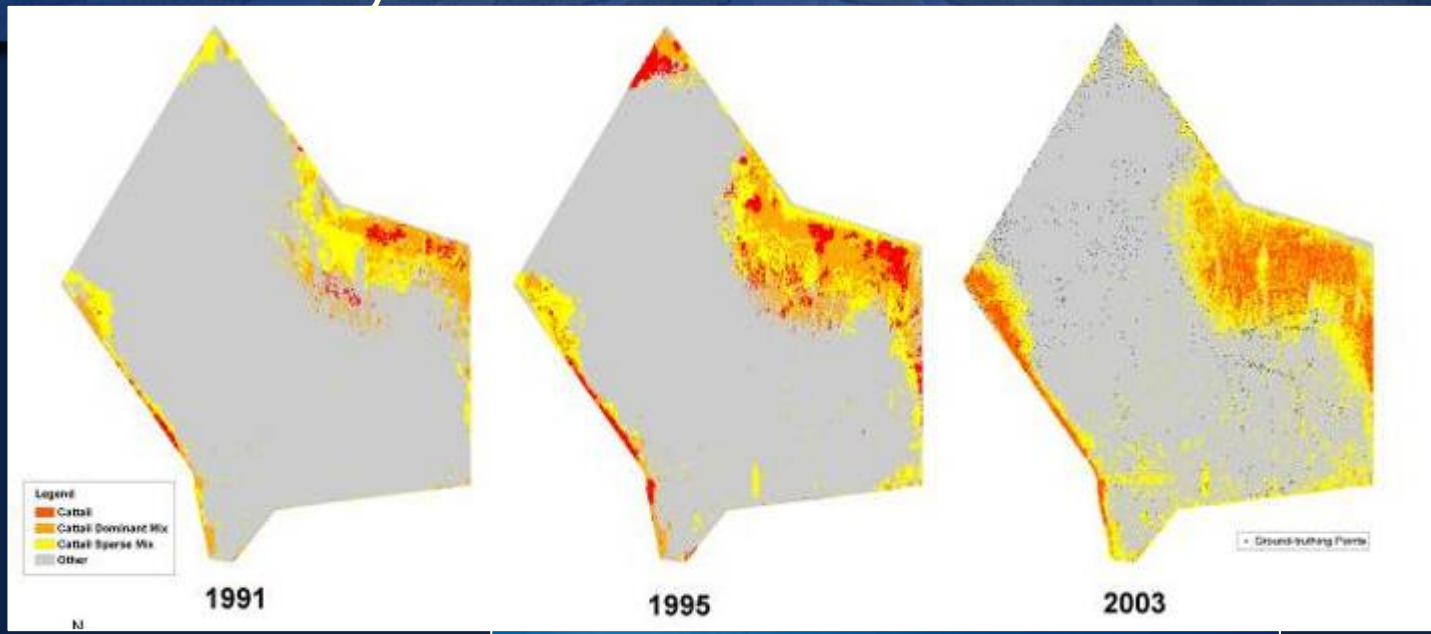
- **Applied research focusing on the ecosystem responses to water management and restoration:**
  - **Tree islands**
  - **Accelerating ecosystem recovery**
  - **Water management impacts on the food web**
  - **Florida Bay / Everglades linkages**

Problem: How does water depth and flow affect the ecosystem?

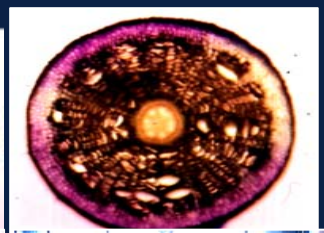


Problem: What effects do nutrients and hydroperiod have on the ecosystem?

