

POREWATER CHEMISTRY AND QUALITY OF ORGANIC MATTER IN SOILS OF COASTAL LOUISIANA MARSHES

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TOPICS

- BACKGROUND
- POREWATER AND SOIL CHARACTERIZATION OF HEALTHY PEAT-BASED MARSHES
- RESPONSE TO RIVER WATER INFLUX
- POREWATER RESPONSE TO EXTREME CLIMATE EVENTS



- ONE WAY TO EXPRESS SOIL ORGANIC MATTER QUALITY

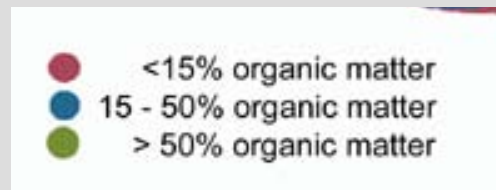
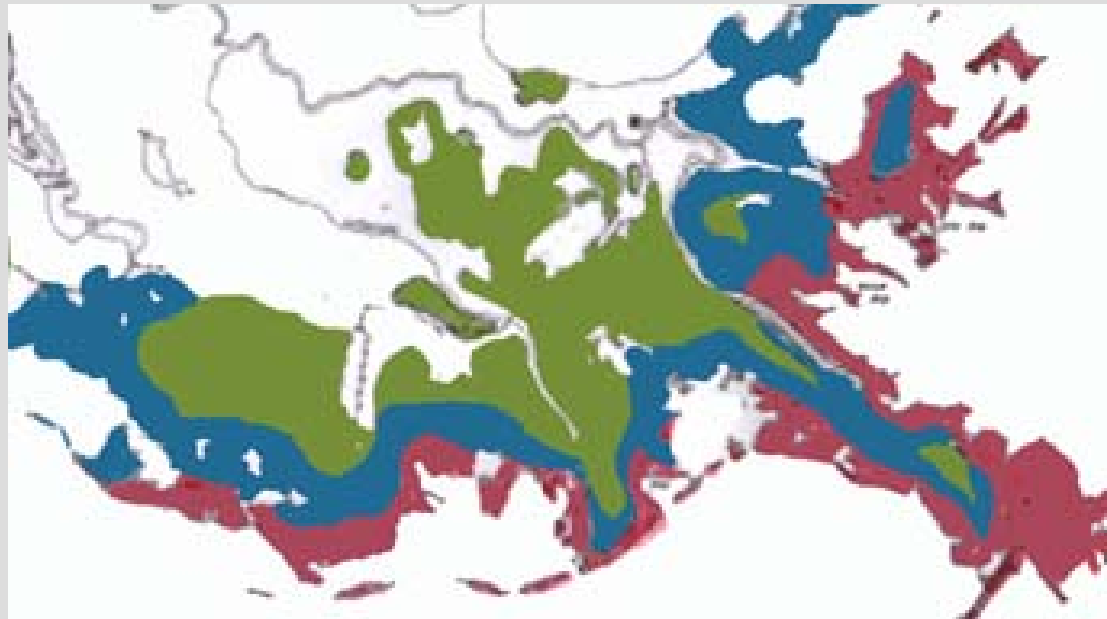


River water



Rain water

Occurrence of organic-rich marshes in the Louisiana Delta Plain



COASTAL LOUISIANA MARSH SOILS

- in Louisiana, as elsewhere, marsh soils rely on organic matter to add volume and keep pace with relative sea level rise
- accrete about $175\text{-}250 \text{ g C m}^2 \text{ y}^{-1}$
- accretion rates ($\sim 0.4\text{-}1 \text{ cm}^{-1}$)
- sulfate: influences humification of soil organic matter

