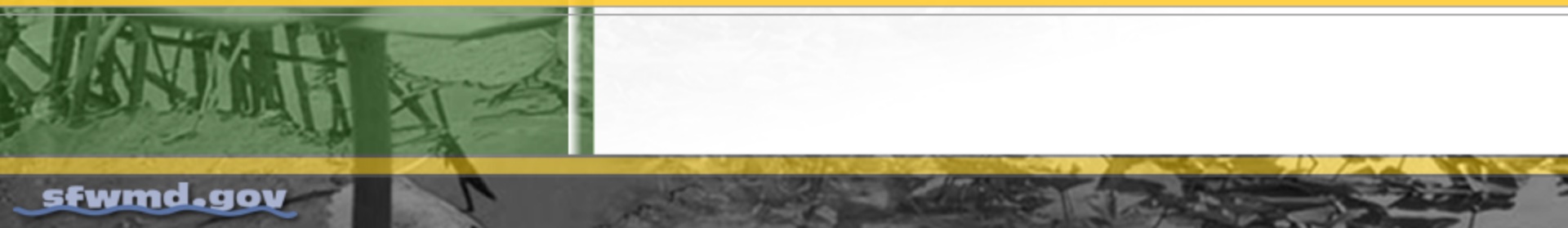
Pre- and Post-Drainage Characteristics of Lake Okeechobee

Paul McCormick, Chief Scientist, Lake Okeechobee Division



Purpose

- **Part 1: Compile available evidence for predrainage lake conditions with respect to:**
  - **Lake size and stage ranges**
  - **Connection to the Everglades**
  - **Water storage and carry-over flows**
- **Part 2: Describe current lake conditions and environmental targets for water-level management:**
  - **Stage ranges**
  - **Ascension/recession rates**

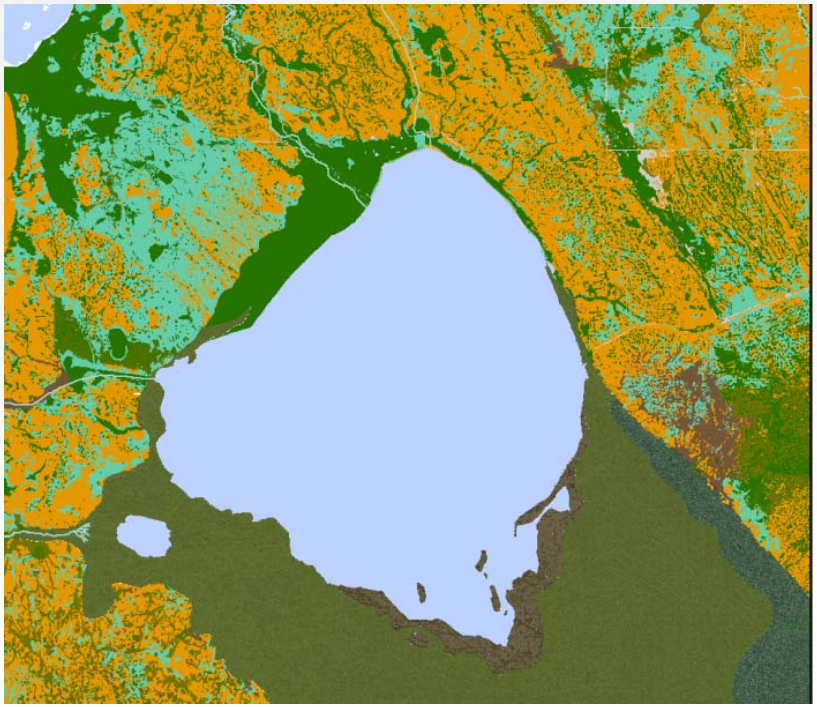
Lake Formation

- **Formed in a shallow bedrock trough**
- **Predrainage lake levels controlled by elevation of peat berm along southern rim**
  - **Bedrock elevation ~7 ft msl**
  - **Increased lake stages through time a function of peat accretion rate (~21 ft msl by 1880s)**
- **Flows to the Everglades and the Caloosahatchee watershed controlled by lake stage relative to this peat berm**

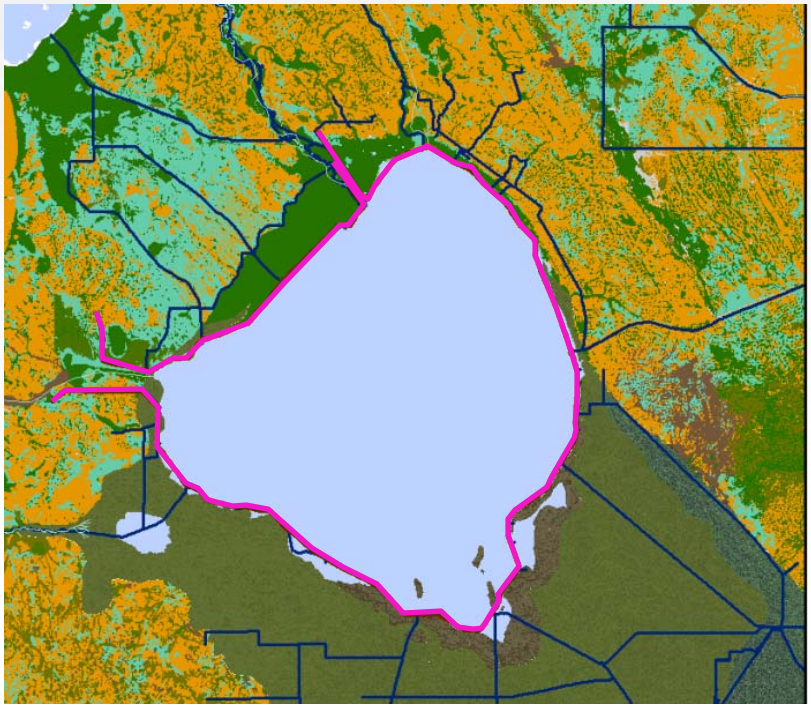
Predrainage Lake Size

The predrainage lake was somewhat larger than it is today

Predrainage:



