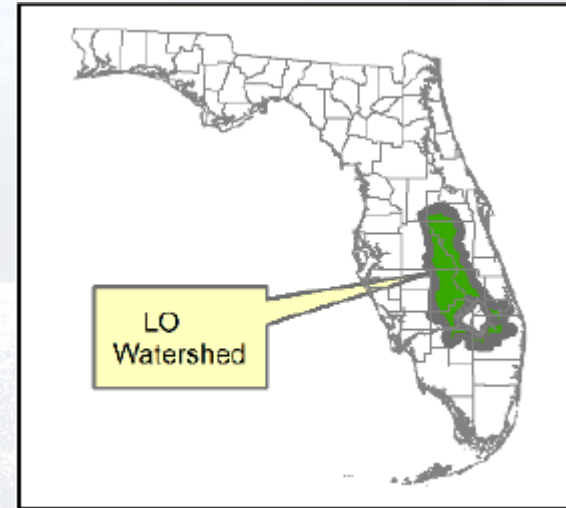
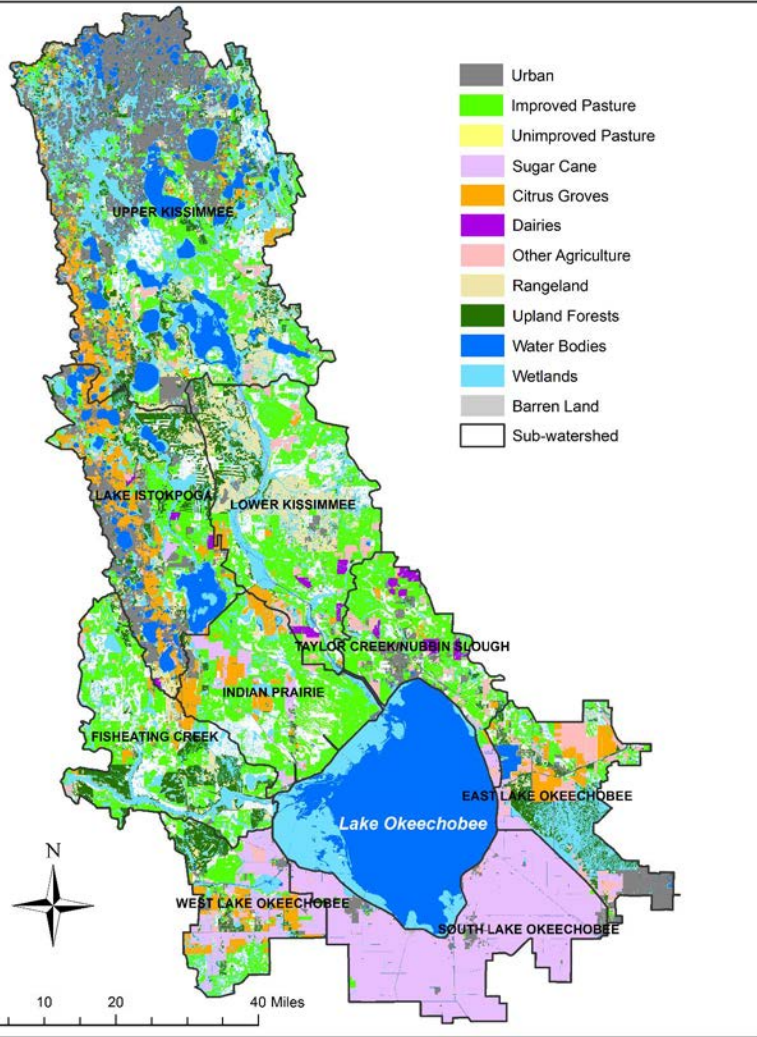


IMPROVING LAKE OKEECHOBEE ECOLOGY

Bruce Sharfstein Ph.D.
Principal Scientist
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LOCATION MAP



- South Central Peninsular Florida
- Covers approximately 735 square miles
- Second largest lake in the continental U.S.A
- Surrounding watershed is largely agricultural
 - Cattle farming
 - Sugar Cane.
 - Dairy, winter vegetables, citrus

A BIT OF HISTORICAL PERSPECTIVE



- First reliable Lake O map 1838
- Hamilton Disston 1881-1894
 - Straightened Kissimmee River
 - Connected Lake to the west coast of Florida
- Everglades Drainage Dist. 1905-1928
 - Connected Lake to the east coast of Florida
 - Built southern agricultural canals
 - First muck dike at south end of Lake
- Hurricanes of 1926 and 1928

