Applied Research Projects Supporting District Activities

Governing Board Workshop
February 11, 2009

Dean Powell

Director, Watershed Management Department

Kissimmee Basin Research

Issue: What are the expectations for vegetation response in the restored river?

- 4 Performance Targets
  - Decrease in floating vegetation
  - ✓ Increase in emergent vegetation
  - ✓ Width of emergent vegetation along sides of straight river channels
  - ✓ Width of emergent vegetation on inside of channel curves

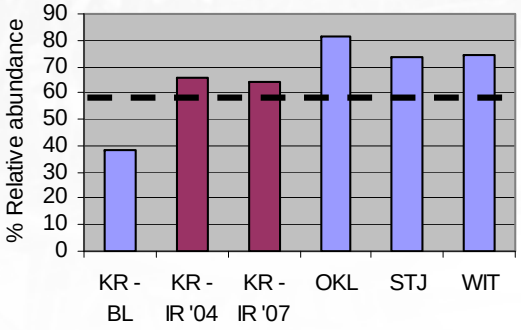
Pre-restoration

Post-restoration

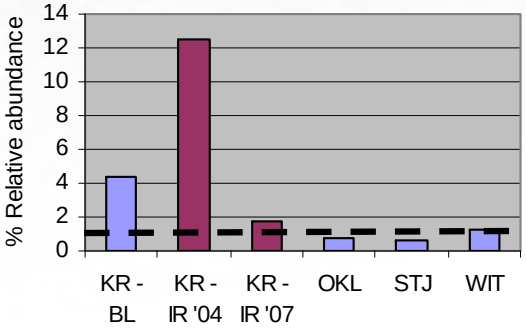
Issue: What are the expectations for invertebrate response in the restored river?

Issue: What are the expectations for fish response in the restored river?

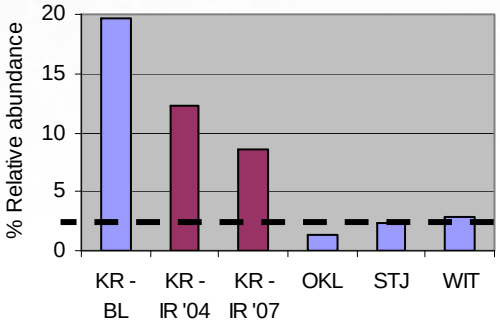
Centrarchids - bass and sunfish



Amia calva- bowfin



Lepisosteus platyrhincus- Florida gar



Issue: What are the expectations for waterfowl response in the restored river?

Performance Target:

- ✓ Winter waterfowl densities ≥3.9 ducks/km²

Performance Target:

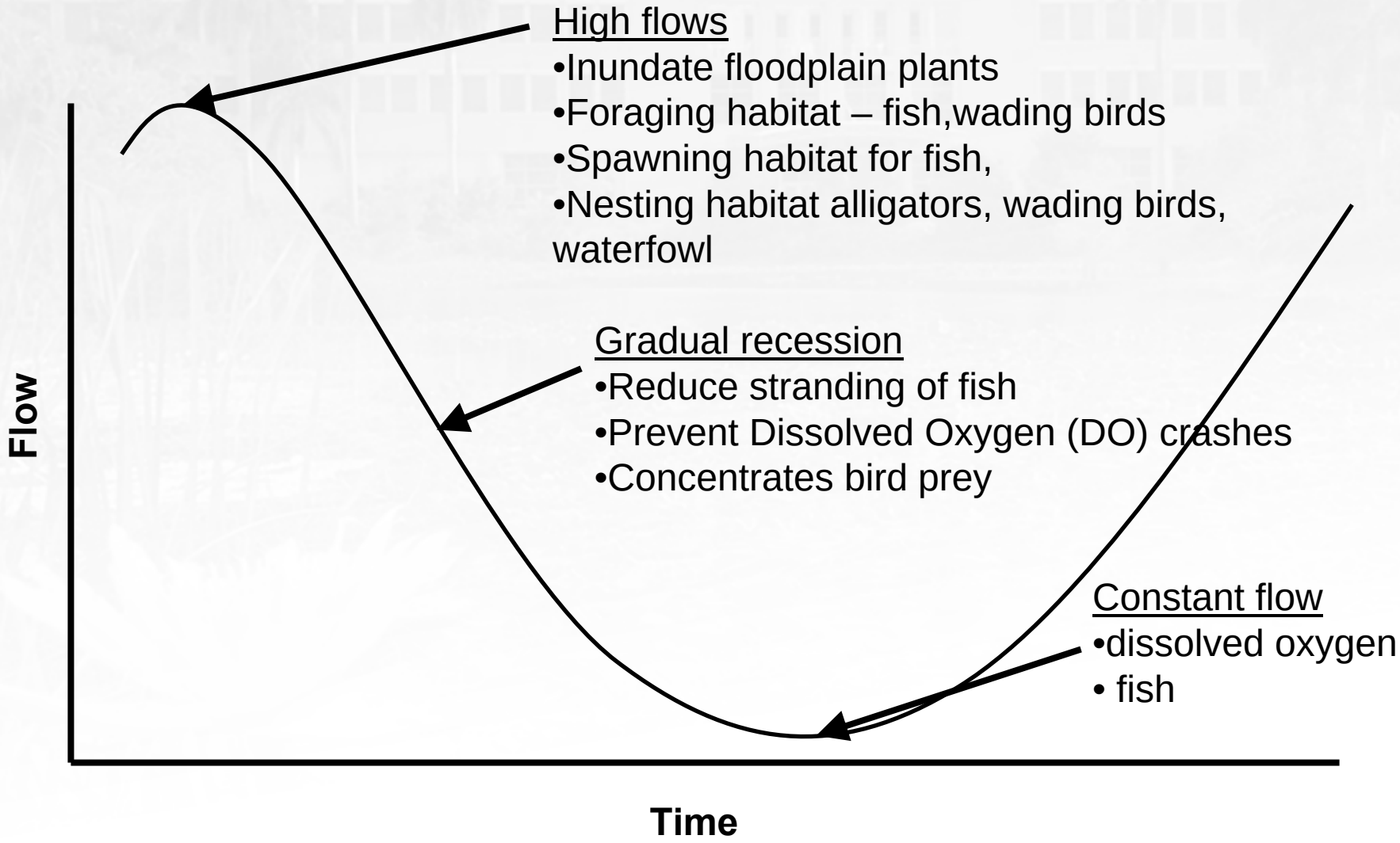
- Species richness ≥13
- 9 species have returned

Issue: What are the expectations for wading bird response in the restored river?

Performance Target: Dry season density ≥30.6 wading birds/km²

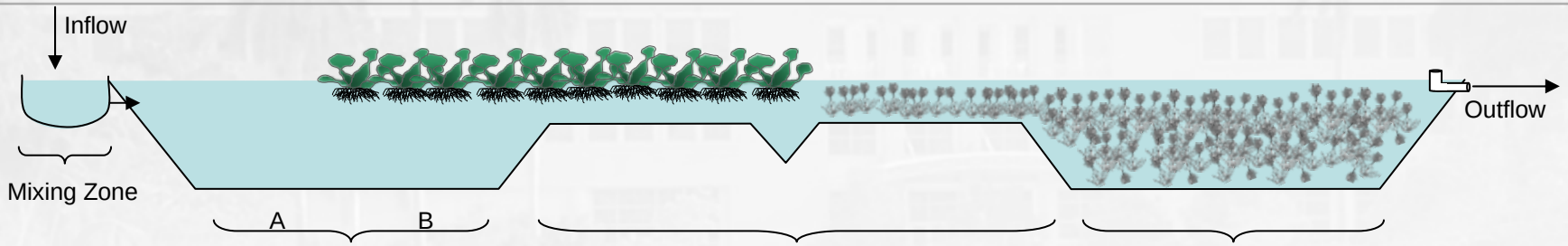
✓ Current density = 35 birds/km²

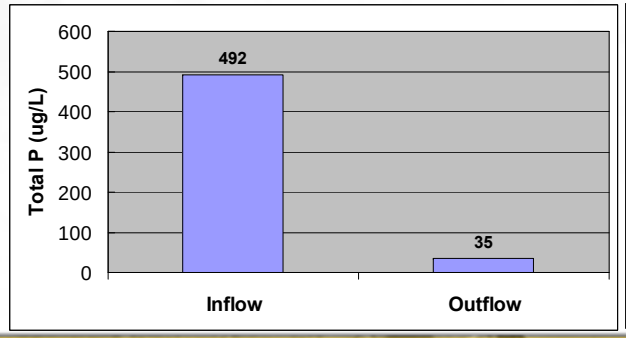
Issue: What is the best available science for establishing water reservations for the Kissimmee Basin?