Dike Overlay:

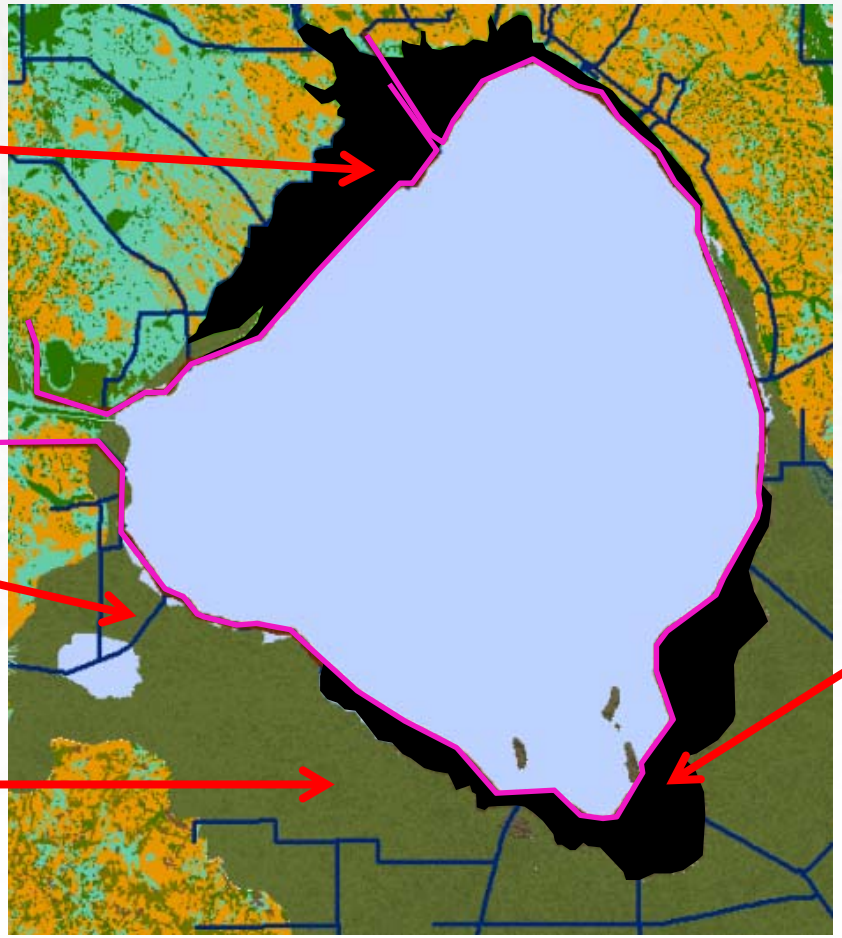


Predrainage Lake Littoral Zone

Sawgrass marsh

Okeechobee Marsh (*separate hydrologic unit*)

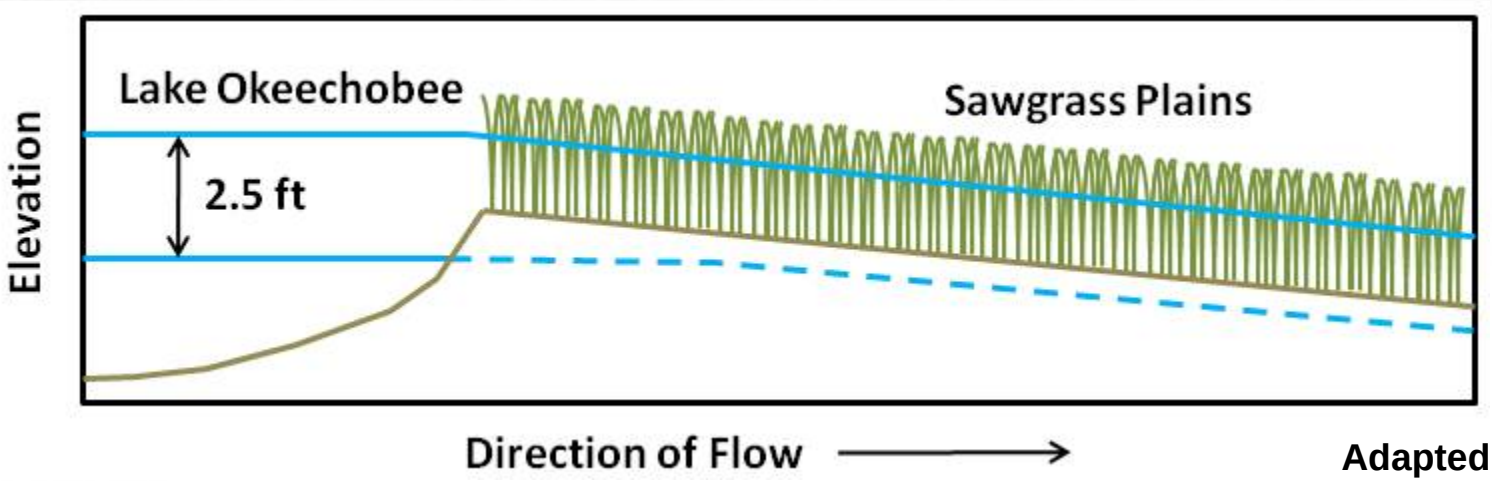
Sawgrass Plains (*separate hydrologic unit*)