Mapping Cattail Expansion 1991-2003



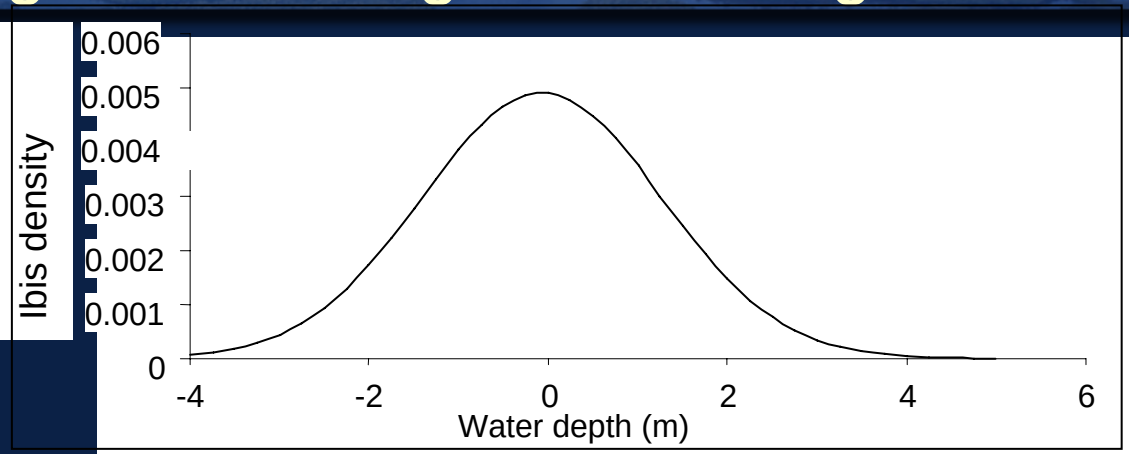
Cattail

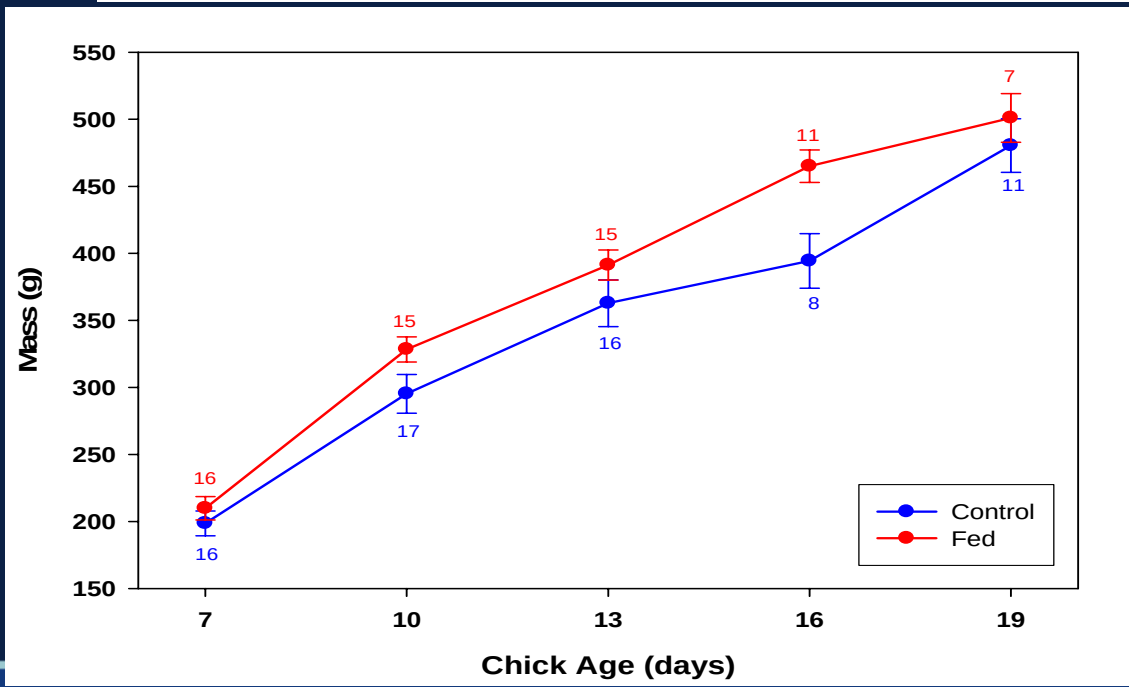


Sawgrass

Problem: What management techniques can be used to accelerate recovery of impacted areas?