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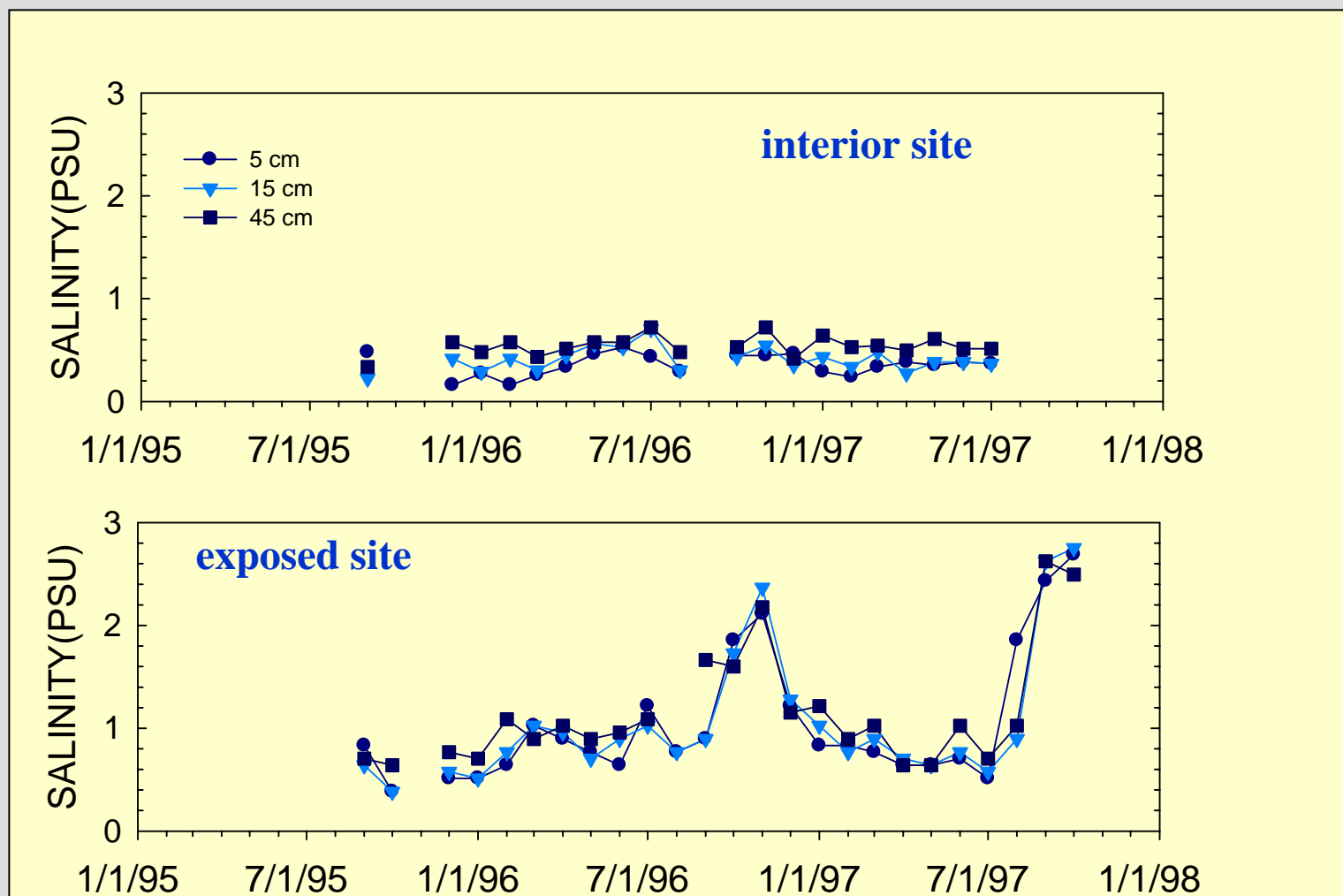
Location of porewater sampling sites at Jean Lafitte National Historic Park



Increasing exposure
to salt pulses



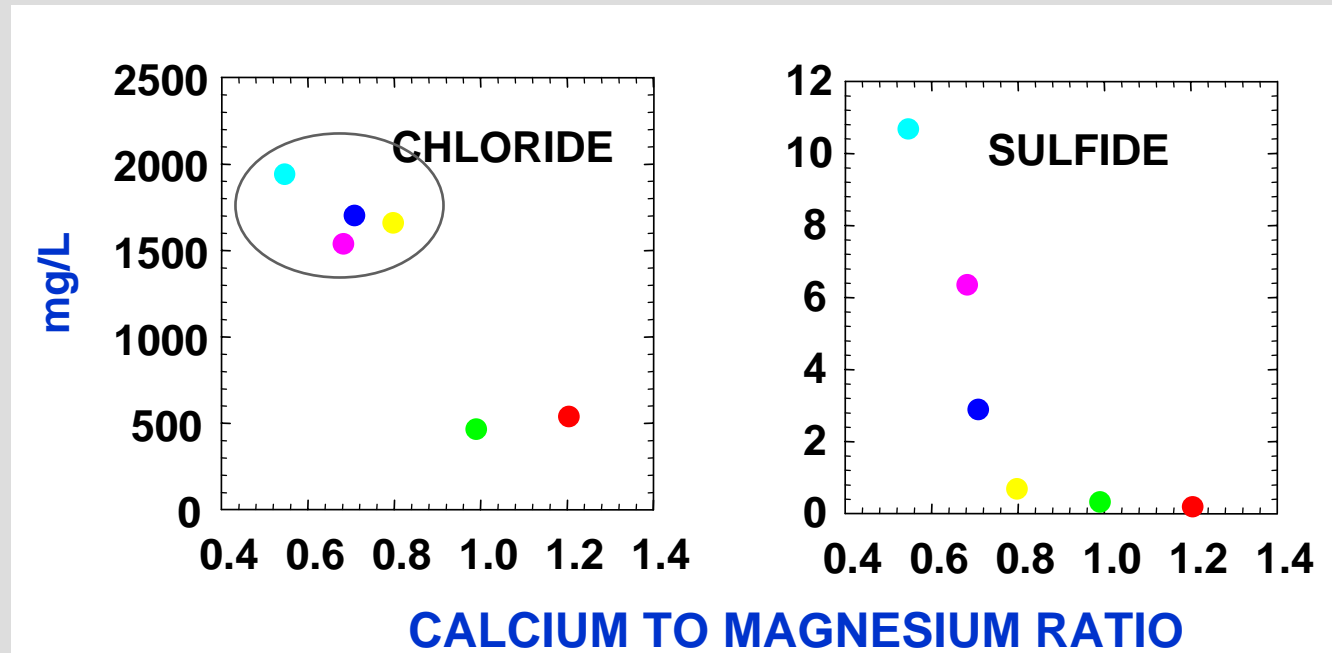
Salinity regime at JELA: interior and exposed marsh