Custard Apple Swamp and Open water

Predrainage Lake Stages

- **Typical stage range: 20-23 ft msl**
- **2-3 ft annual range supported by:**
  - **Pre-drainage and early post-drainage surveys**
  - **Sawgrass the dominant shoreline species**
- **Flow to Everglades at stages >21 ft msl**



Adapted from:
McVoy et al. in press

Carry-over storage in predrainage lake

- **Potential carry-over *lake* storage approx. 1 million acre-ft (assumes max stage of 23 ft and a 500,000 acre lake)**
- **Lake flows to Everglades were dampened by downstream vegetation and flat topography**
- **Lake evapotranspiration (ET, ~4-5 ft/year) is a significant loss factor for stored water**
- **Typical predrainage hydrology in sawgrass plains* indicates that lake flows were not continuous:**
  - **-0.5 to +1.5 ft depths**
  - **9-10 month hydroperiod**

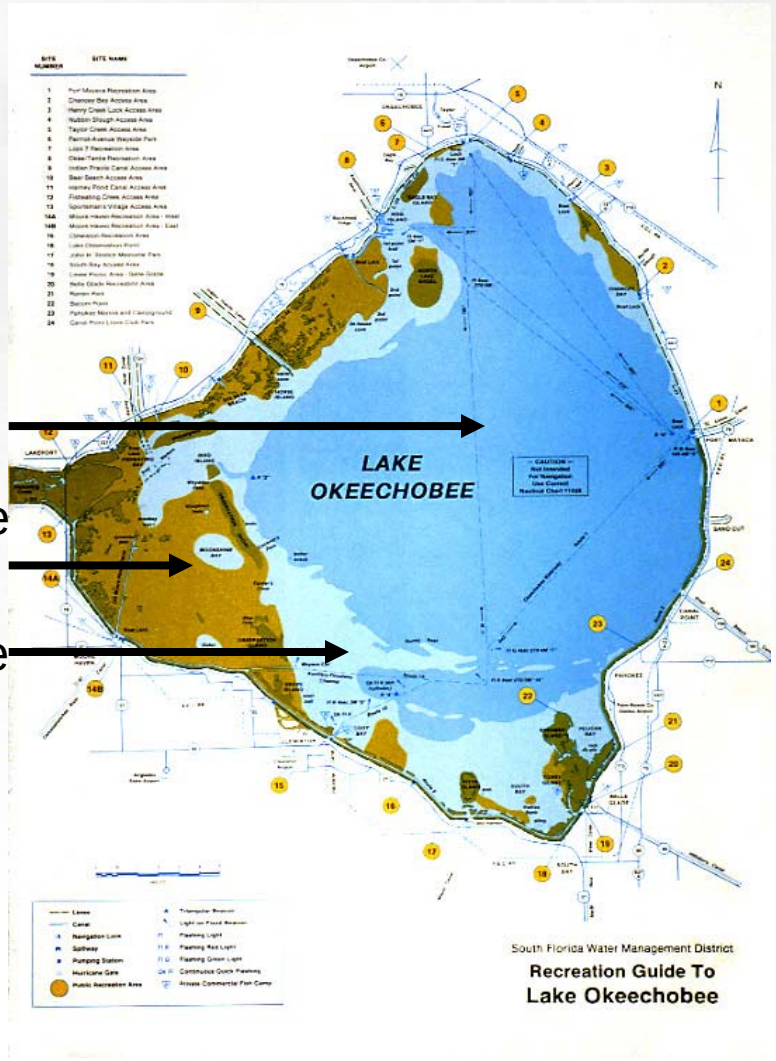
*** From McVoy et al. in press**

Summary: Predrainage Lake

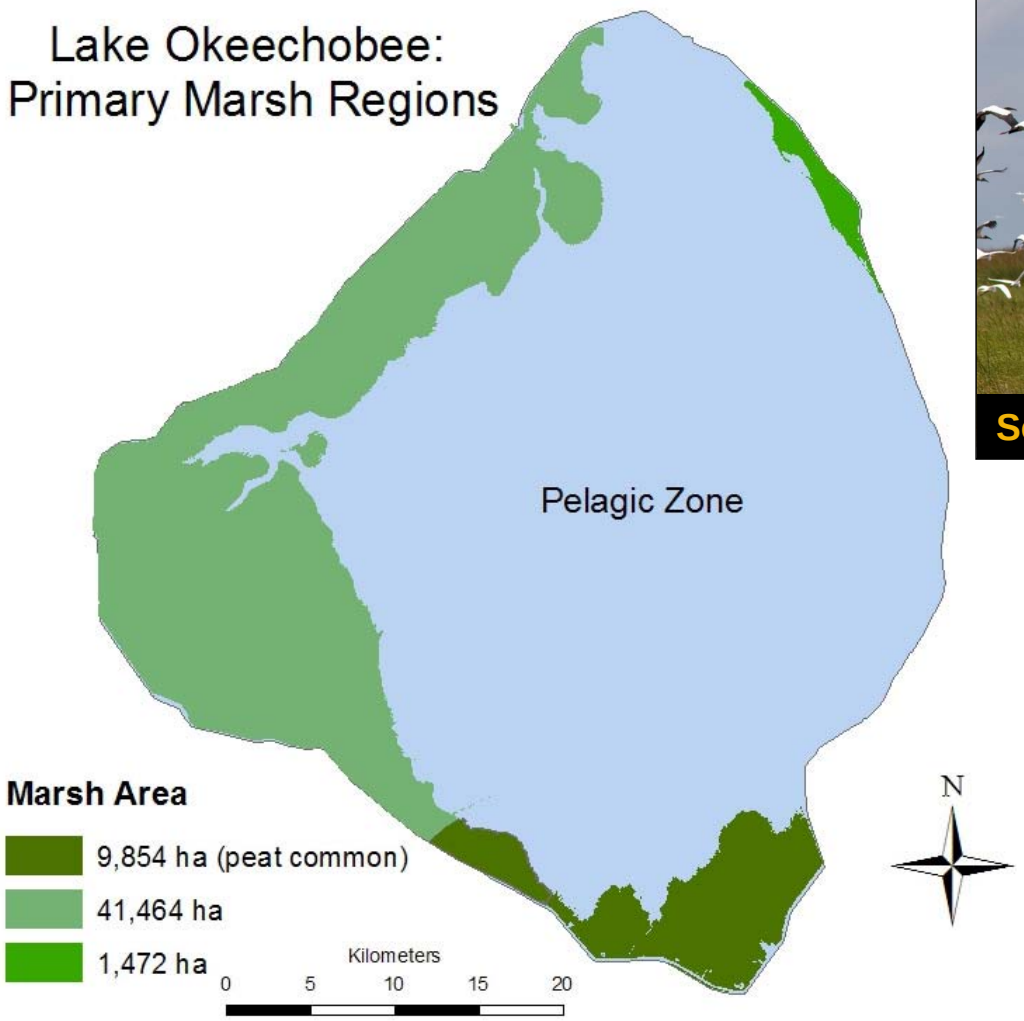
- **Somewhat larger than today**