THE NEED FOR FLOOD CONTROL

1928



1928



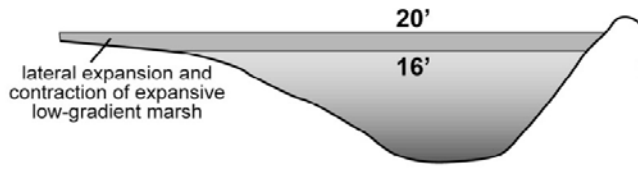
1926 & 1928
DEVASTATING HURRICANES
... LOSS OF 2,500 LIVES

HOOVER DIKE AUTHORIZED 1930

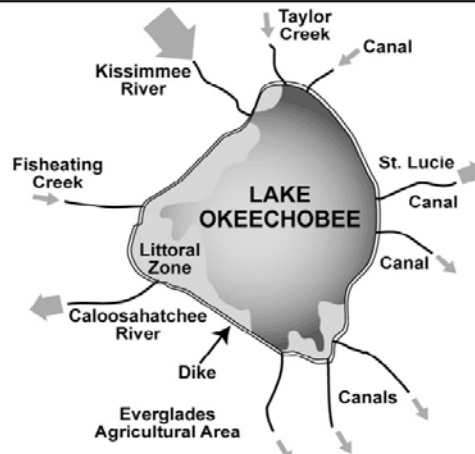
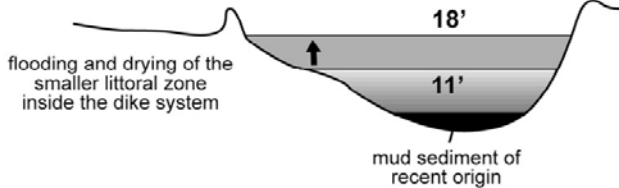
... **COMPLETED 1937**

CONSTRUCTION OF THE HERBERT HOOVER DIKE

PAST



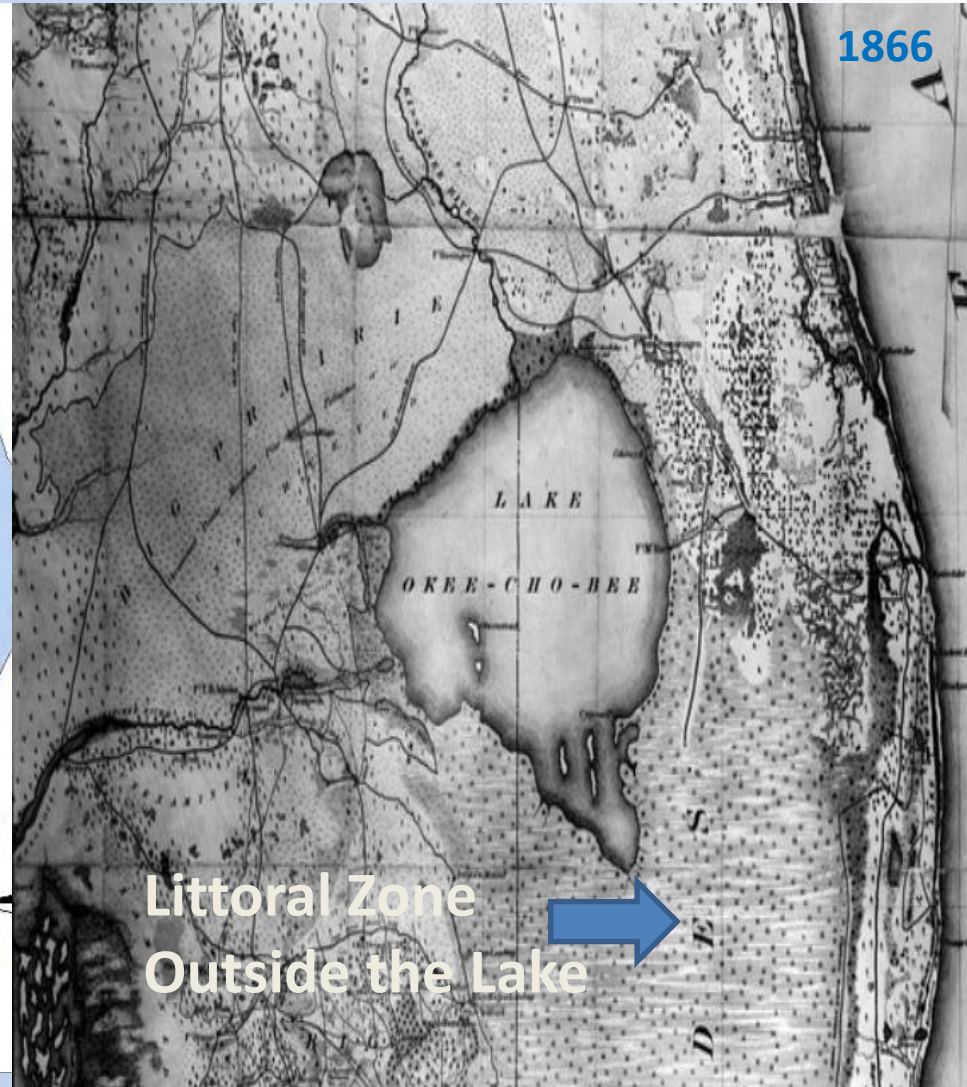
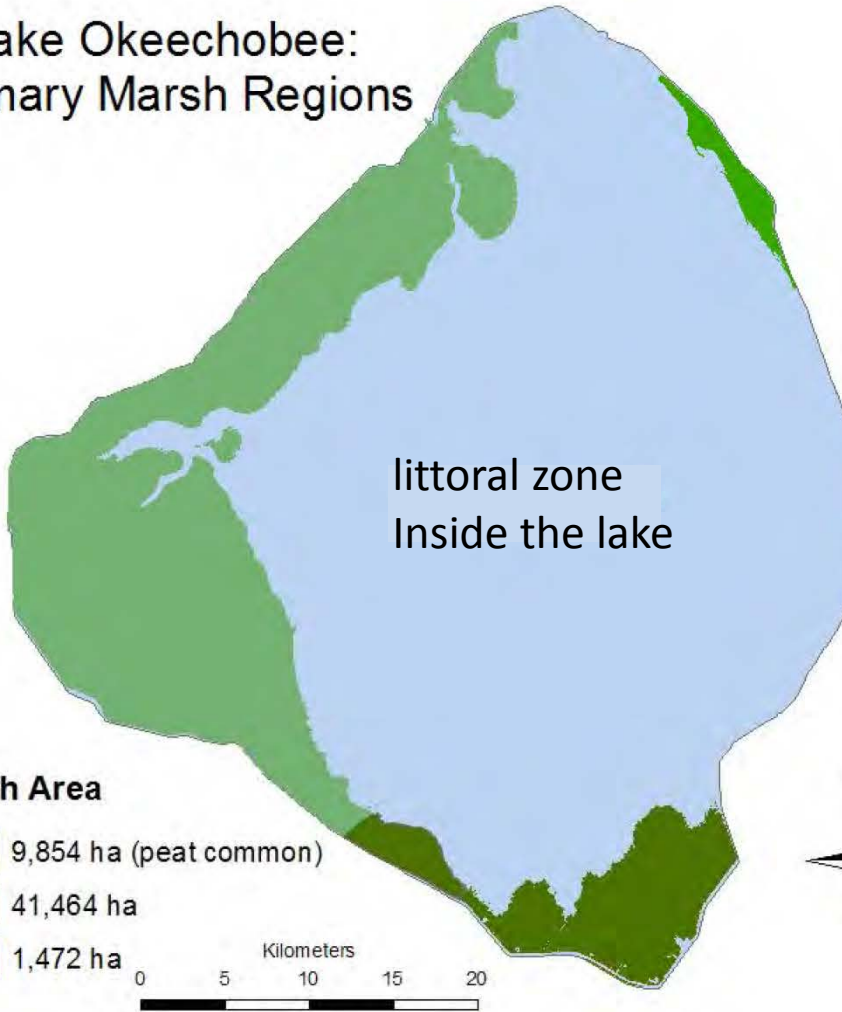
PRESENT