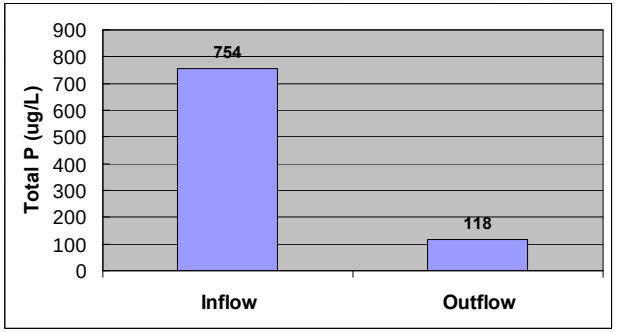


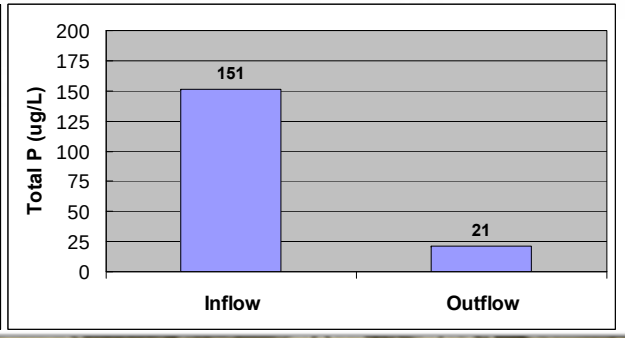
Lake Okeechobee Research

Hybrid Wetland Treatment Technology (HWTT)

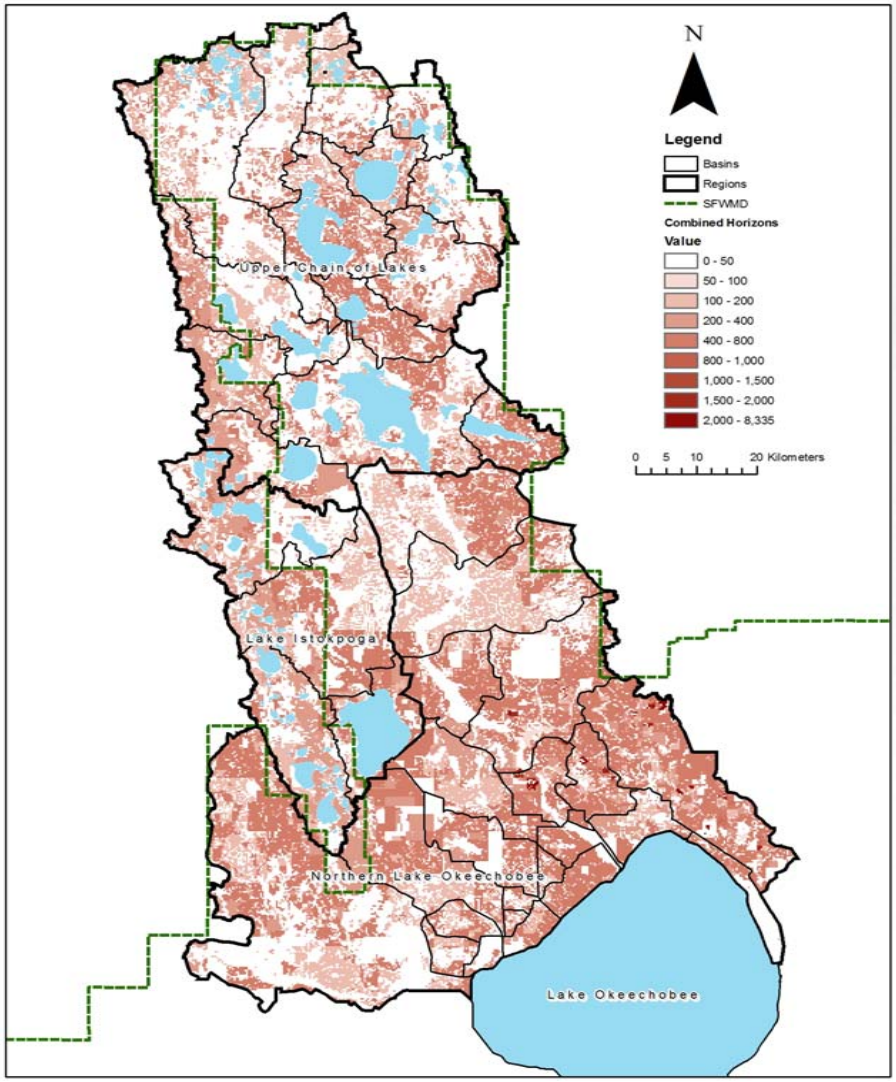








Issue: How much Legacy Phosphorus is in the Lake Okeechobee watershed?

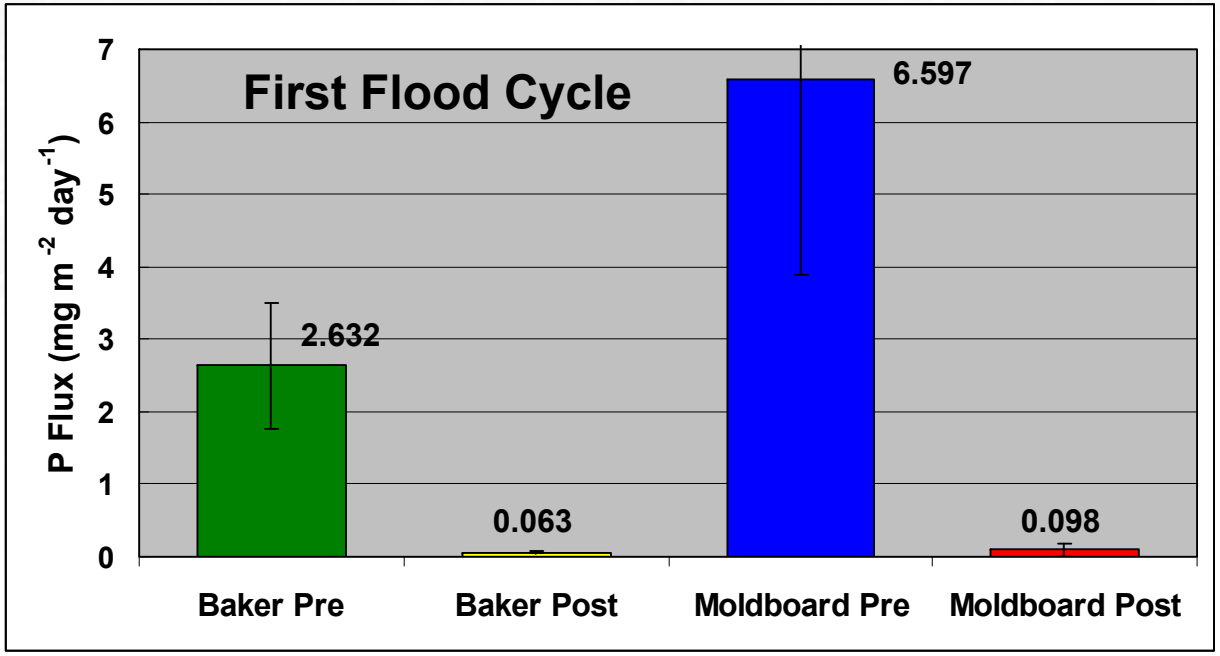


- <u>Quantified</u> the Legacy P in the watershed - 176,000 metric tons
- <u>Estimated</u> it would take about 350 years to wash out the legacy P
- <u>Abatement plan</u> will need to be folded into the Lake Okeechobee Protection Plan

Issue: are there more cost-efficient in-lake water quality improvement technologies?