- **2-3 ft stage range typical**
- **Roughly 1,000,000 acre-ft potential carry-over storage, some of which was lost to ET**
- **Frequent but not continuous surface-water connection to the Everglades**

Post-Drainage Lake Zones and Ecology

- **All three zones are ecologically important**
  - **Littoral zone:**
    - **fisheries**
    - **waterbirds**
    - **herps**
  - **Nearshore:**
    - **fisheries**
    - **waterfowl**
  - **Pelagic:**
    - **fisheries**
    - **waterfowl**



Post-drainage Littoral Zone Extent




Source: D. Unsell, SFWMD

Existing littoral zone (~130,000 acres) would be lost if lake stages were returned to predrainage levels

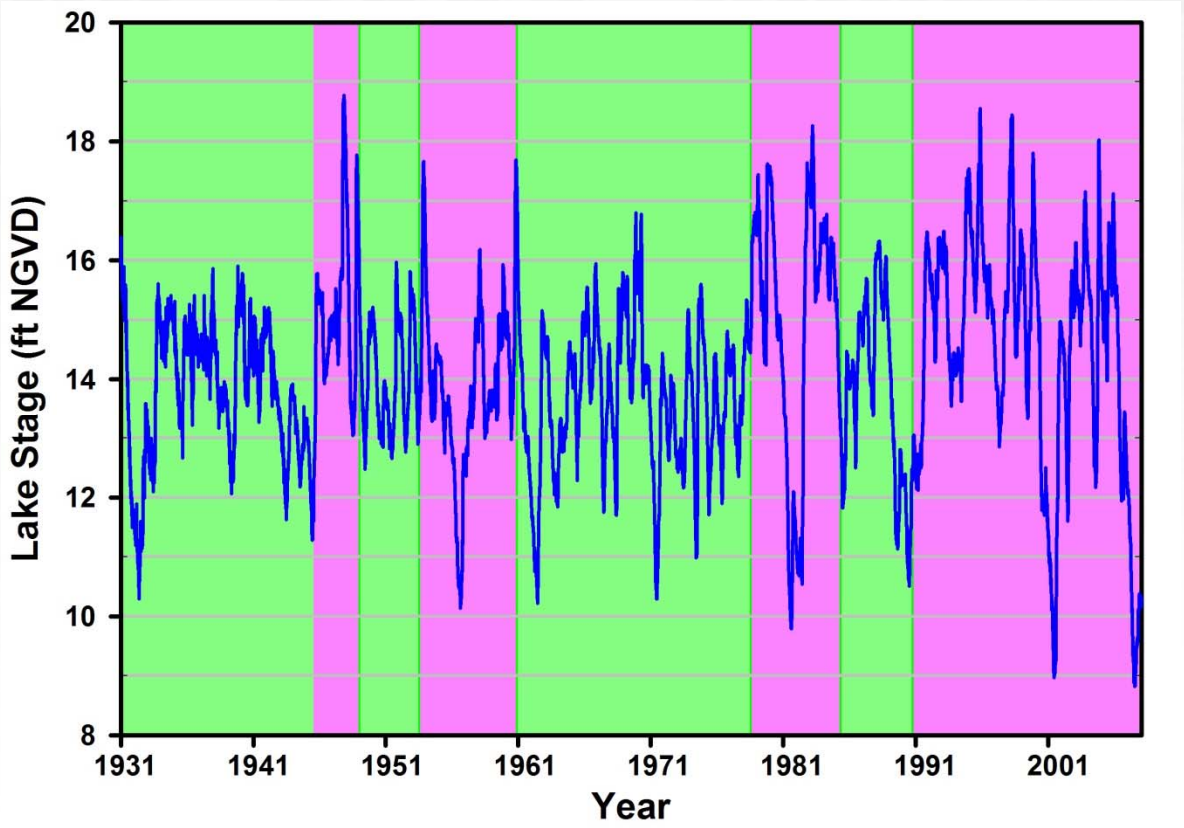
Current Issues

- **Stage Regulation (extreme water-levels and fluctuations)**
- **Eutrophication (increased P loading)**
- **Sediment Accumulation (“mud zone”)**
- **Invasive Plant Species**
- **Priorities: All four issues important, but stage regulation is a 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**