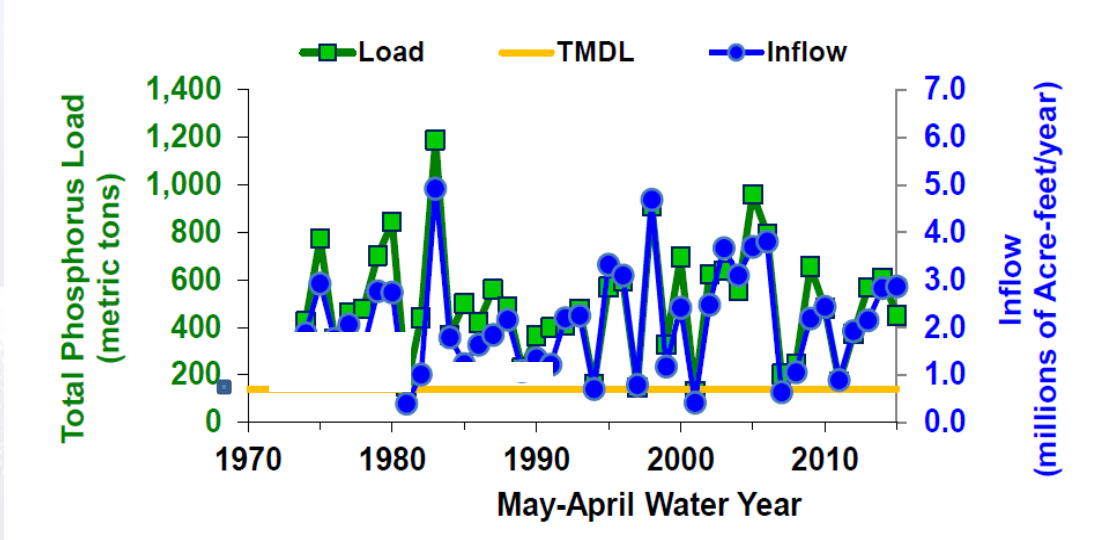
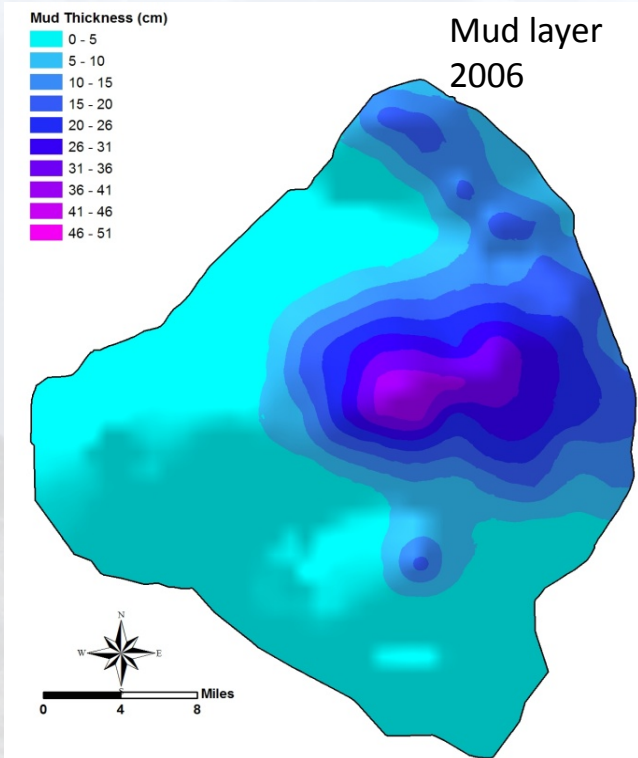
- 177 km long
- Encircles entire lake
- No Spillway
- All inflows and outflows gated except Fisheating Creek
- Lake can fill up to six times faster than it can be emptied