Baker Disk Plow

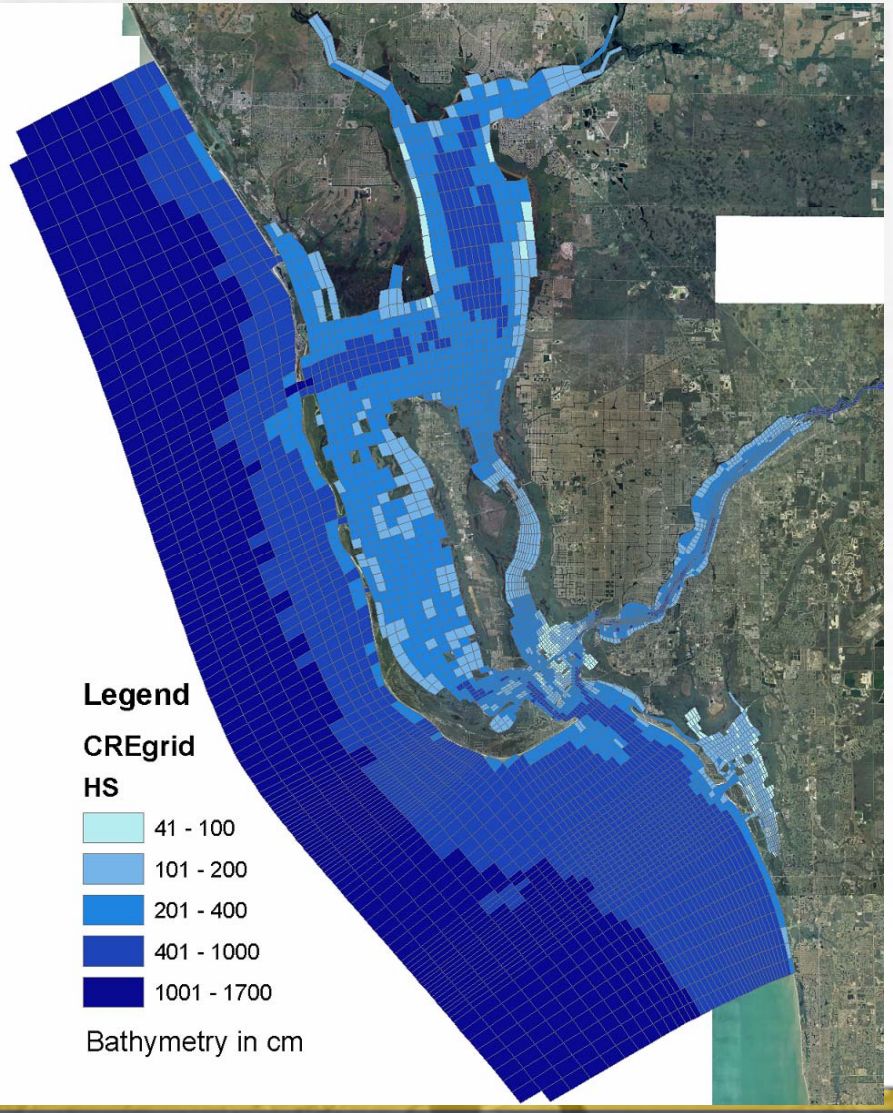
Moldboard Plow



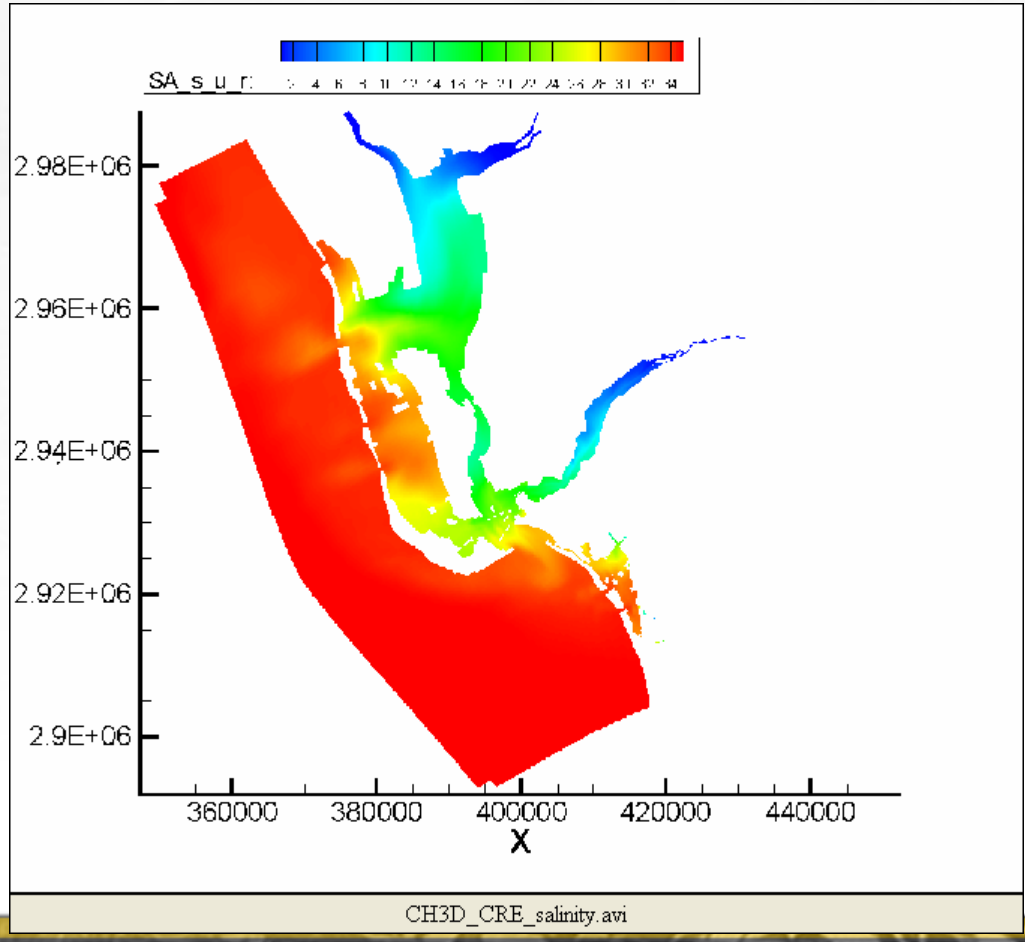
Issue: What can be done to enhance recovery of endangered snail kites?

Northern Estuaries Research

Estuary Hydrodynamic Salinity Model as a Water Management Tool



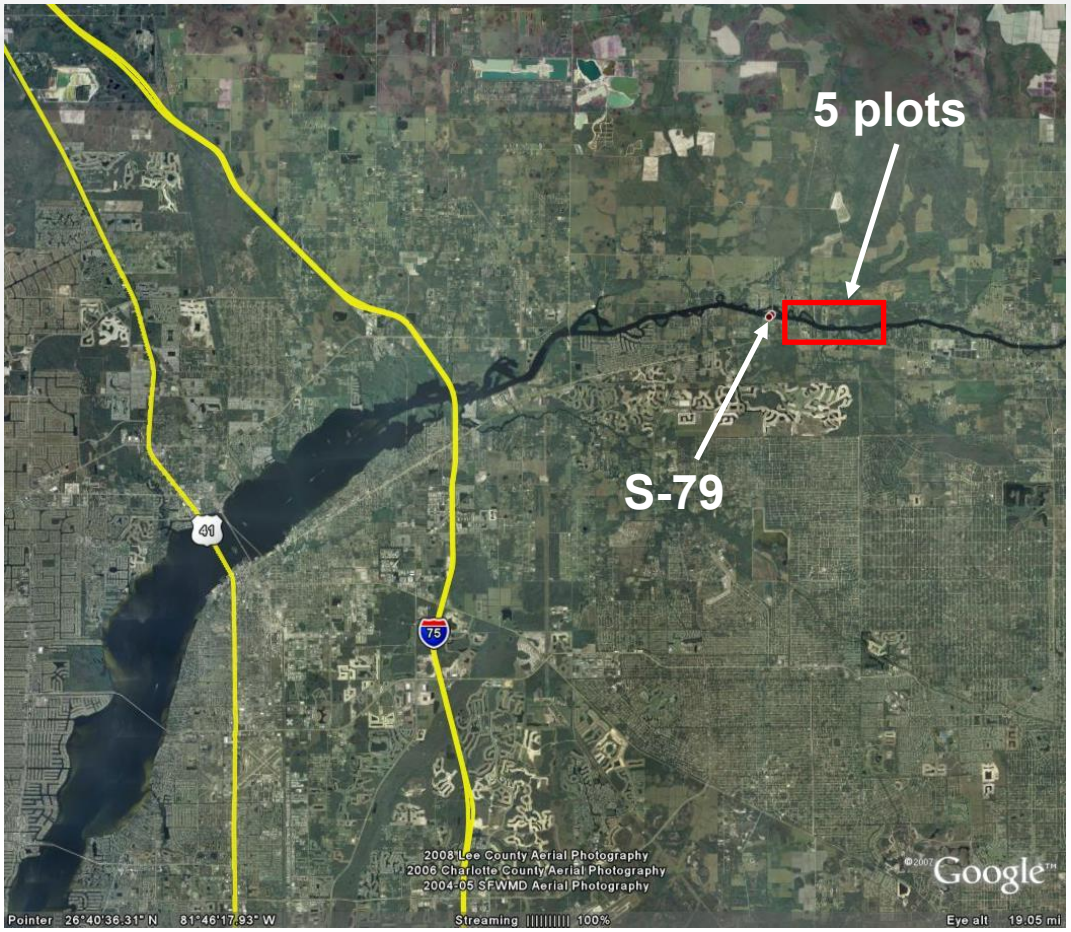
Caloosahatchee River System CH3D Model
Salinity <-> Flow Targets



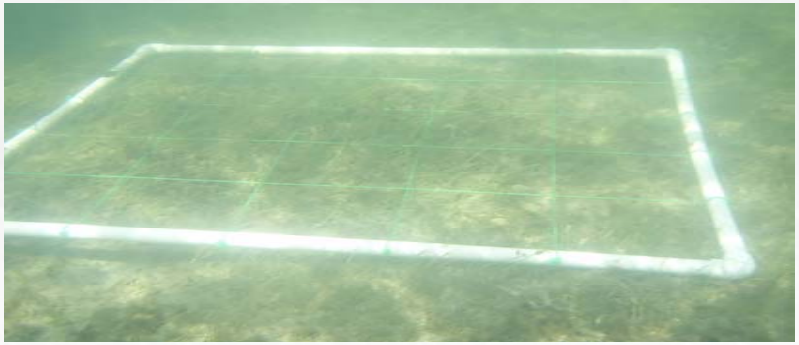
Issue: how can we enhance recovery of Tape Grass in Caloosahatchee River?

Objective:

- Establish a viable reproductive population of Tape Grass (*Vallisneria)*above S-79
- provides a seed source to the downstream estuary.

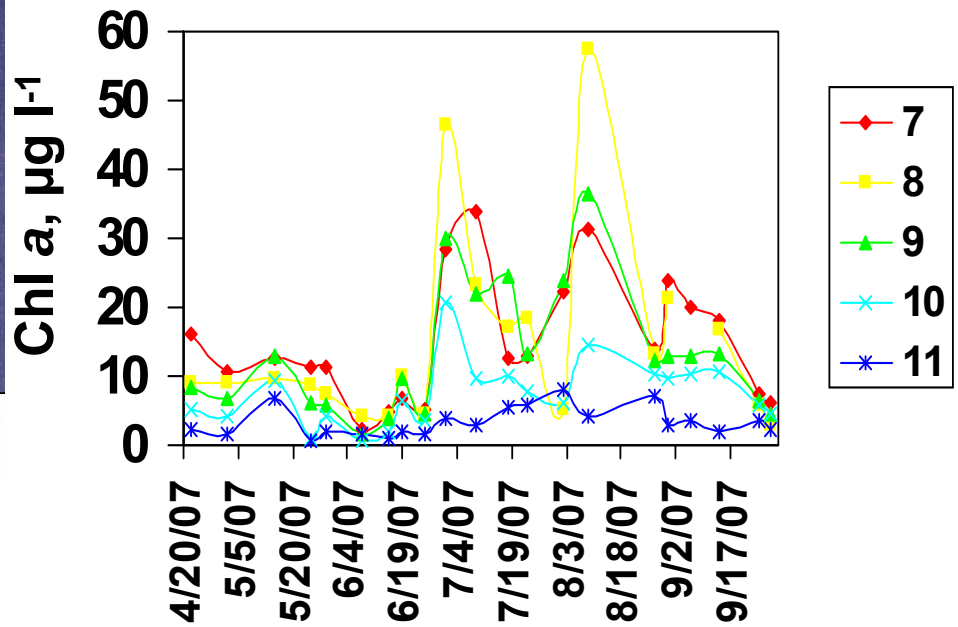


Issue: What water quality conditions are needed for healthy seagrass?