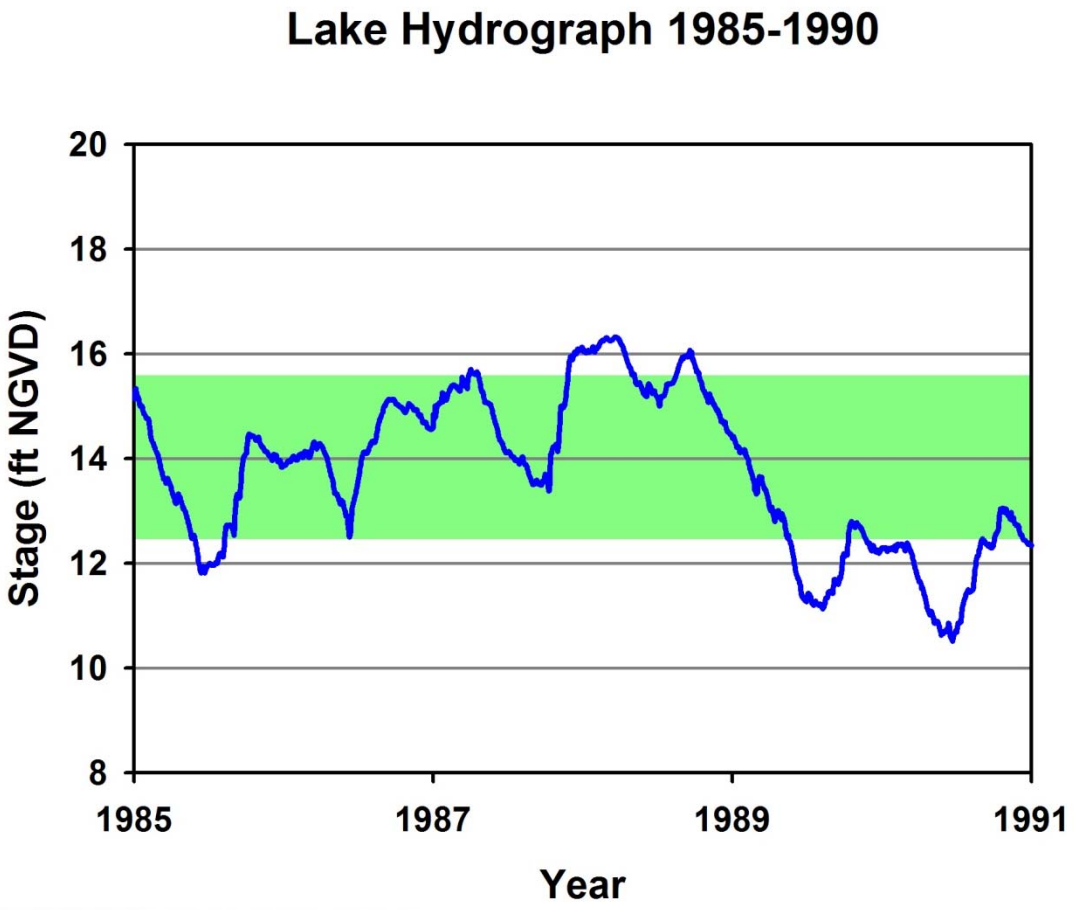
Post-Dike Lake Stages

Post-Dike stages are characterized by:

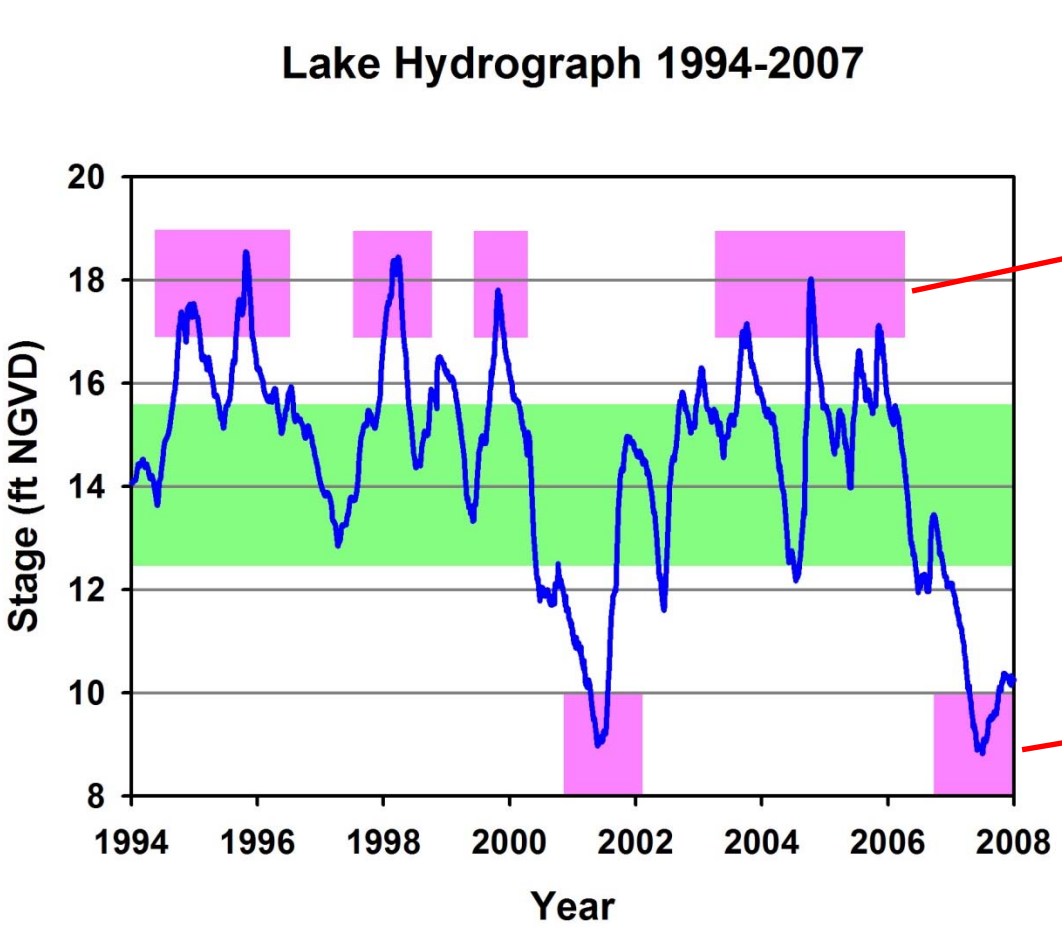
- **Lower stages**
- **Greater stage fluctuations**
- **Alternating periods of favorable and unfavorable conditions**