LOCATION OF THE LITTORAL ZONE SHIFTED

Lake Okeechobee:
Primary Marsh Regions

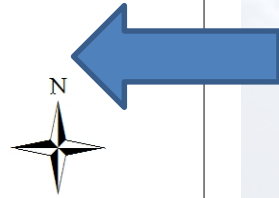
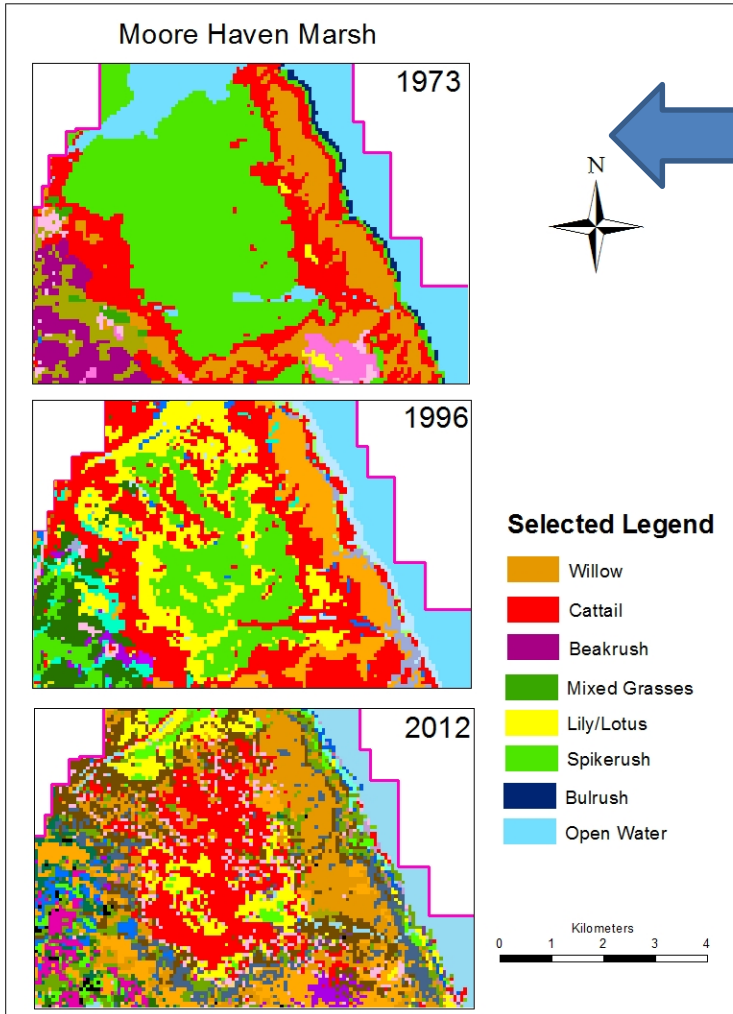


RESULTS OF AGRICULTURAL DEVELOPMENT OF SURROUNDING WATERSHED



- Phosphorus loading consistently exceeds Total Maximum Daily Load
- Large internal mud sediment nutrient pool.

EXOTIC INVASIVE AND NUISANCE VEGETATION MONOCULTURES



Between 1973 and 2012 the Moore Haven Marsh changed from being spikerush dominated to being dominated by cattail.

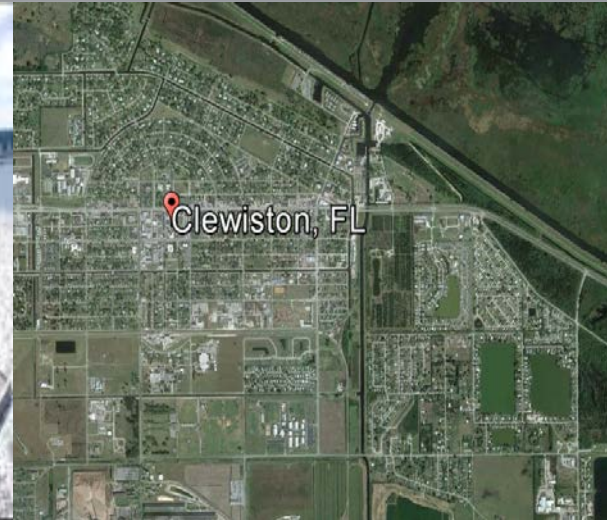
Close to 10% of marsh is Torpedo Grass Monoculture



CURRENT ISSUES SUMMARY

- Extreme water-levels and fluctuations
- Eutrophication increased P loading
- Sediment accumulation (“mud zone”)
- Invasive plant species

HISTORIC FLOWPATH TO THE EVERGLADES CANNOT BE REESTABLISHED



Long Beach Nguyen

TOOLS IN THE TOOLBOX

- Phosphorus Source Control (Removal of the internal sediment nutrient pool is infeasible)
- Control of Exotic Invasive and Nuisance Vegetation
- Stage regulation
 - The key constraint:
 - Improved water quality in the absence of water-level management will yield limited environmental benefits to the lake
 - Improved water-level management would mitigate some water-quality impacts in the nearshore and littoral zones