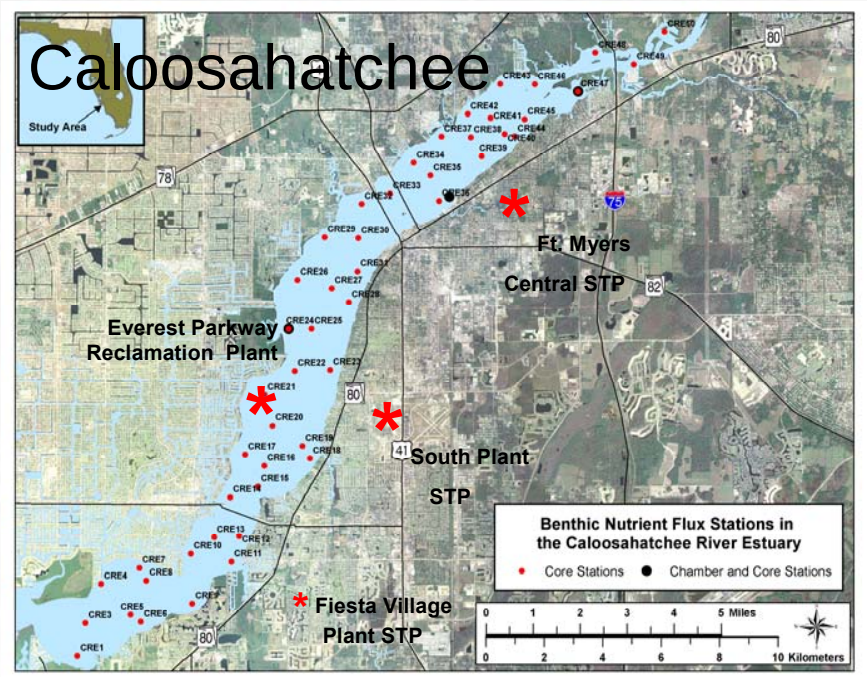
Issue: What nutrients contribute to eutrophication in the St. Lucie estuary?

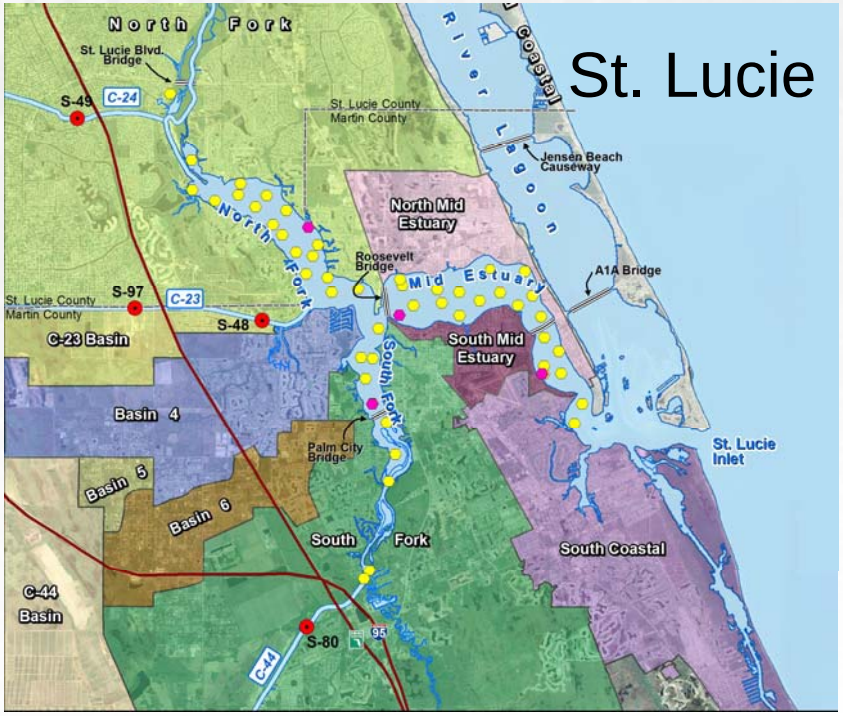
Inorganic nitrogen limits phytoplankton density or Chlorophyll concentrations. Reducing the loading of this nutrient will reduce eutrophication .



Issue: What proportion of the nutrients in the estuaries come from the sediments?

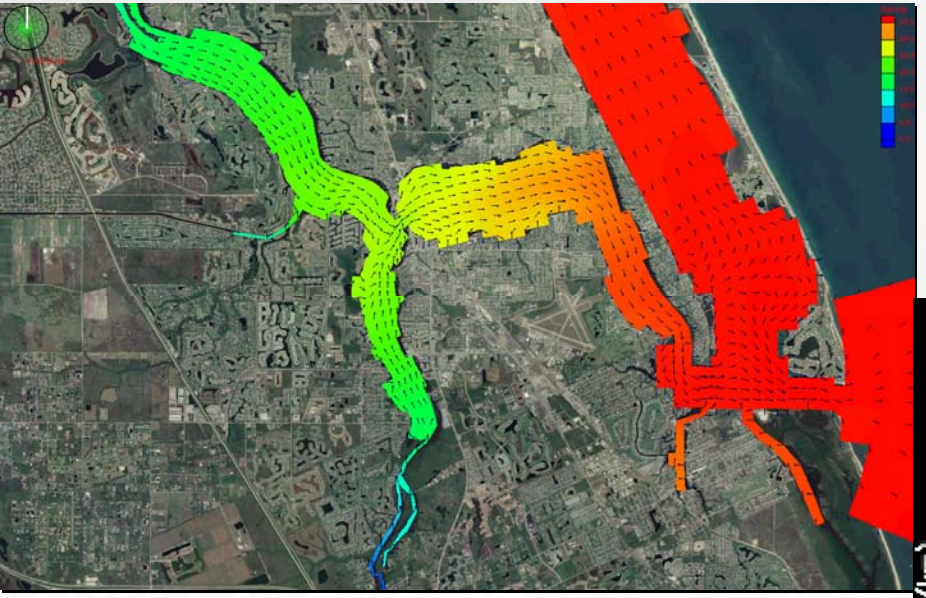
Benthic Flux Sampling





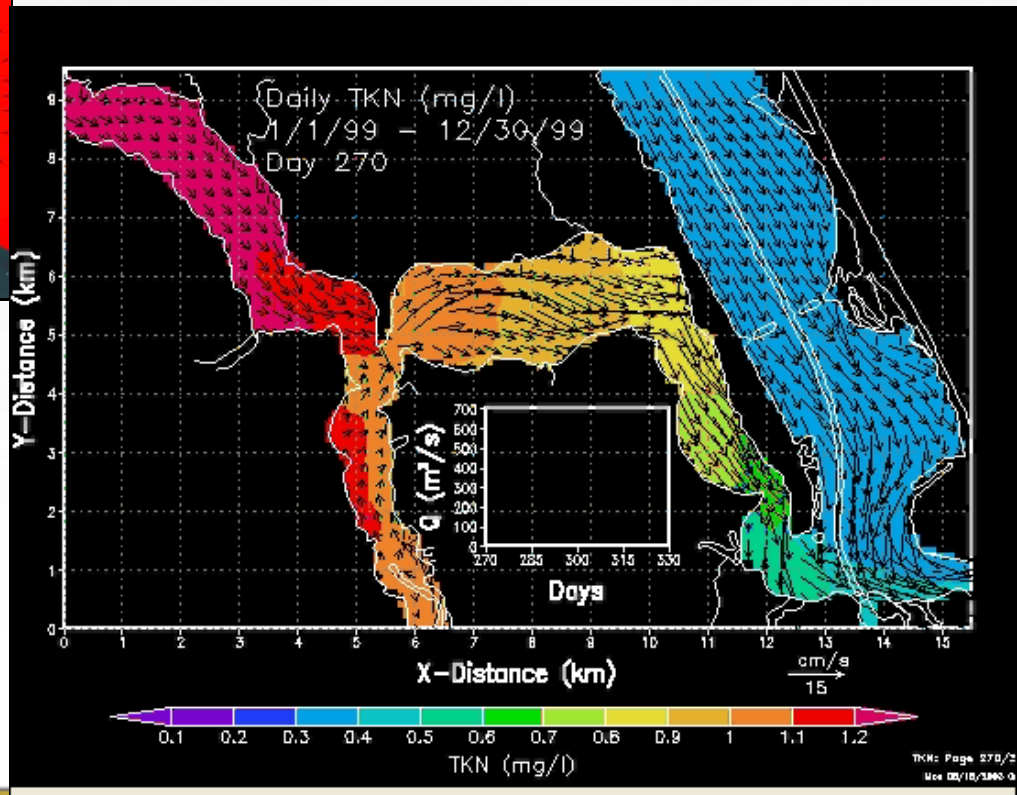
- 50 Core Sites
- 3-4 Duplicate Core/Chamber Sites