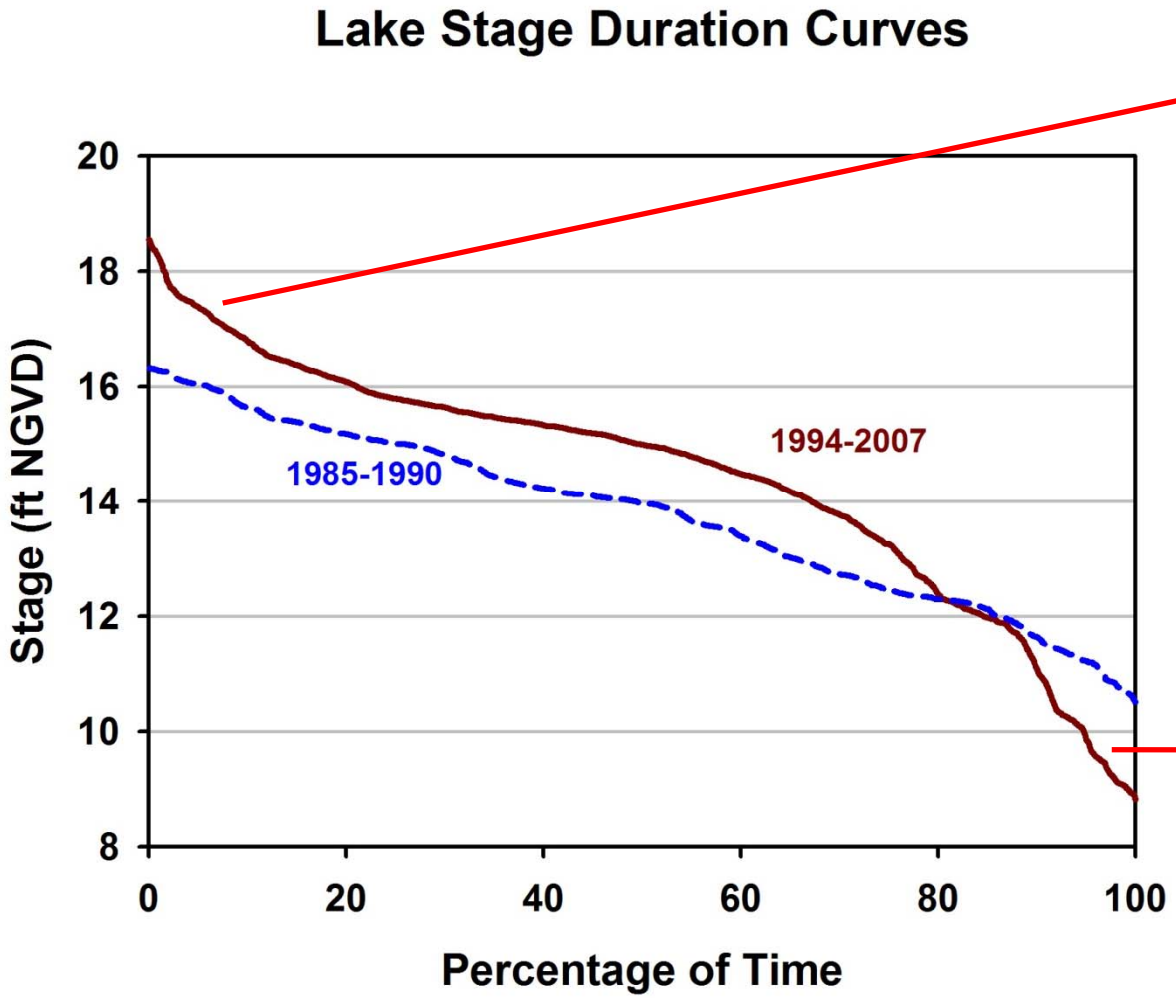
Generally Favorable Stage Range

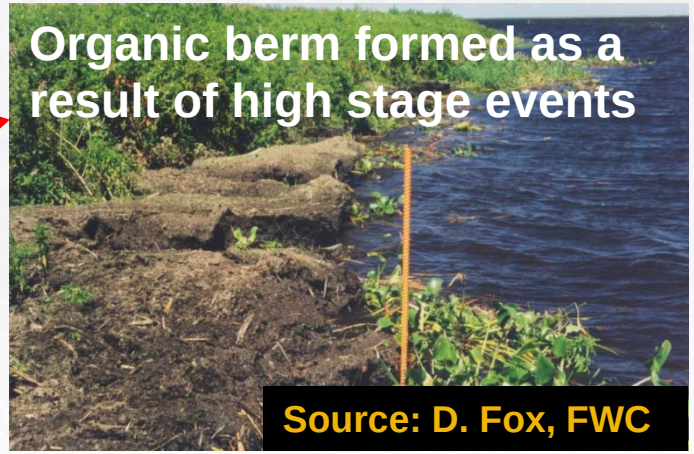


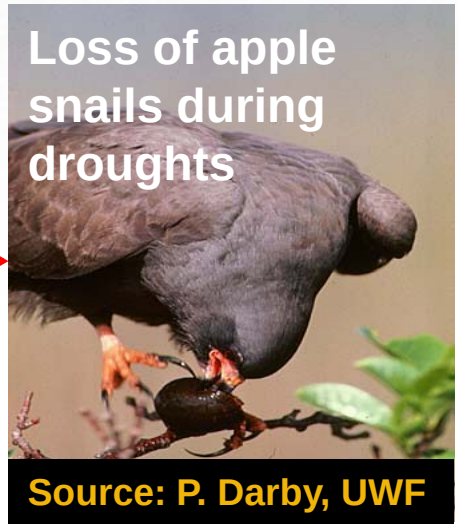