PHOSPHORUS SOURCE CONTROL

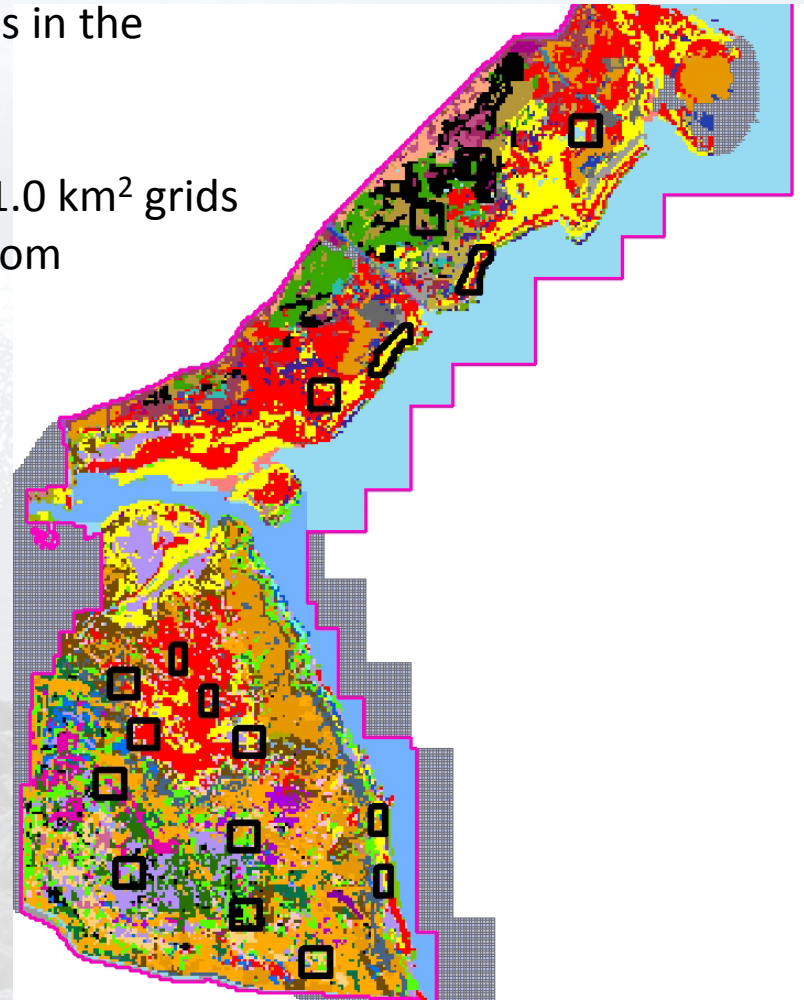
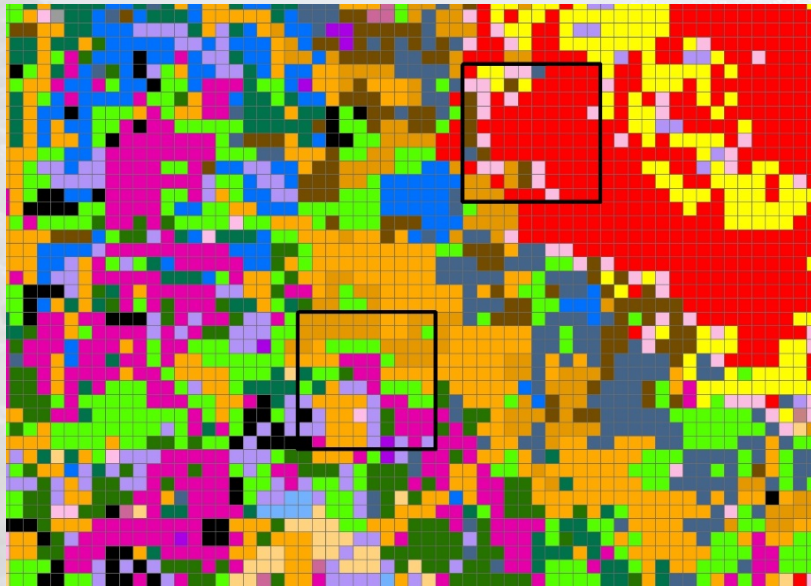
- Northern Everglades Protection Program
- Three coordinating agencies: FDEP, FDACS, SFWMD.
- Improve the quality of water discharged from the watershed and minimize undesirable flows
- A variety of projects and initiatives.
- Emphasis on Best Management Practices
- Five year average TP load 438 MT
- Exceeds TMDL by 296 MT
- Current load reduction capacity is ~ 16 MT annually
- After TMDL is achieved will take decades to bury internal nutrient pool under clean sediments.



VEGETATION MANAGEMENT CONSISTS OF MONITORING AND CONTROL

Maps quantifying the distribution of emergent species in the marsh are created every 4 to 5 years.

In other years sentinel sites consisting of 0.5 km² or 1.0 km² grids are used to monitor changes in the marsh resulting from hydrologic conditions or management actions.