Estuary Water Quality Model for Nutrient Management



St Lucie Estuary 3-D Model: Salinity Distribution

St Lucie Estuary 3-D Model: Nutrient Distribution



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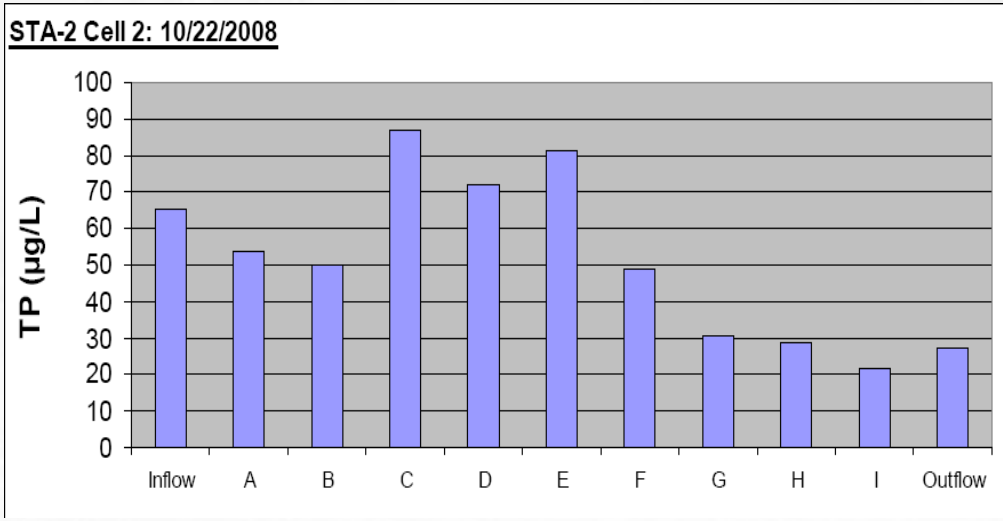
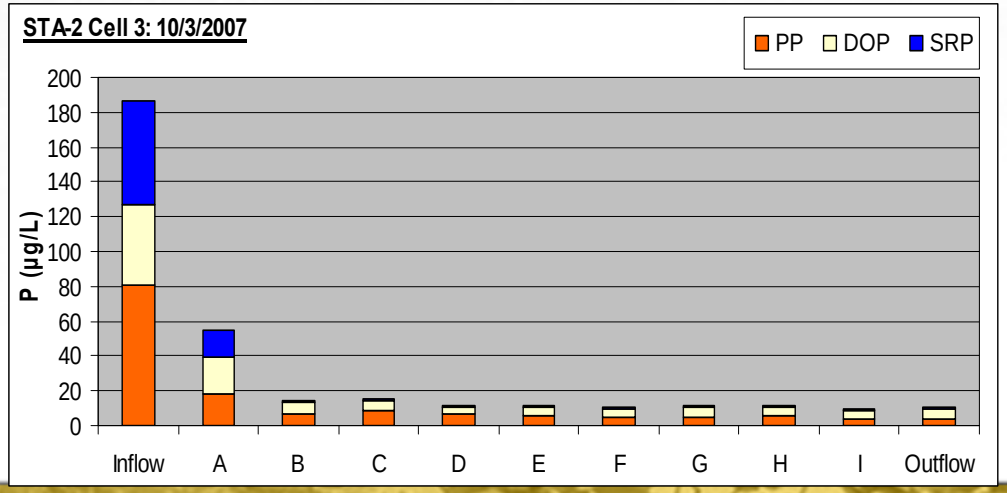
Stormwater Treatment Area Research

Issue: How can STA phosphorus uptake performance be further improved?

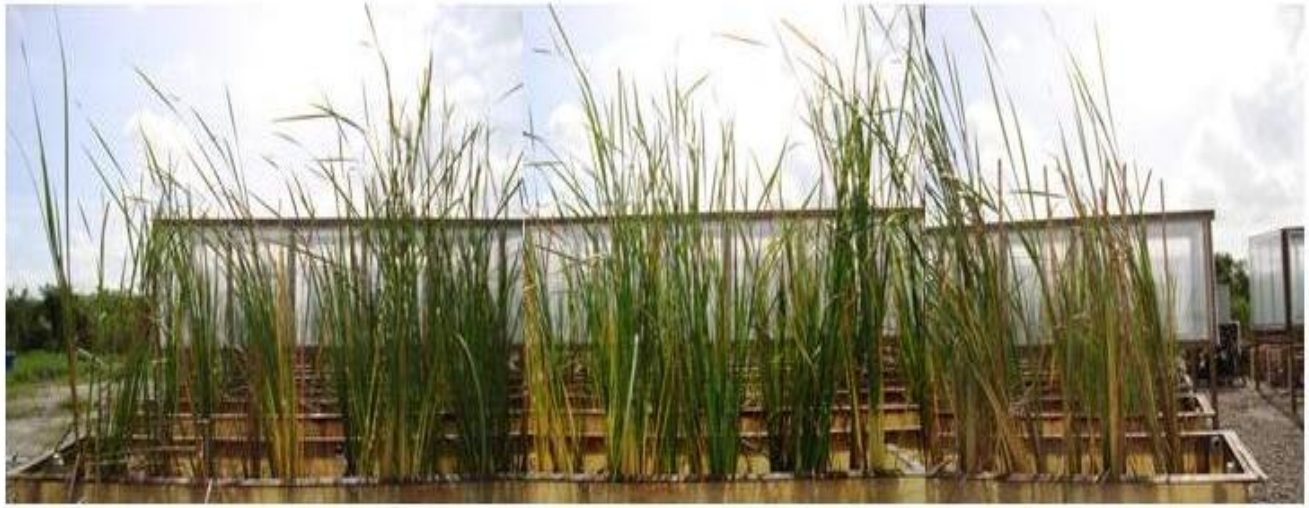




Issue: How much flooding can cattail communities in the STAs tolerate?

Flooded phase

Recovery phase



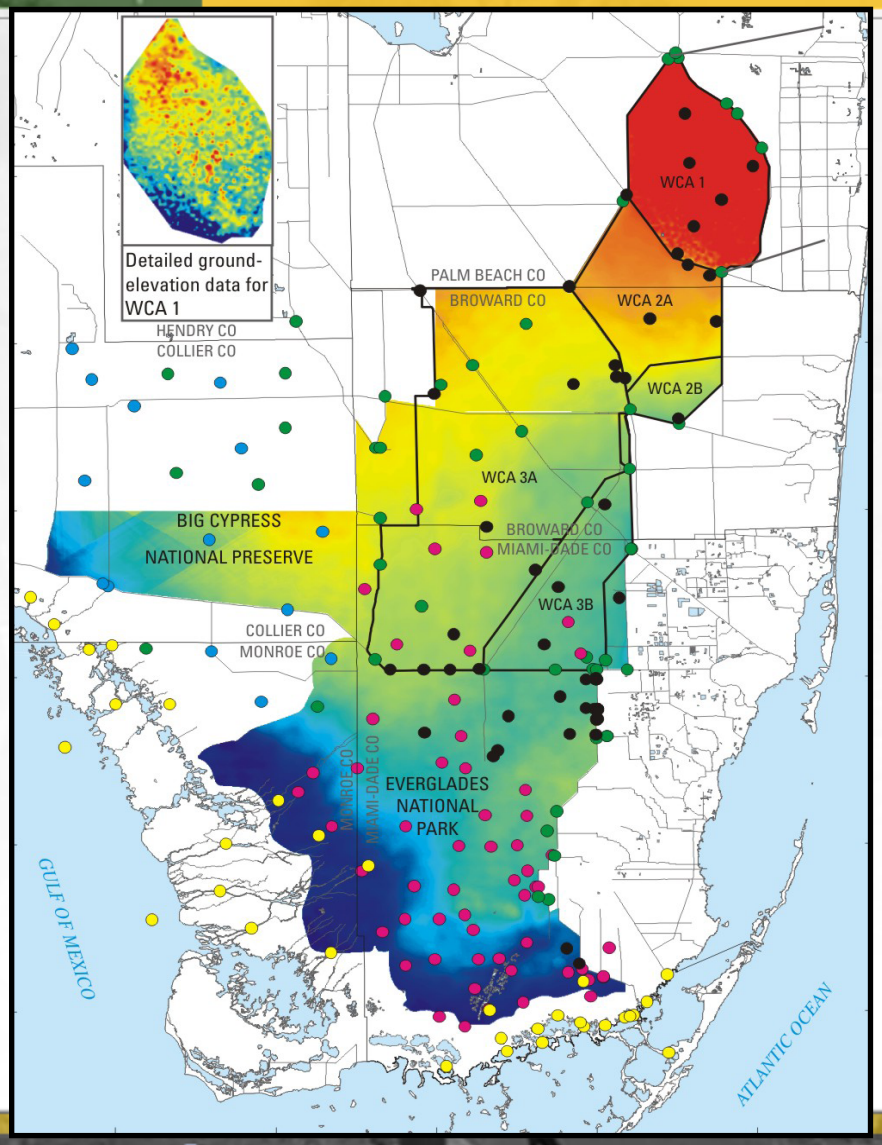
Issue: How much dry-out can cattails tolerate and what are the stress signals?

Mesocosm Study

Field Assessment

Everglades and Florida Bay Research

RECOVER developed tool to estimate Everglades water depths



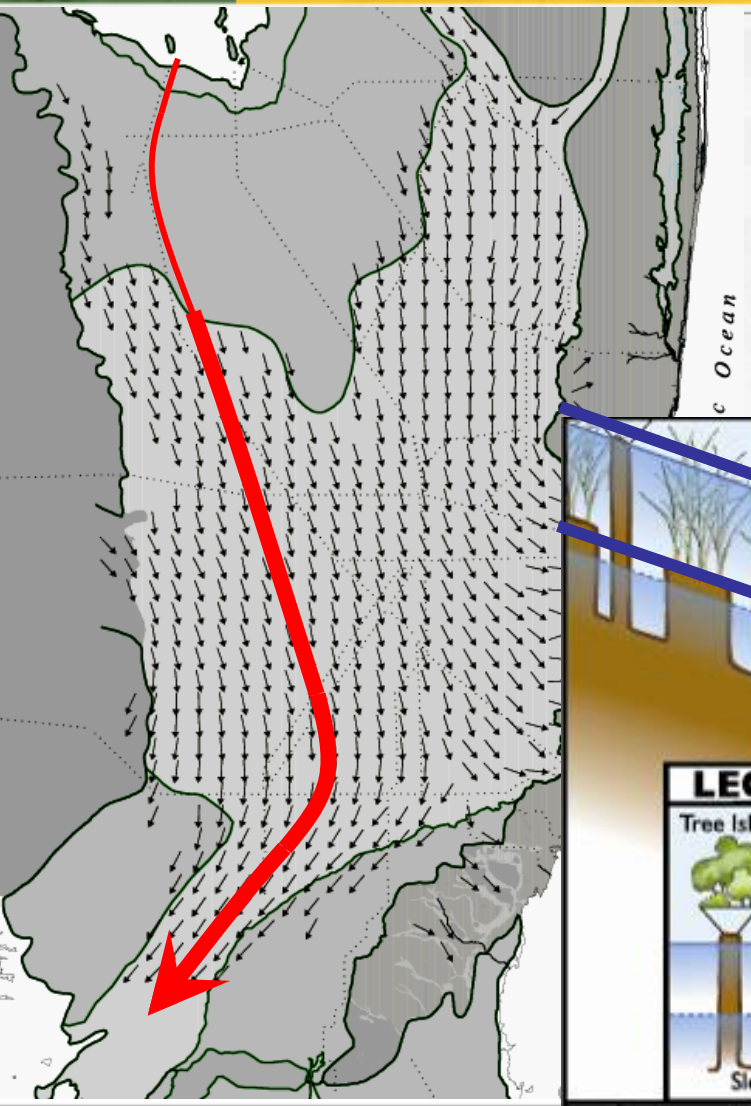
Everglades Depth Estimation Network (EDEN)