Generally Unfavorable Stage Range



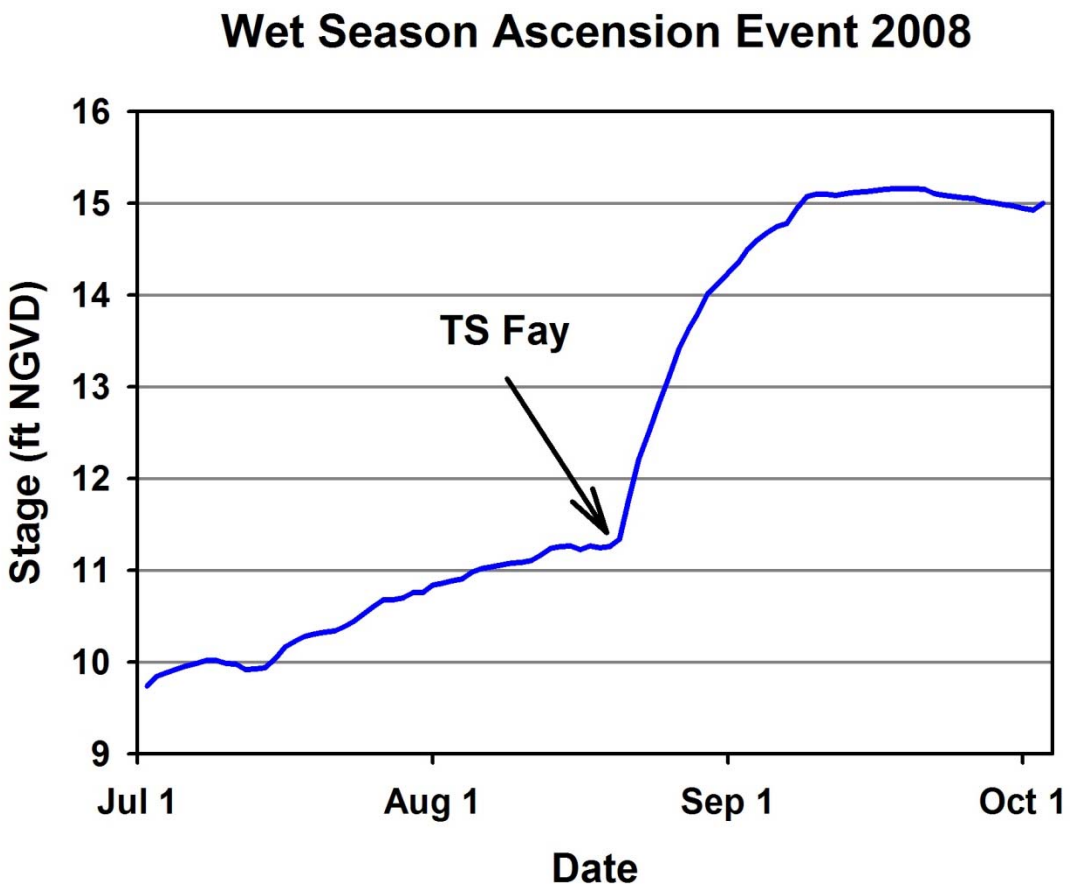
Ecological Impacts of Extreme Stage Events