Differential exposure to marine influence influential in controlling occurrence of different plant species

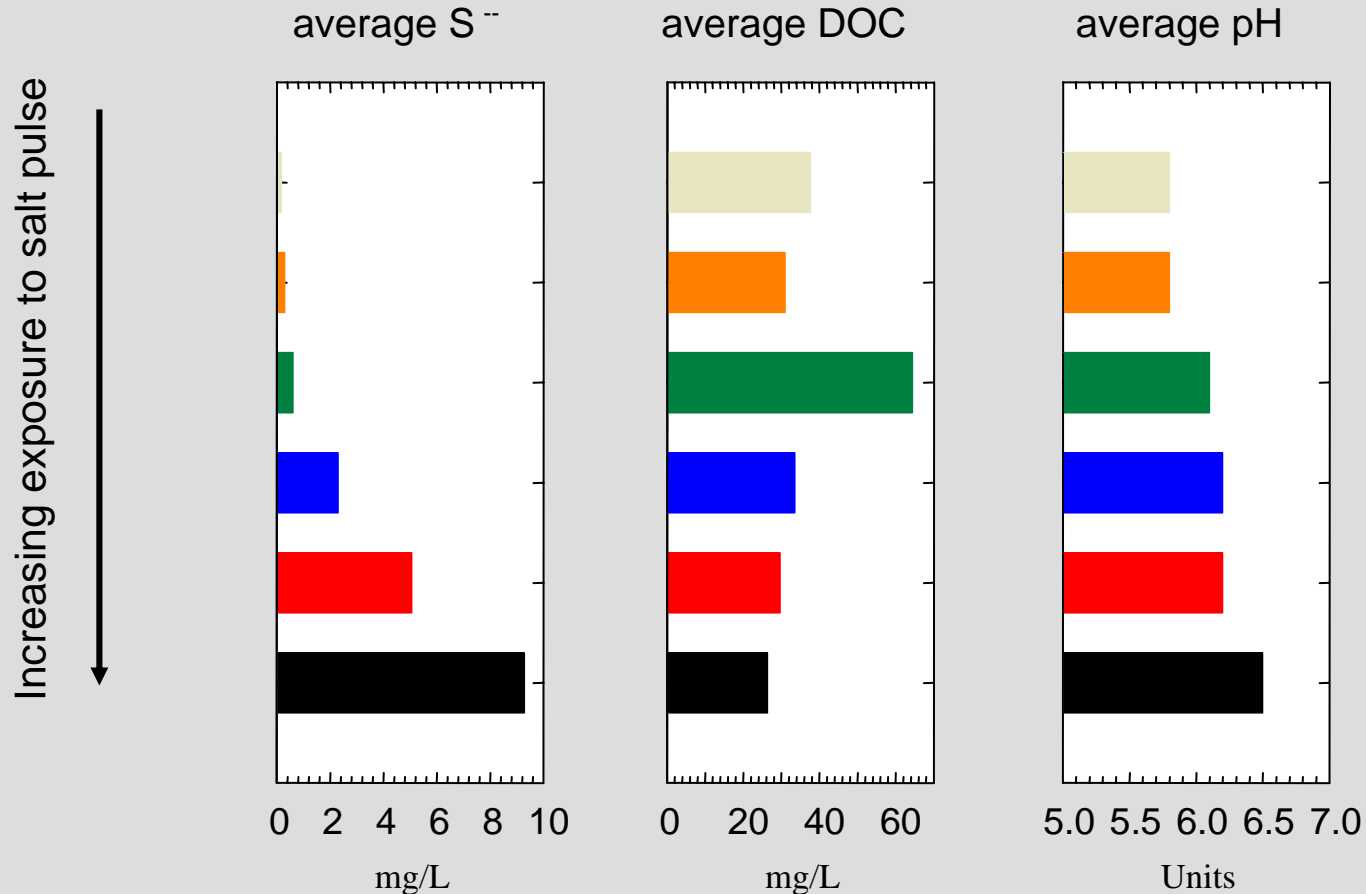
Plant community

- *P. hemitomon* (non floating)
- *P. hemitomon* (floating)
- *Eleocharis mix*
- *Eleocharis* dominant
- *S. falcata*
- *S. patens/S. americanus*



JELA: BARATARIA PRESERVE

Averaged porewater concentrations (5,15 and 45 cm depth, 2000-2002)