- Provides real-time water depth estimation
- Links ecological monitoring to system hydrology
- Links monitoring to operational changes

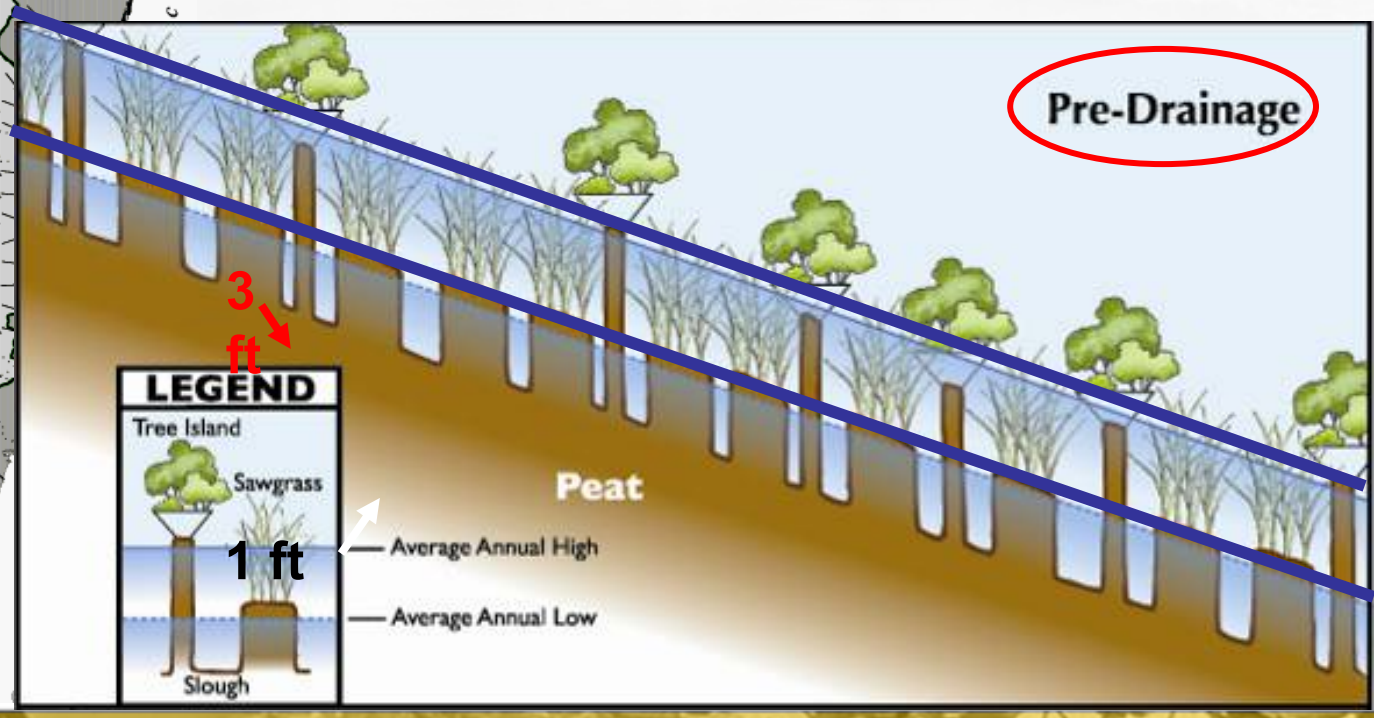
Issue: What hydrologic conditions are necessary to sustain healthy tree islands

- Hydrological sequence matters: plants studied recovered better if subjected to drier conditions prior to flood conditions.
- Management implications include consideration of constant (not preferred) versus variable (preferred) hydrologic conditions.

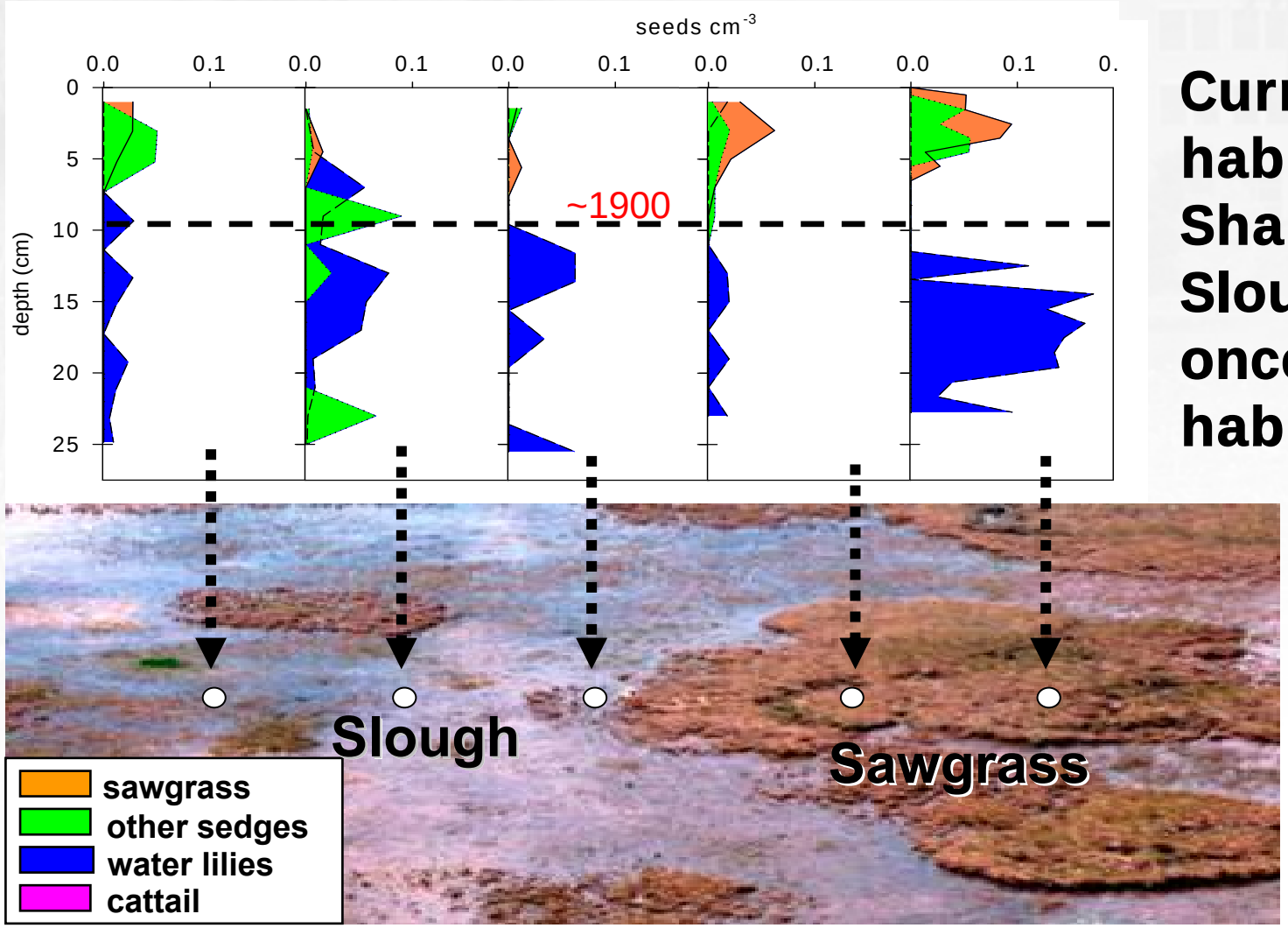
Issue: What were the Water Depths and flows in pre-drainage Everglades



- Records of early explorers and surveying expeditions, painstakingly researched

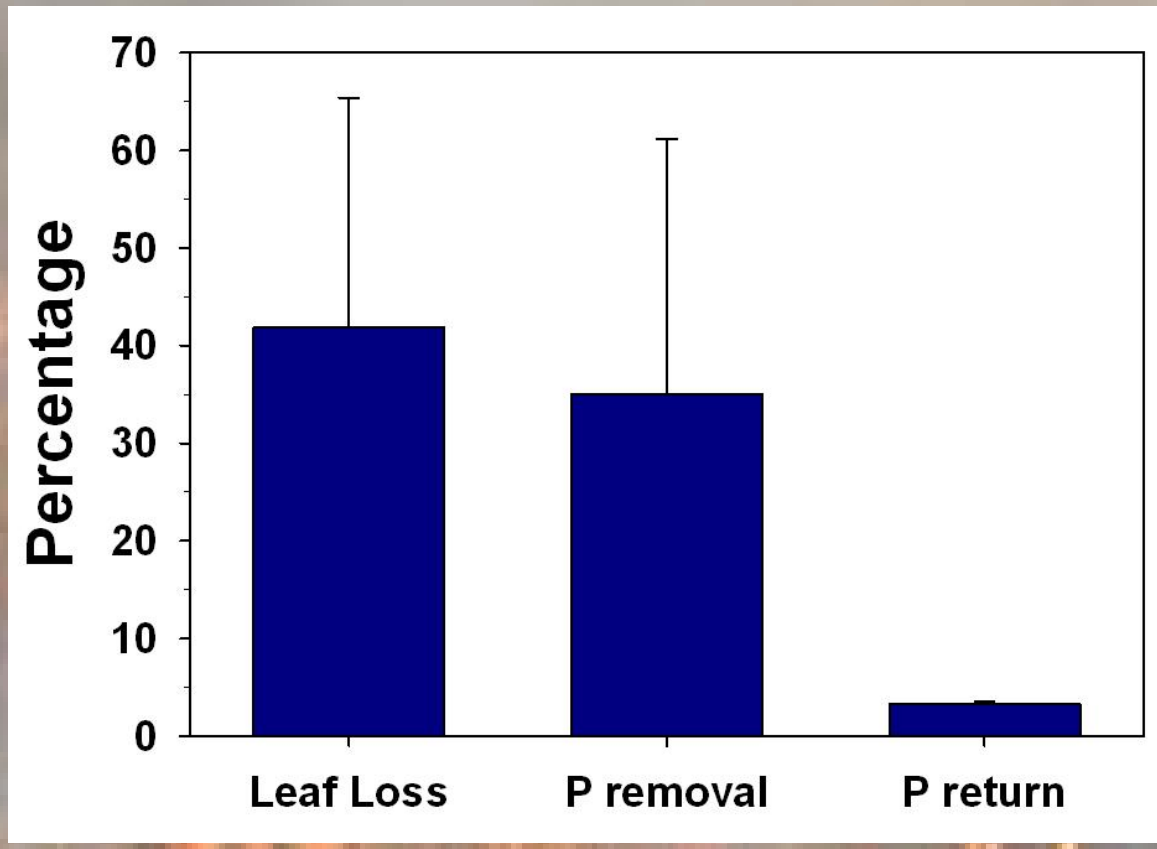


Issue: when did big shifts in Everglades vegetative communities occur?