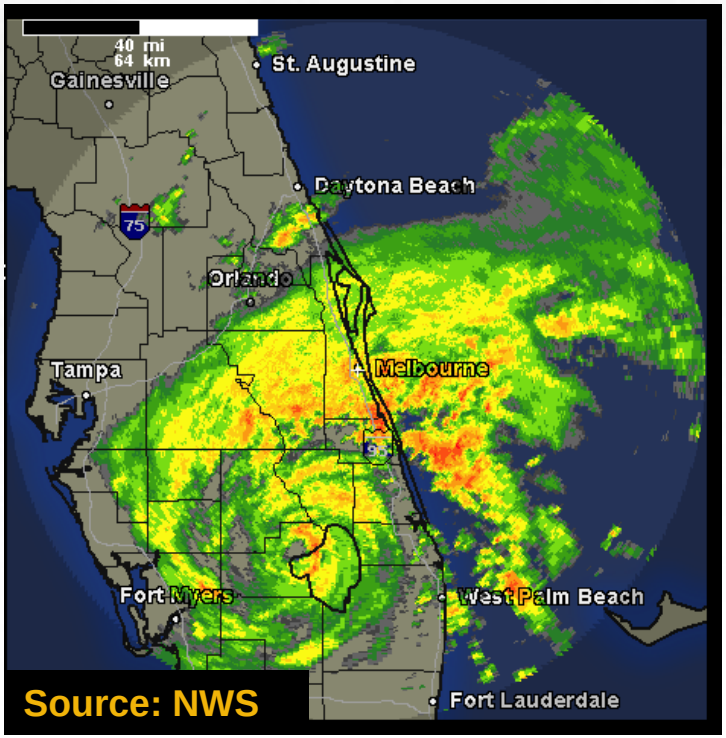






The lake is prone to rapid ascension rates that can be ecologically damaging

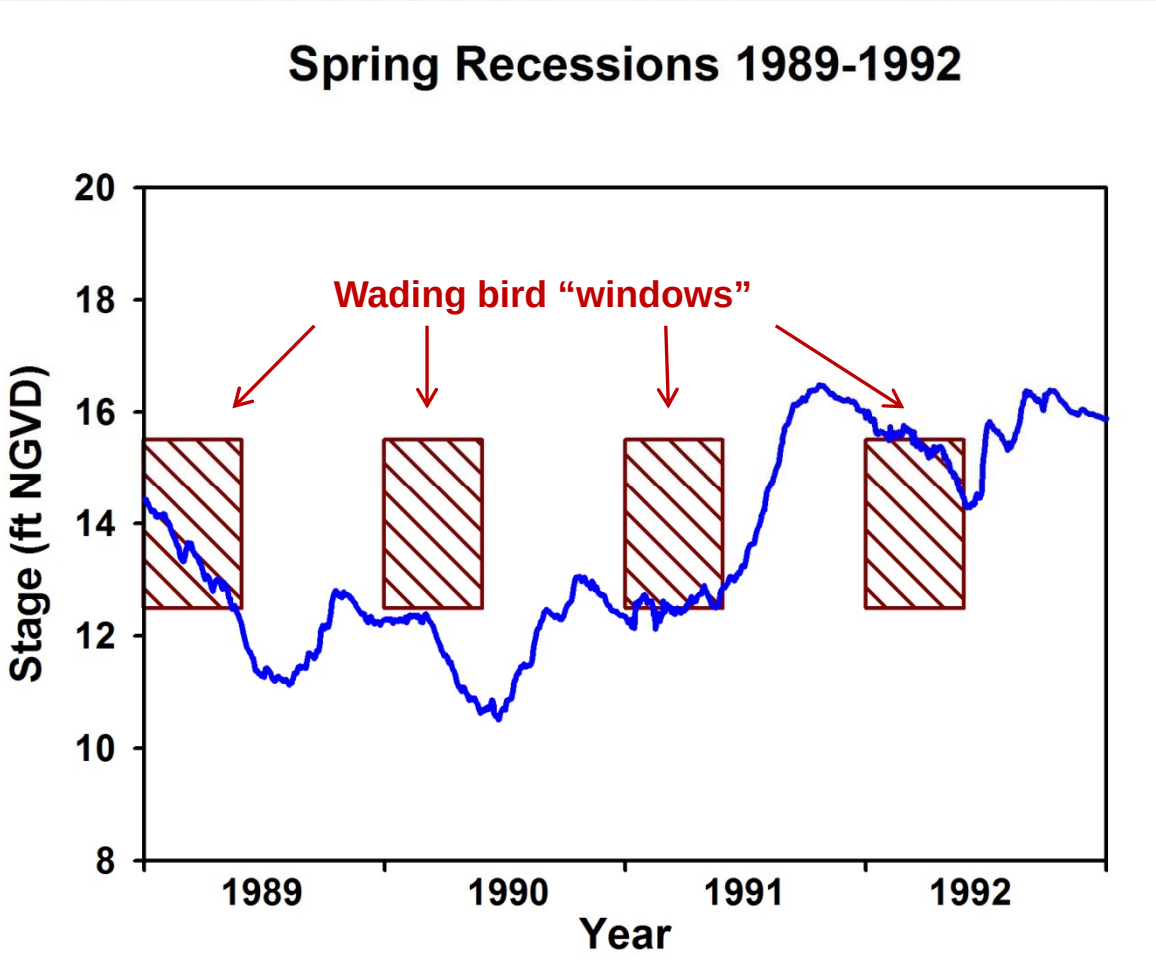




The lake also has requirements for dry season recession rates and reversals

Spring recession rate criteria for the lake:

- **gradual stage decline from 15.5 ft in Jan to 12.5 ft in June**
- **reversals not to exceed 0.5 ft**



Summary: Post-Dike Lake

- **Lower and wider stage range than predrainage**
- **Hydrologic conditions often suboptimal relative to environmental needs**
- **Environmental-hydrologic relationships well established**
- **Improved ecological conditions dependent upon reducing extreme stages and water-level fluctuations**