Panicum



Sagittaria



S. Patens
(most exposed)



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ONE PURPOSE OF A RIVER DIVERSION

BUILD MARSH SOILS

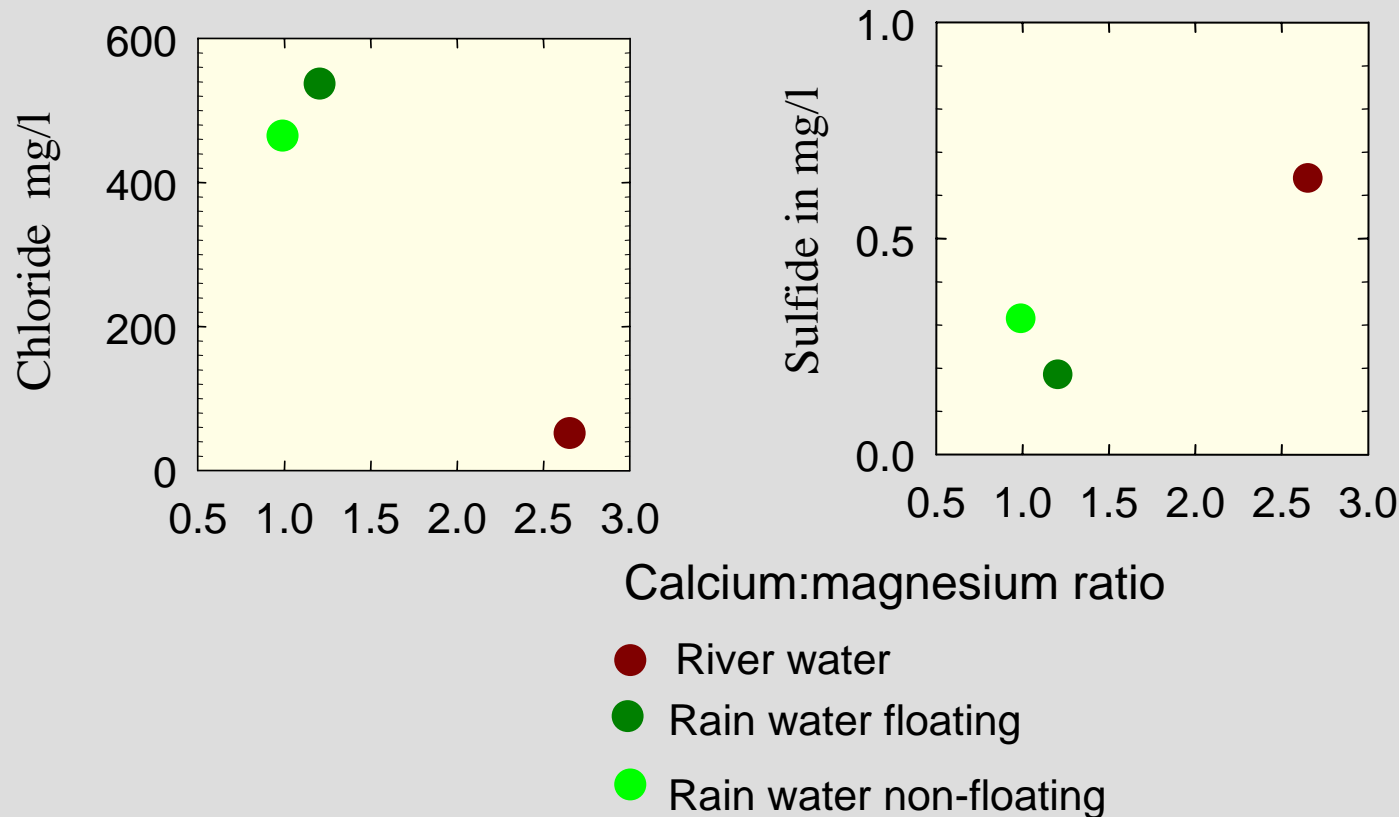
- 1) RESILIENT IN TERMS OF DAY-TO-DAY (TIDES) AND EXTREME EVENTS (STORM SURGE, DROUGHTS) -
 - focus on organic matter **quality**: decomposition, shear strength