Current ridge habitats in Shark River Slough were once slough habitats.

Issue: Can repeated burns restore the structure of Everglades vegetation in impacted areas?

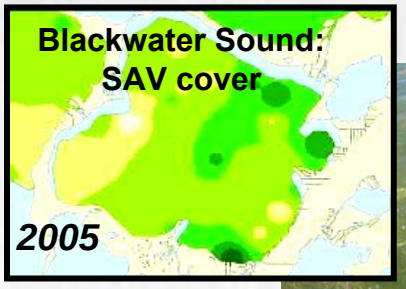


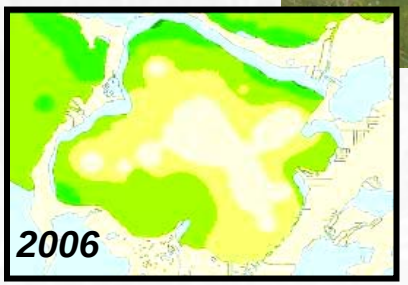
Issue: Can we restore wildlife habitat functions in impacted areas of the Everglades?

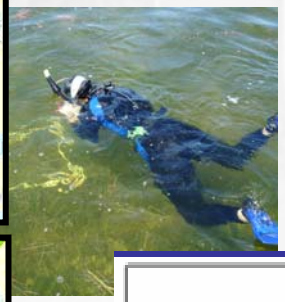
Cattail Habitat Improvement Project (CHIP)

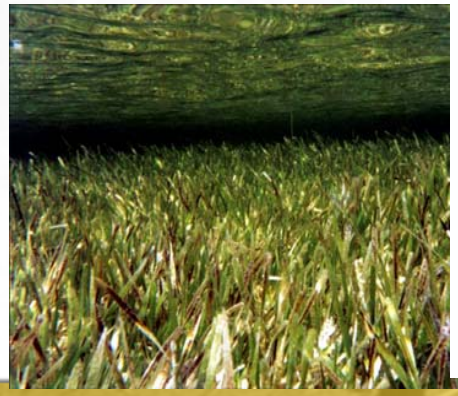
Issue: What is the effect of salinity on Florida Bay seagrass?

Monitoring

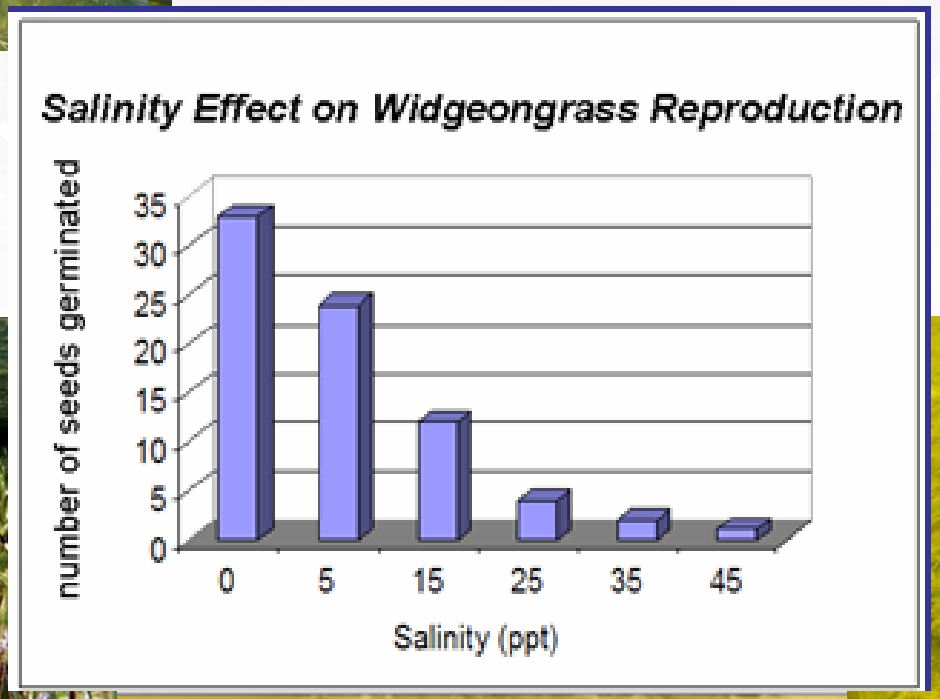




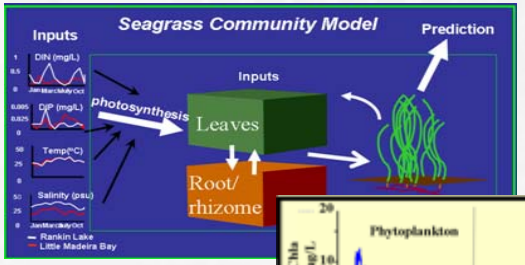


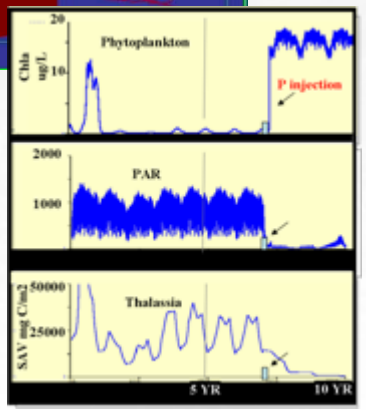


Research

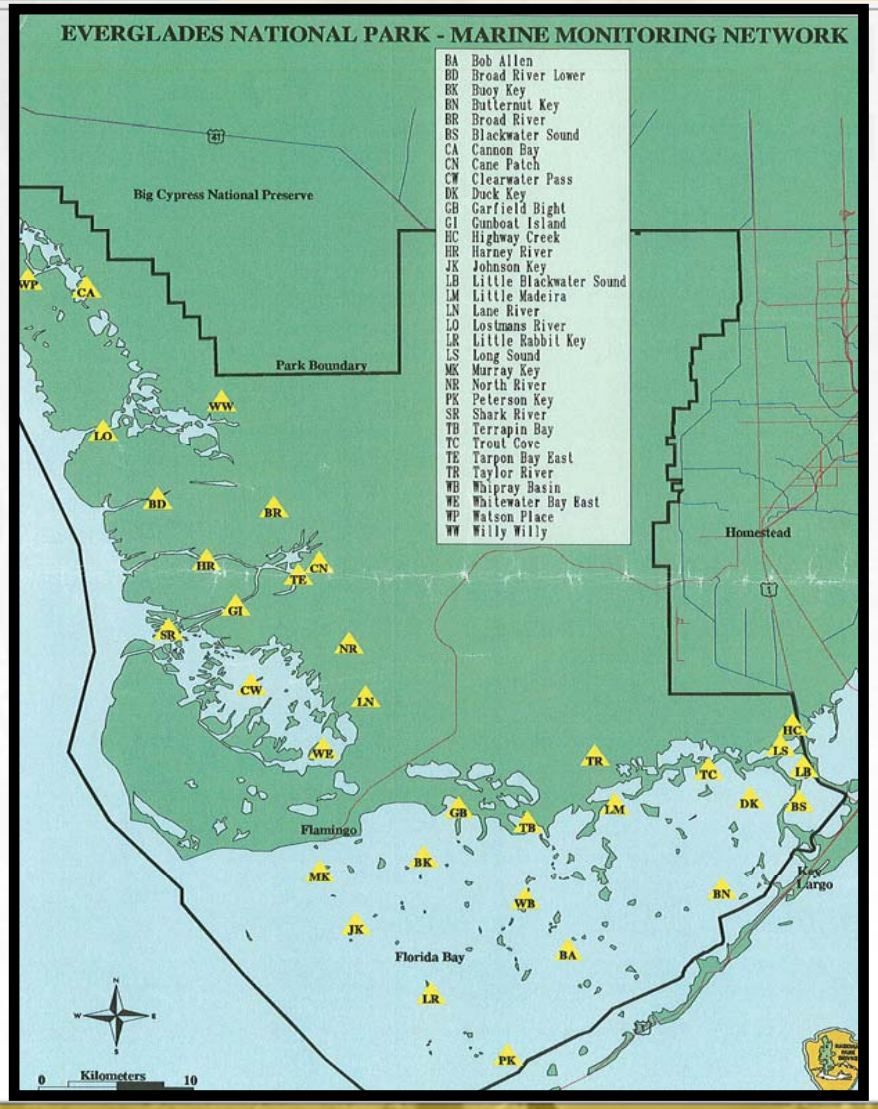


Modeling





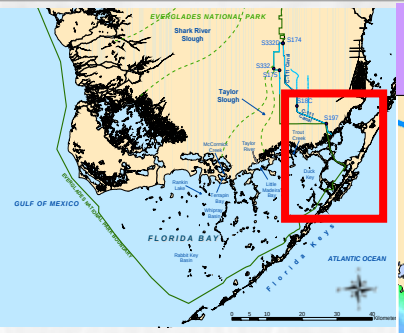
RECOVER has developed a tool to interpolate salinities in southern estuaries based on upstream stage