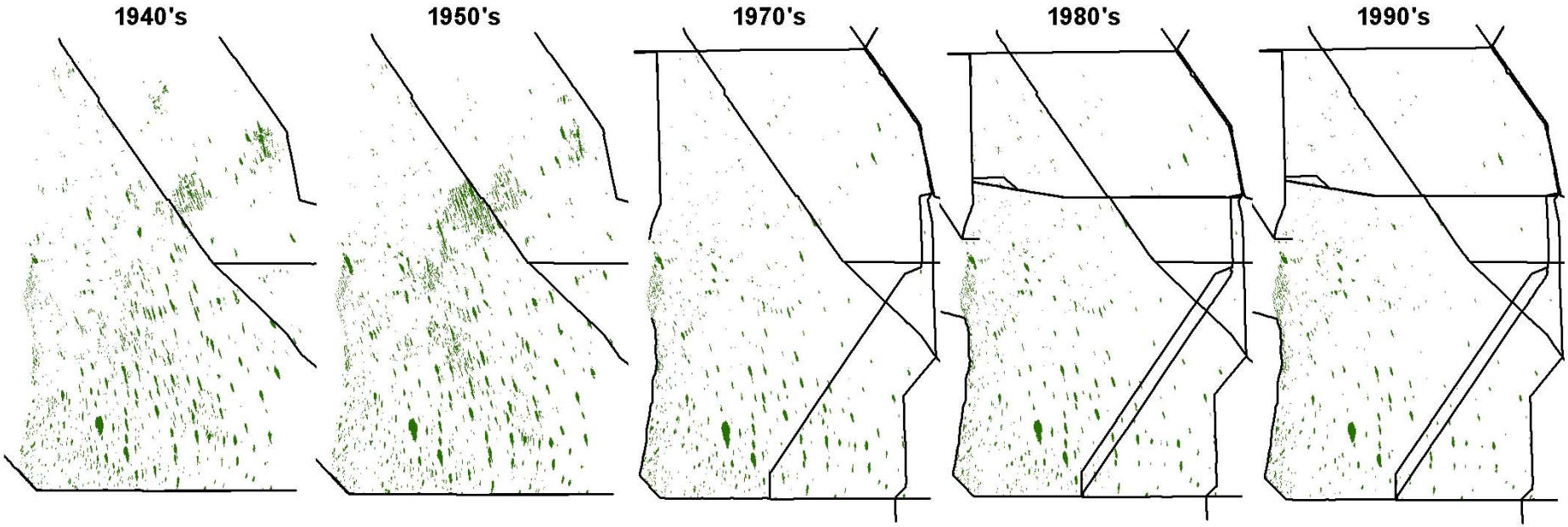
Problem: How does water management affect wading bird nesting and feeding?



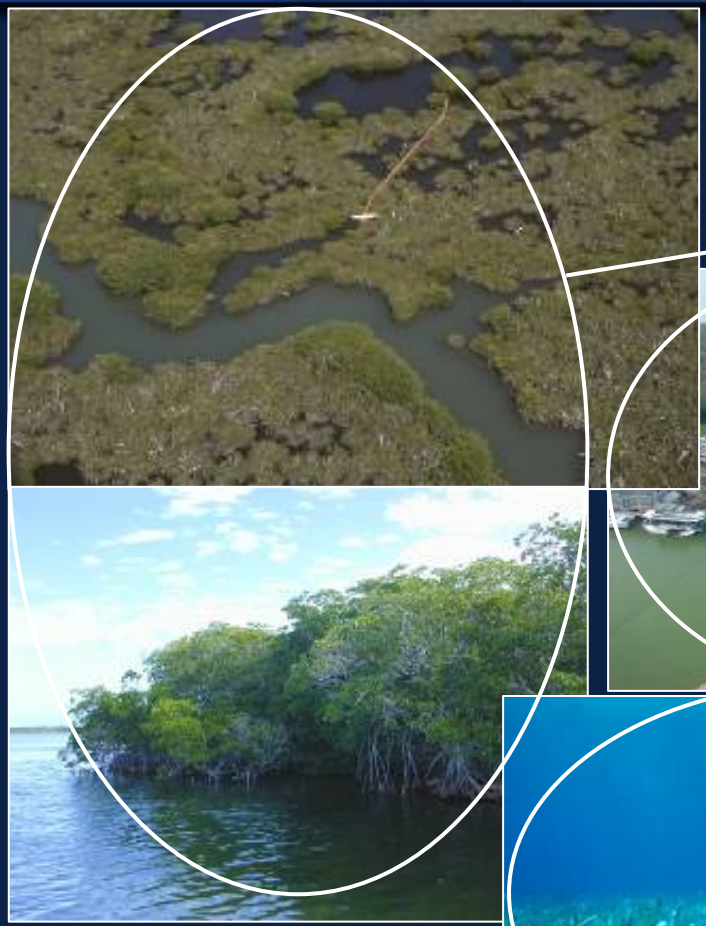


Inappropriate water depths (poor food supply) led to reduced chick growth and survival