- 2) ACCRETE IN BALANCE WITH APPARENT SEA LEVEL RISE
 - focus on organic matter **quantity**: accretion rates

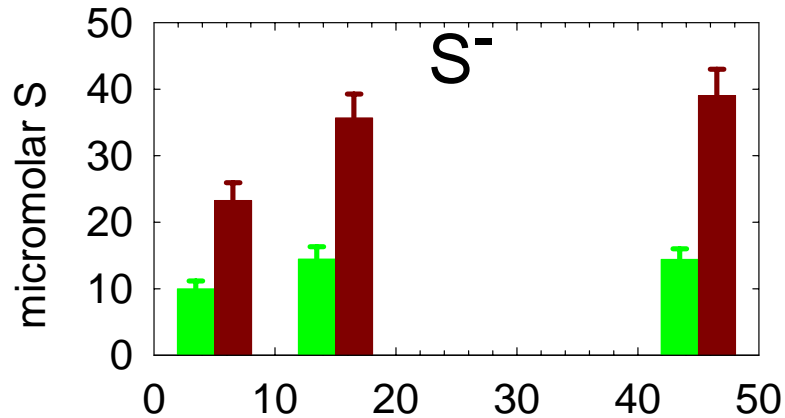
Organic-rich marshes have experienced extensive conversion to open water and degraded marsh in Penchant basin, an area where influx of Mississippi river water predominates. Why?



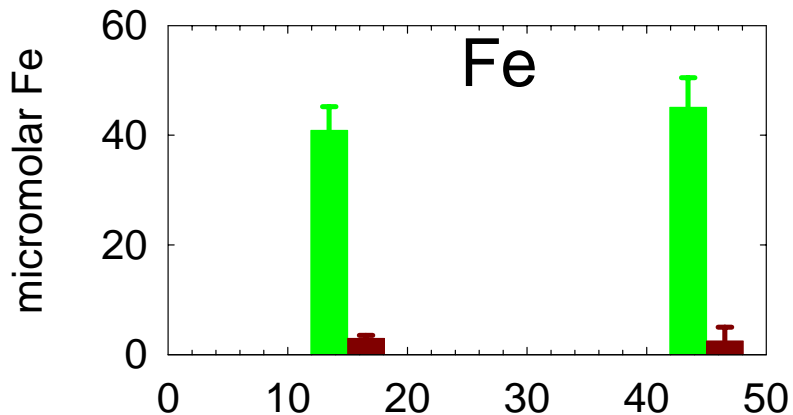
Porewater sulfide and chloride in relation to calcium/magnesium ratio: comparison rain vs river water