VEGETATION MANAGEMENT

CONTROL IS ACCOMPLISHED BY HERBICIDE APPLICATION
AND BURNING WHEN CONDITIONS ALLOW

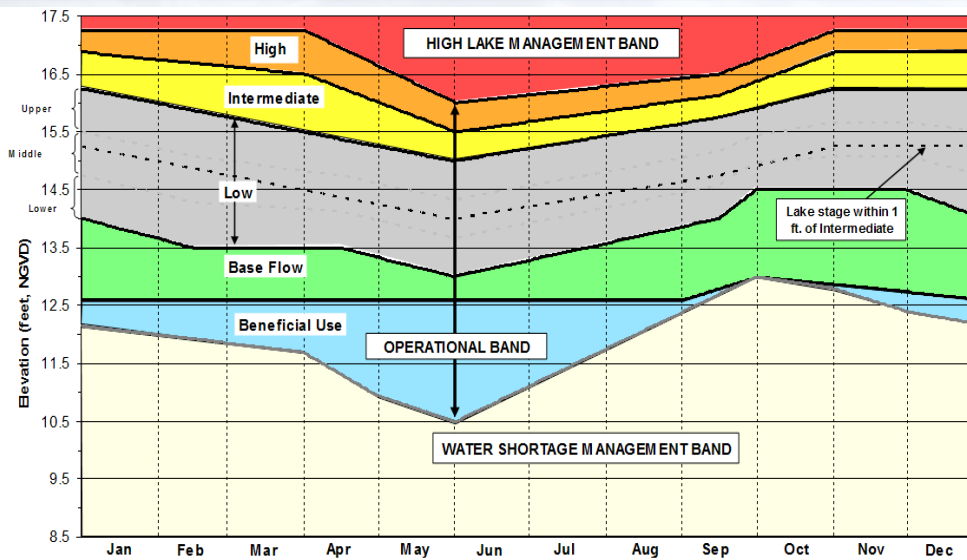


VEGETATION MANAGEMENT

Resulting open marsh habitats support forage and sport fish that serve as a critical link in the energy pathway between primary producers and higher trophic level consumers (birds, reptiles, humans).