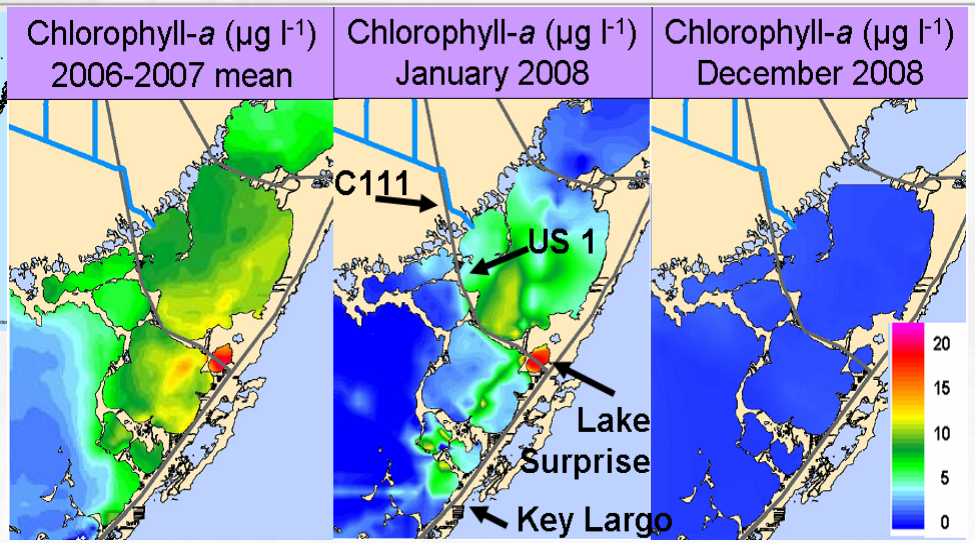


Salinity Interpolation Tool

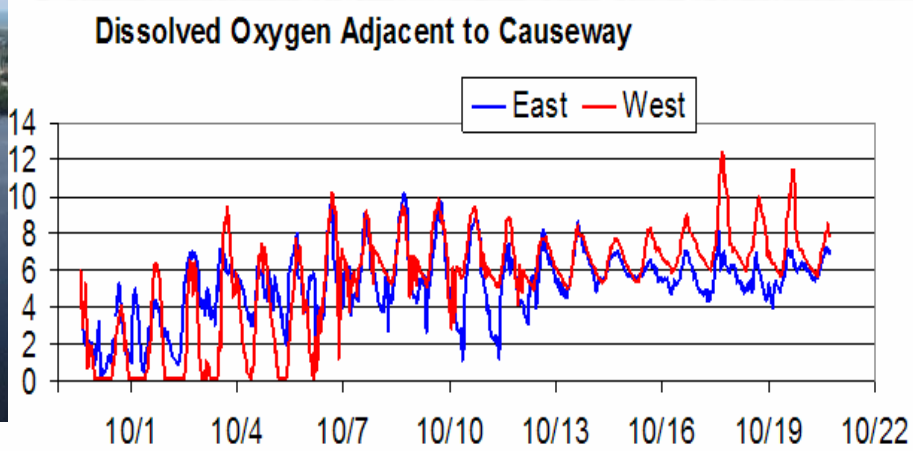
- Estimates salinity in estuary based on stage upstream in the Everglades
- Estimates salinity at any point in estuaries
- Biscayne Bay and Florida Bay

Issue: How to minimize impacts associated with road construction





- Algal bloom:
- began fall 2005
- ended in 2008



- Lake Surprise
- monitoring & research led to recommendation:
- remove causeway in late fall, not summer
- Causeway removal successful:
  - ✓ no bloom,
  - ✓ no dissolved oxygen problem

Publications

- **BOOKS**
- Grace, J., S. Carstenn, S.L. Miao. 2008. Ecology in real world: How might we progress? In Real World Ecology: Large-Scale and Long-Term Case Studies and Methods, page 293-302. Edited by Miao, S.L. S. Carstenn, and M. Nungesser. Springer, USA
- Johnson, R. 2009. The Everglades Experiments: Lessons for Ecosystem Restoration, Springer, USA, Curtis J. Richardson, Duke University, Chapter 14, 375-383.
- Miao, S.L., S. Carstenn, M. Nungesser (editors) 2008. Real World Ecology: Large-Scale and Long-Term Case Studies and Methods. Springer, USA
- Miao, S.L., S. Carstenn, M. Nungesser. 2008. Introduction: Unprecedented Challenges In Ecological Research: Past and Present. In Real World Ecology: Large-Scale and Long-Term Case Studies and Methods, page 1-18. Edited by Miao, S.L., S. Carstenn, and M. Nungesser. Springer, USA
- Miao, S.L., S. Carstenn, C. Thomas, C. Edelstein, E.Sindhøj, B. Gu. 2008. Integrating multiple spatial controls and temporal sampling schemes to explore short- and long-term ecosystem response to fire in an Everglades wetland. In Real World Ecology: Large-Scale and Long-Term Case Studies and Methods, page 73-110. Edited by Miao, S.L., S. Carstenn, and M. Nungesser. Springer, USA
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- Bousquin, S.G., D.H. Anderson, D.J. Colangelo, B.L. Jones, M.D. Cheek, and L.J. Spencer. 2008. Kissimmee Basin. Chapter 11 *in* South Florida Environmental Report Volume I: The South Florida Environment - Water Year 2007. South Florida Water Management District, West Palm Beach, FL.
- Boyer, J. N., C. R. Kelble, P. B. Ortner, and D. T. Rudnick. Phytoplankton bloom status: an indicator of water quality condition in the southern estuaries of Florida, USA. Ecological Indicators (in press).
- Chang, C.C.Y., P.V. McCormick, S. Newman, and E.M. Elliott. 2009. Isotopic indicators of environmental change in a subtropical wetland. *Ecological Indicators*: In press.
- Chang, Miao-Li, Doering, Peter Doering, Yongshan Wan, Chenxia Qiu, and Detong Sun. 2008.Integrated Modeling in South Florida Coastal Area. Proceedings of the Tenth International Conference. Newport, Rhode Island. Published by the American Society of Civil Engineers.
- Chen, H., I. Mendelssohn, B. Lorenzen, H. Brix, and S. Miao. 2008. Effects of redox intensity and phosphate level on growth and nutrient uptake of *Rhynchospora tracyi*. *Wetlands* 28(1): 151-163.

Publications

- Chimney, M.J. and F. Jordan. 2008. The fish assemblage of a constructed treatment wetland in south Florida. Florida Scientist 71(3): 246-264.
- Chuirazzi, Kimberly J., Michael J. Duever and Nenad Iricanin, 2009. Picayune Strand
- Restoration Project Baseline Report, Appendix 7A-2, 2009 South Florida Environmental Report, South Florida Water Management District, West Palm Beach, FL.
- El-Rifai, H., M. Heerboth, T.E. Gedris, S. Newman, W.H. Orem, and W.T. Cooper. 2008. NMR and mass spectrometry of phosphorus in wetlands. European J. of Soil Science 59:517-525.
- Frederick, P, Gawlik, D.E., Ogden, J.C., Cook, Mark, Lusk, M. (in press) White Ibis and Wood Storks as indicators for restoration of the Everglades Ecosystems. Ecological Indicators
- Gottlieb, Andy, Robert F. Doren, Joel C. Trexler, Matthew C. Harwell, 2009. Ecological
- Indicators for System-wide Assessment of the Greater Everglades Ecosystem Restoration program. Ecological Indicators 2008.08.009
- Grimshaw, H.J. and B. Sharfstein. 2008. The effects of shading on dioecious, pistillate *Hydrilla verticillata* (Lf) Royle transplants from Lake Okeechobee, Florida, USA. *Fundamental and Applied Limnology* 173 (2): 101-109.
- Gu, Binhe, S.L. Miao, C. Edelstein and T. Dreschel. 2008. Effects of a Prescribed Fire on Dissolved Inorganic Carbon Dynamics in a nutrient-enriched Everglades Wetland. Fundamental and Applied Limnology 171: 263-272.
- Gu, Binhe. Phosphorus removal efficiency in constructed wetlands dominated by submerged aquatic vegetation. Journal of Plant Ecology PAGES 1–8 doi: 10.1093/jpe/rtm002
- Gu, Binhe, Dreschel, Thomas. Phosphorus removal in constructed wetlands with different plant types under constant hydrologic loading. WETLANDS, Vol. 28, No. 1, March 2008, pp. 81–91
- Hagerthey, S.E., S. Newman, K. Rutchey, E.P. Smith, and J. Godin. 2008. Multiple regime shifts in a subtropical peatland: establishing community specific thresholds to eutrophication. Ecological Monographs 78(4): 547-565.
- Hu, Guangdou Gordon and Yongshan Wan. 2008. Modeling the Hydrology and Hydrodynamics in Loxahatchee River and Estuary, Florida during Hurricanes Frances and Jeanne. Proceedings of the Tenth International Conference. Newport, Rhode Island. Published by the American Society of Civil Engineers.

Publications

- Inglett, P.W., E.M. D'Angelo, K.R. Reddy, P.V. McCormick, and S.E. Hagerthy. 2009. Periphyton nitrogenase activity as an indicator of Everglades nutrient impacts. *Wetlands Ecology and Management:* In press.
- James, R.T., M.J. Chimney, B. Sharfstein, D.R. Engstrom, S.P. Shottler, T. East and K.-R. Jin. 2008. Hurricanes effects on a shallow lake ecosystem, Lake Okeechobee, Florida (USA). Fundamental and Applied Limnology/Archiv für Hydrobiologie 172(4): 273-287.
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- Miao ,S.L., Chris B. Zou and David D. Breshears. 2009. Sequence of extreme hydrological events triggers different mortality and growth of tree species. American Naturalist 173:113-118.
- Miao, S.L. and Chris Zou. 2008. Seasonal variations in seed bank composition and their interactions with nutrient enrichment in the Everglades wetlands. Aquatic Botany 90:157-164.
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