Porewater S and Fe

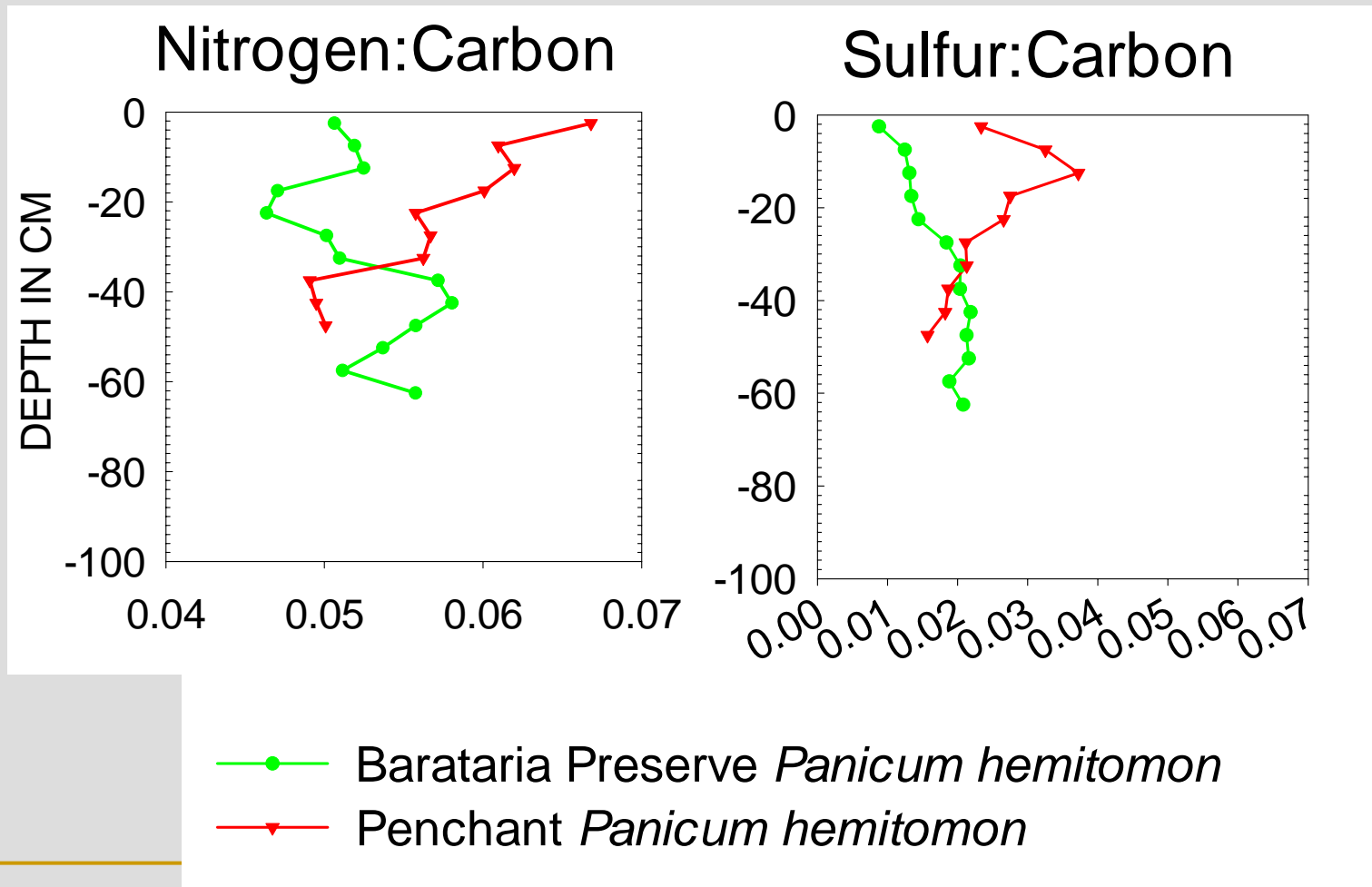


Sulfide concentrations are much higher; Fe concentrations much lower in Penchant marshes



Probably iron-phosphate complexes are broken, and iron complexes with S²⁻ → internal eutrophication, release of phosphate

COMPARING NITROGEN AND SULFUR TO CARBON RATIOS IN SOILS FROM JEAN LAFITTE NATIONAL PARK AND PENCHANT BASIN



Soil Quality: with long-term (30+ years) river water influx decomposition appears enhanced (same plant community, *Panicum hemitomon*)