FEDERAL WATER CONTROL PLAN MANAGED BY ACOE

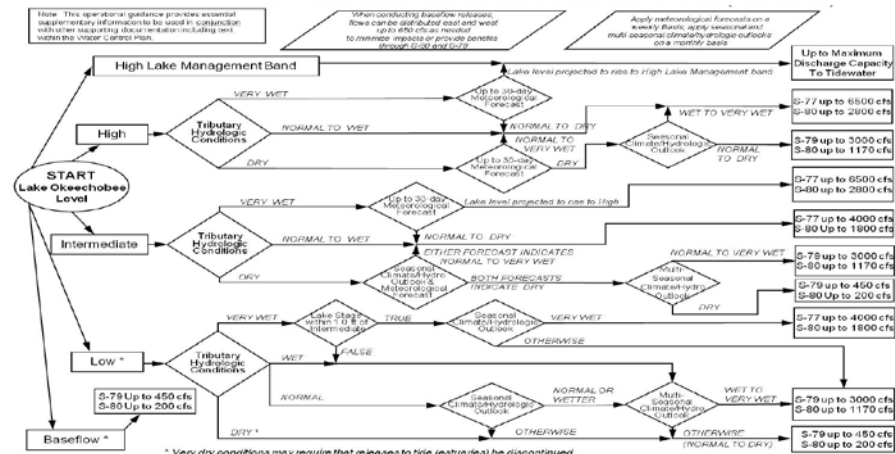


Lake is managed for water supply, flood control and environmental benefits

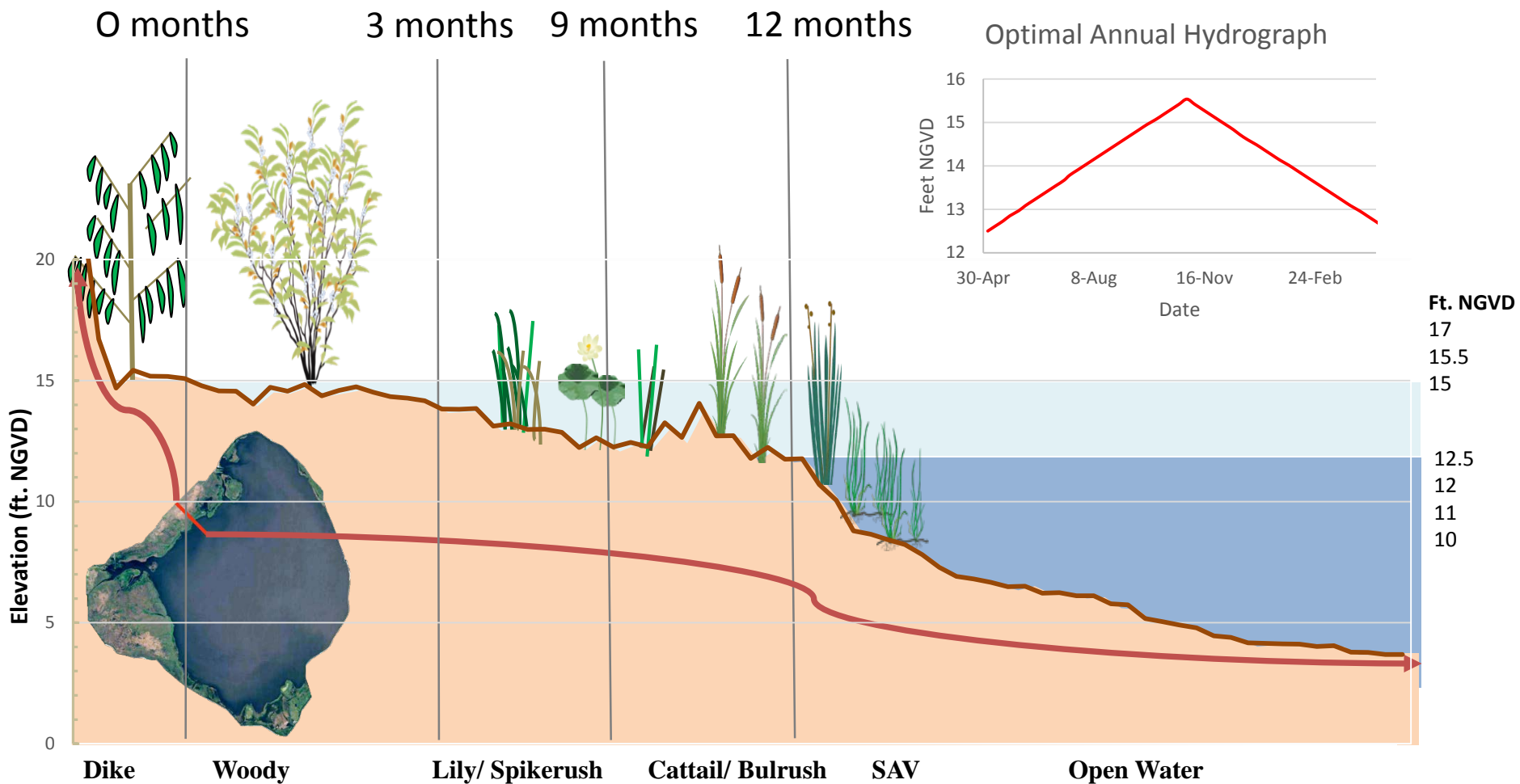
LORS Operational Bands

- Interim Schedule During DiKE Repairs
- Top High Lake Mgmt. 17 ft NGVD
- Bottom Base Flow, 12.5 ft NGVD

Decision Tree



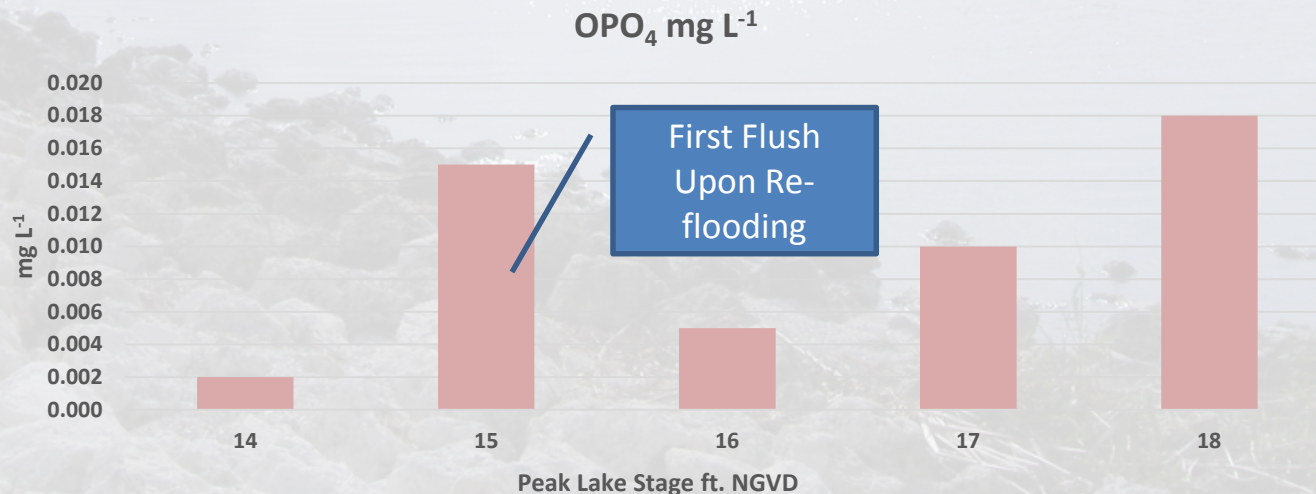
Regulation Schedule Helps Determine Water Depth and Duration of Inundation in the Littoral and Nearshore Zones Which in Turn Establishes Plant Community Distribution



Ecological Impacts of Lake Stage

Incursion of High Nutrient Pelagic Zone Water into the Littoral Zone

- Below 14 ft NGVD Little Incursion of High Nutrient Pelagic Zone Water into the Littoral Zone.
- At 14 ft NGVD and Above Incursion is Roughly Proportional to Lake Stage.
- Recent Conversion of Large Acreages of Wet Prairie into Dense Cattail Habitat may be Related to Such Incursions Caused by the 2004-2005 Hurricanes.