Problem: Why has there been a 60% decline in tree islands since the 1940s?



Problem: How do changes in water management affect Florida Bay?



Assessing effects of fresh water flow through mangrove wetlands

Assessing effects of fresh water flow on algal blooms

Assessing effects of fresh water flow on sea grass habitat and fish species

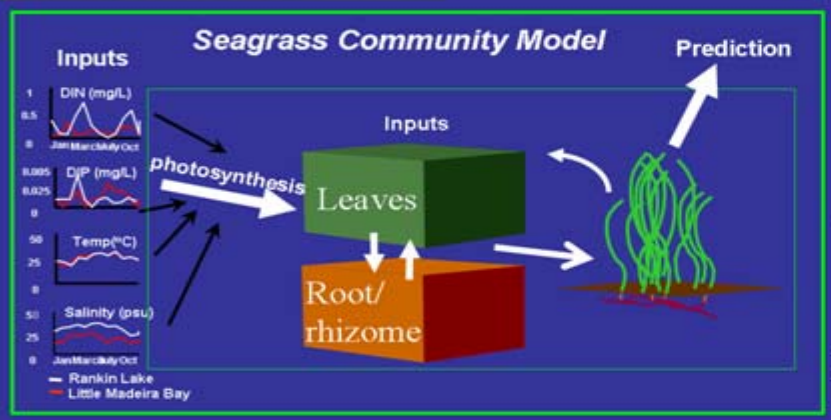
Problem: What factors affect seagrass abundance in Florida Bay?