Wading Bird Hydrologic Variables

Great Egret

- Days Since Drawdown
- Hydroperiod
- 2-week Recession Rate

Snowy Egret

- Depth
- Days Since Drawdown
- Hydroperiod
- 2-week Recession Rate

White Ibis

- Depth
- 4 week Recession Rate



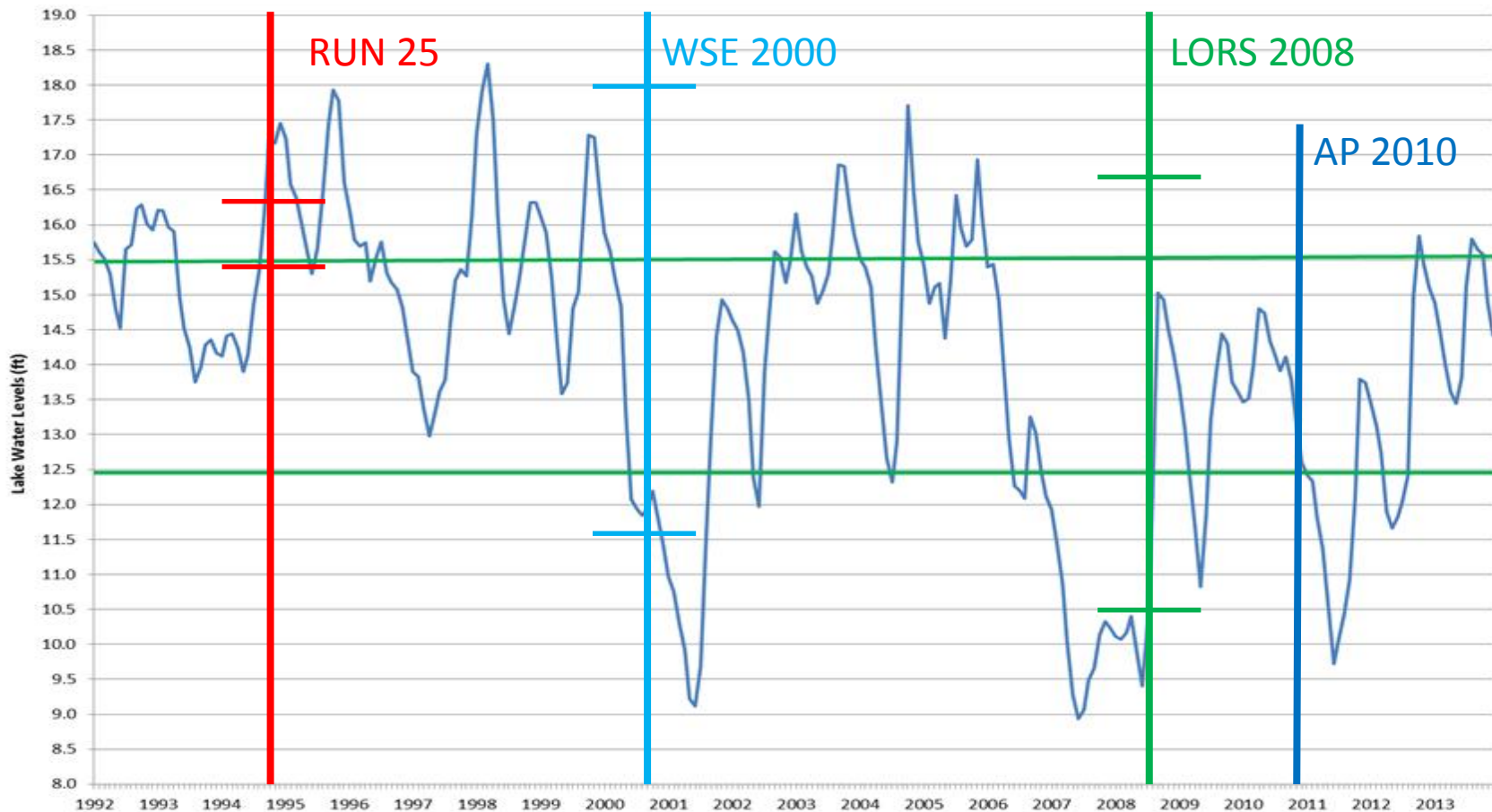
ADDITIONAL IMPACTS OF WATER LEVELS ON LAKE ECOLOGY

Based on Statistical Relationships Between Stage and Long Term Monitoring Data Sets

- **CYANOBACTERIAL ABUNDANCE** –Lake stage above 14' NGVD in May increases probability of Cyanobacterial blooms
- **PANFISH** – Abundance favored between 12 and 15 ft NGVD. Negative effects at stages greater than 16 ft NGVD
- **VASCULAR SAV** – Summer conditions between 12 and 15 ft NGVD optimal. Lower and higher lake stages suboptimal.
- **EPIPELON** – Optimal conditions when spring and fall lake stages are below 12 ft NGVD or between 12 and 15 ft. NGVD.
- **EPIPHYTON** - Optimal conditions when spring and fall lake stages are below 14 ft NGVD

Impacts of Climatic Events and Disparity Between Inflow and Outflow Rates on Lake Levels

Lake Stage 1992 - 2013



Long Term Solution Requires Recoverable Storage

- Currently 62,000 acre feet of dispersed storage, most non-recoverable, in Lake O watershed
- Original CERP planning called for 883,000 acre feet of above ground recoverable storage
 - Equivalent to a bit less than 2 feet of Lake Okeechobee elevation
 - Would help smooth out extreme high and low stages.
 - Limitations may be due to disparity between climatic conditions and operational needs.



THANK YOU !

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