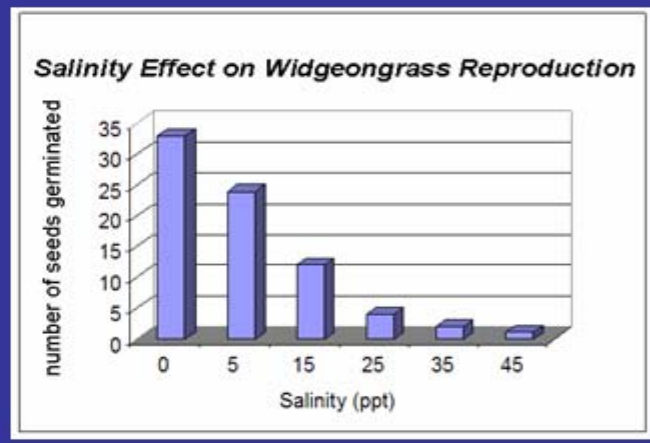
monitoring

research

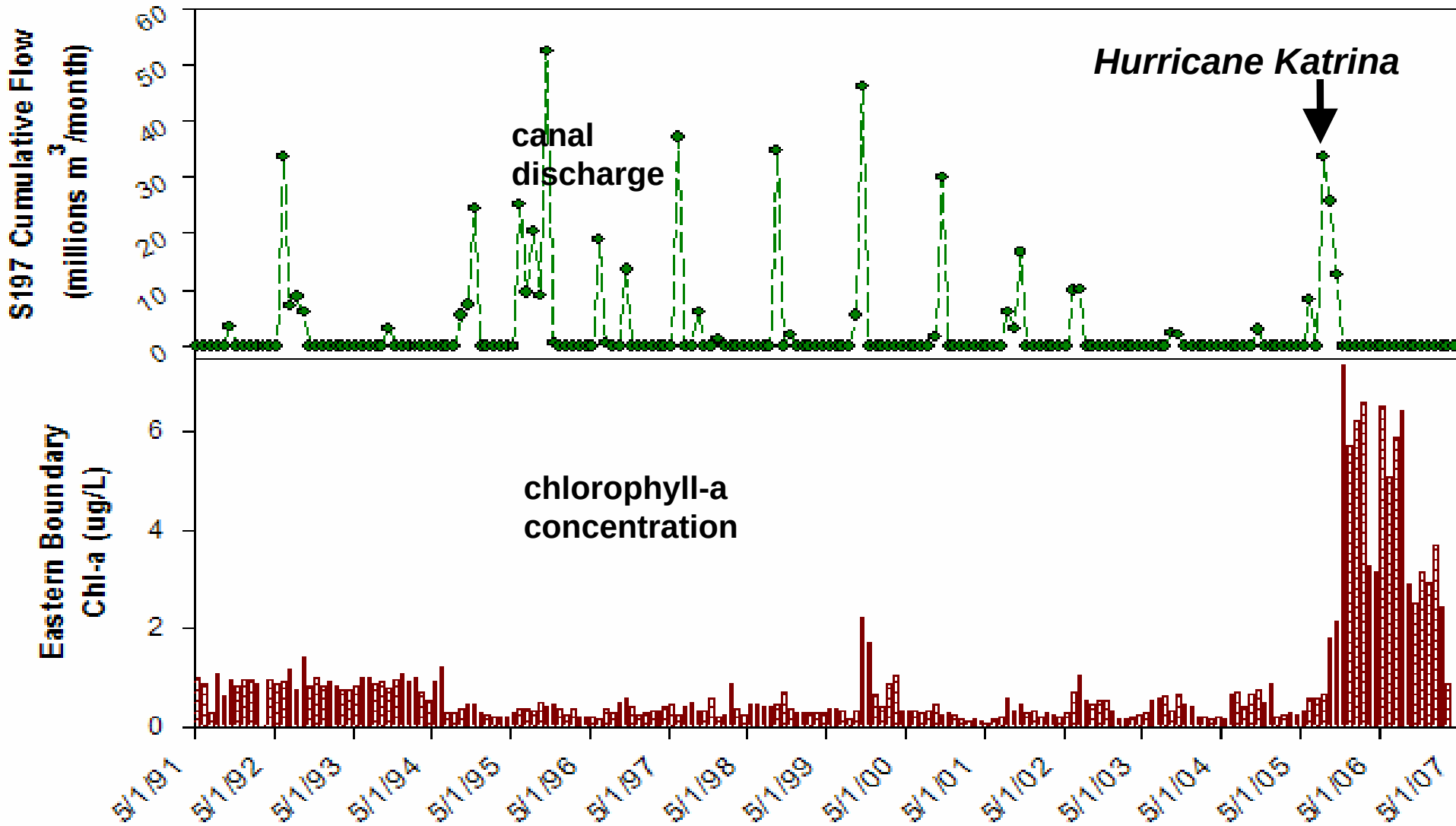
modeling

Results for Restoration





Problem: What is the cause of algal blooms in Florida Bay?



Everglades & Florida Bay FY08 Research Budget

Project Name	Year x of y	FY08 Budget	Partners
Hydrology Impacts on the Food-web			ENP, FWC, USGS, FFWCC, Various FL Universities, Audubon, Solid Waste Authority, USCOE
Factors Affecting Wading Bird Prey Availability and Foraging Success	2 of 3	$105,946	
Plant Exotic Survey and Ecological Assessment on Tree Islands	1 of 2	$294,000	
Accelerated Ecosystem Recovery			FDEP, FWC, Auburn University, UF-IFAS
Fire Project	3 of 5	$2,000,000	
C.H.I.P. Project	3 of 5	$1,950,000	
Understanding Ecosystem Processes			ENP, USGS, Miami-Dade DERM, FFWCC, FIU, Audubon
FL Bay - Submerged Aquatic Vegetation Model Parameterization for MFLs	3 of 3	$100,000	
Landscape Structure & Function: Water Management and Restoration			USCOE, FIU, ENP, FAU, FWC
Greater Everglades Vegetation Interpretation	0 of 1	$248,248	
Loxahatchee Landscape Impoundment Assessment Tree Island Experiments	4 of 4	$128,000	

Hazards of Field Work

Researchers With Vision

Thank you