River water



Rain water



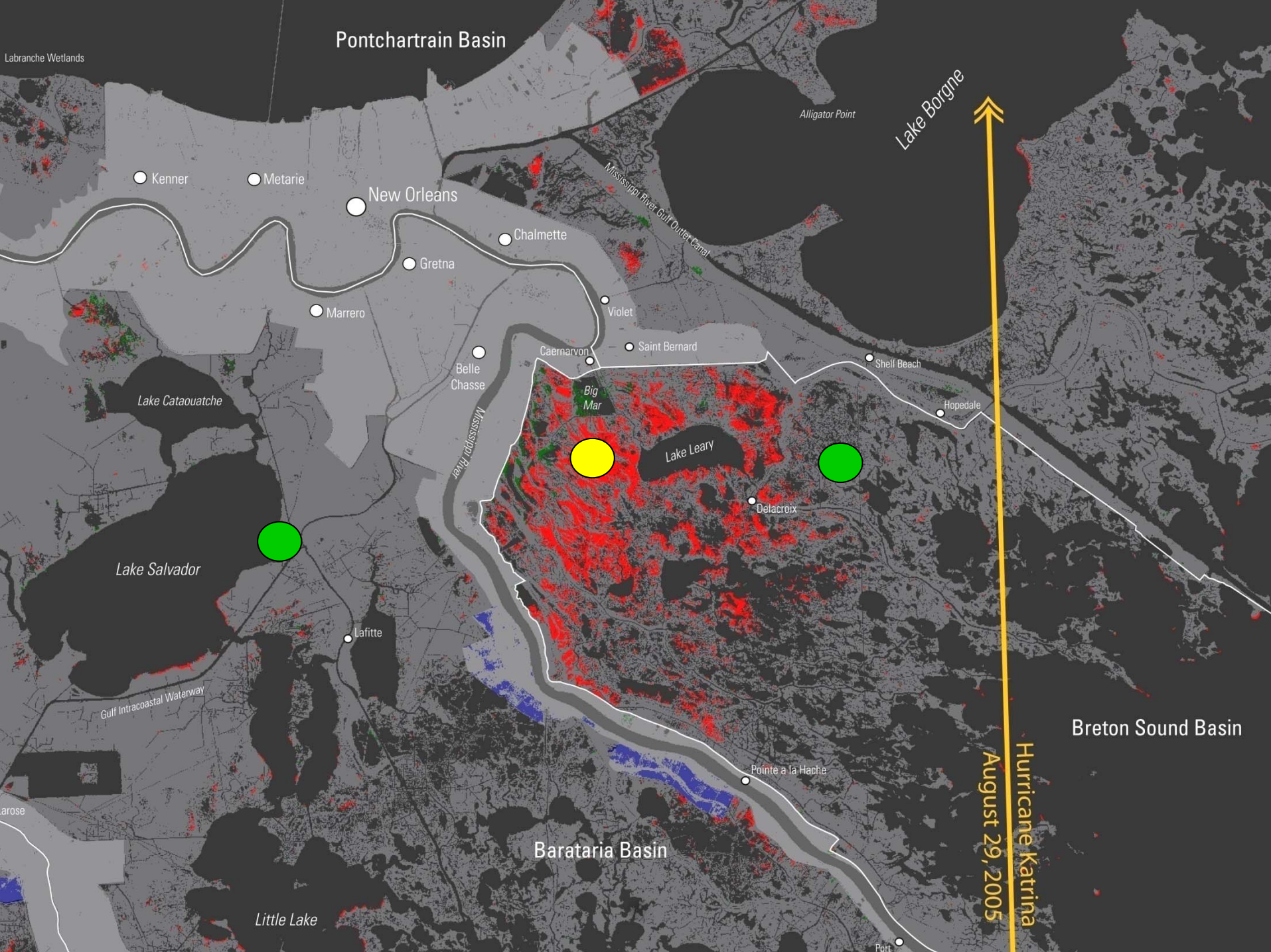
- No difference in year-end standing biomass

- No difference in accretion rates

BUT:

- Soil is much more decomposed

- links to river water include **sulfate**, **nitrate**, alkalinity



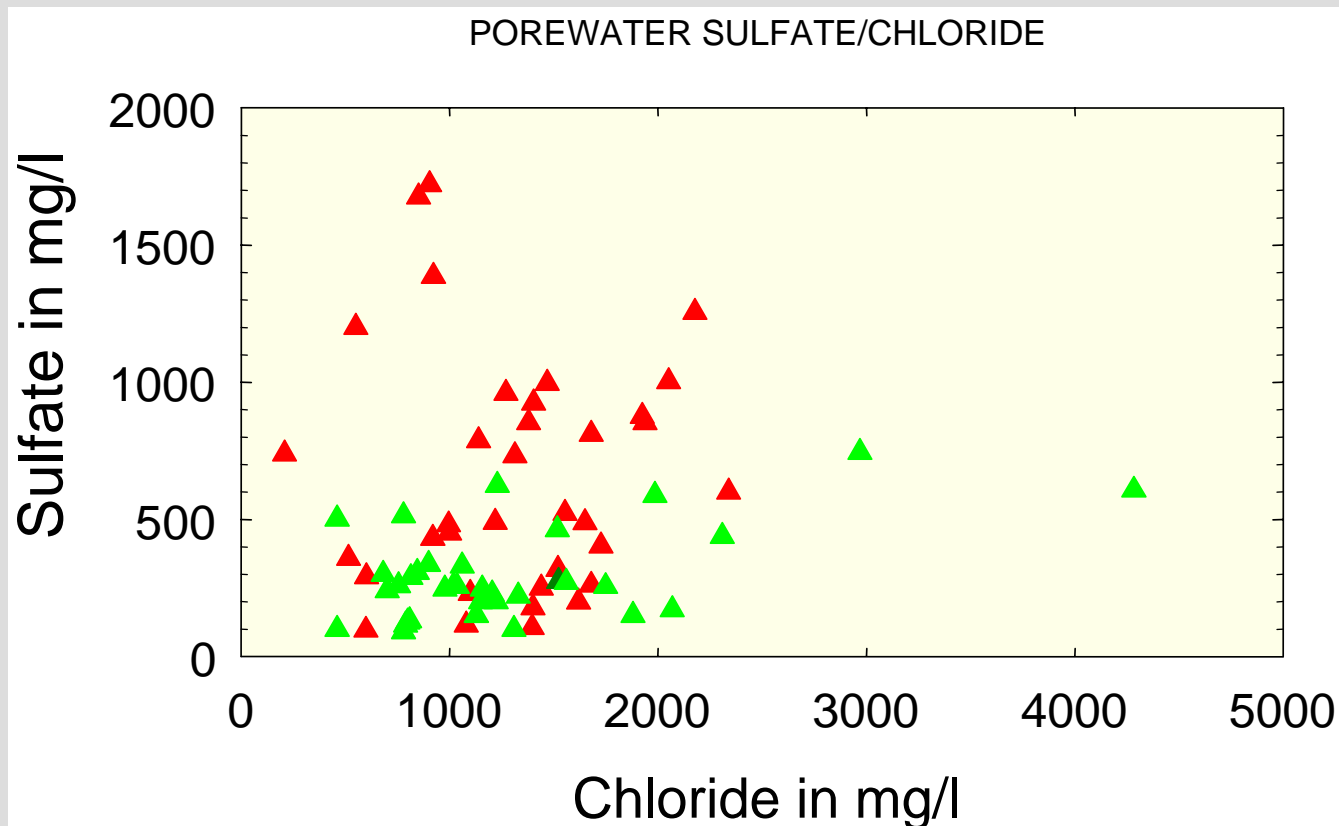
Marshes at outfall and east control

Marshes on the east side of Delacroix road survived the storm surge fairly intact. The east side is isolated from river influx.



Marshes on the west side of Delacroix road were picked apart, leaving only scattered remnants. These marshes have been in the diversion outfall path since 1992.

POST KARINA, SOILS IN AREA RECEIVING RIVER WATER EXHIBITED DIFFERREING POREWATER RESPONSE: OXIDATION OF FeS?

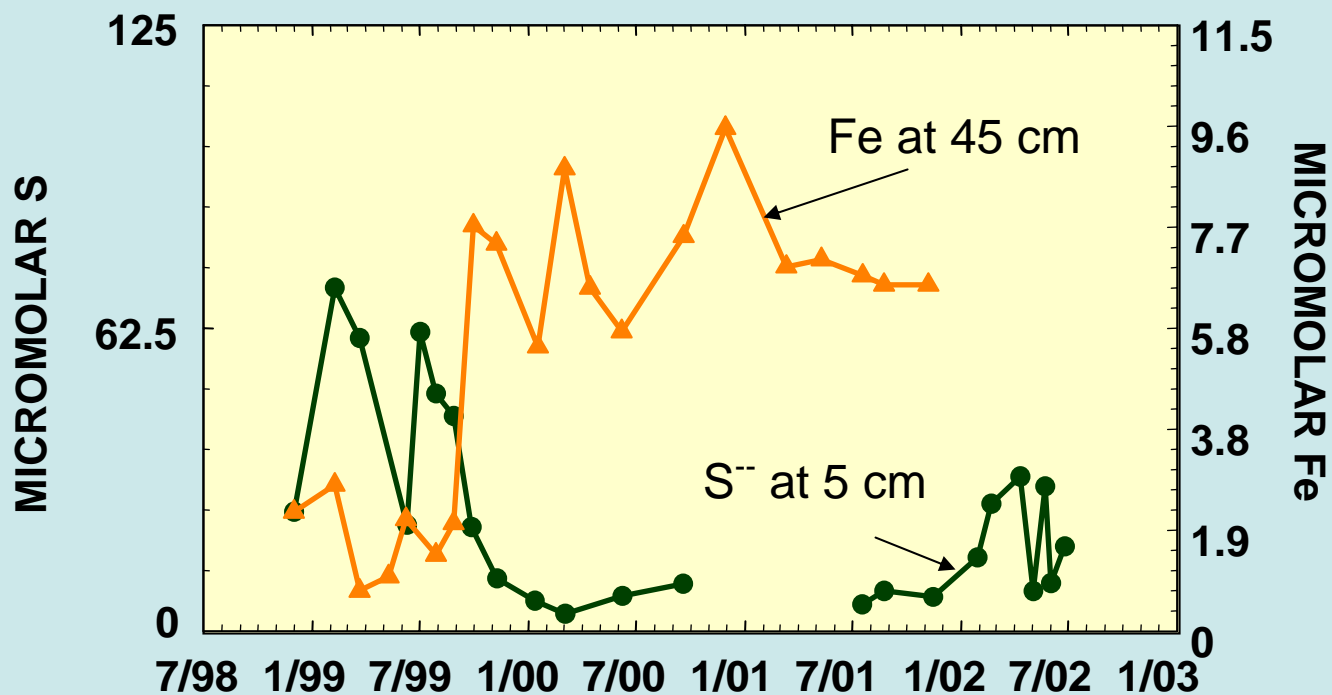


River subsidy sulfate values are higher and spread over a larger range relative to chloride compared with the two control areas.

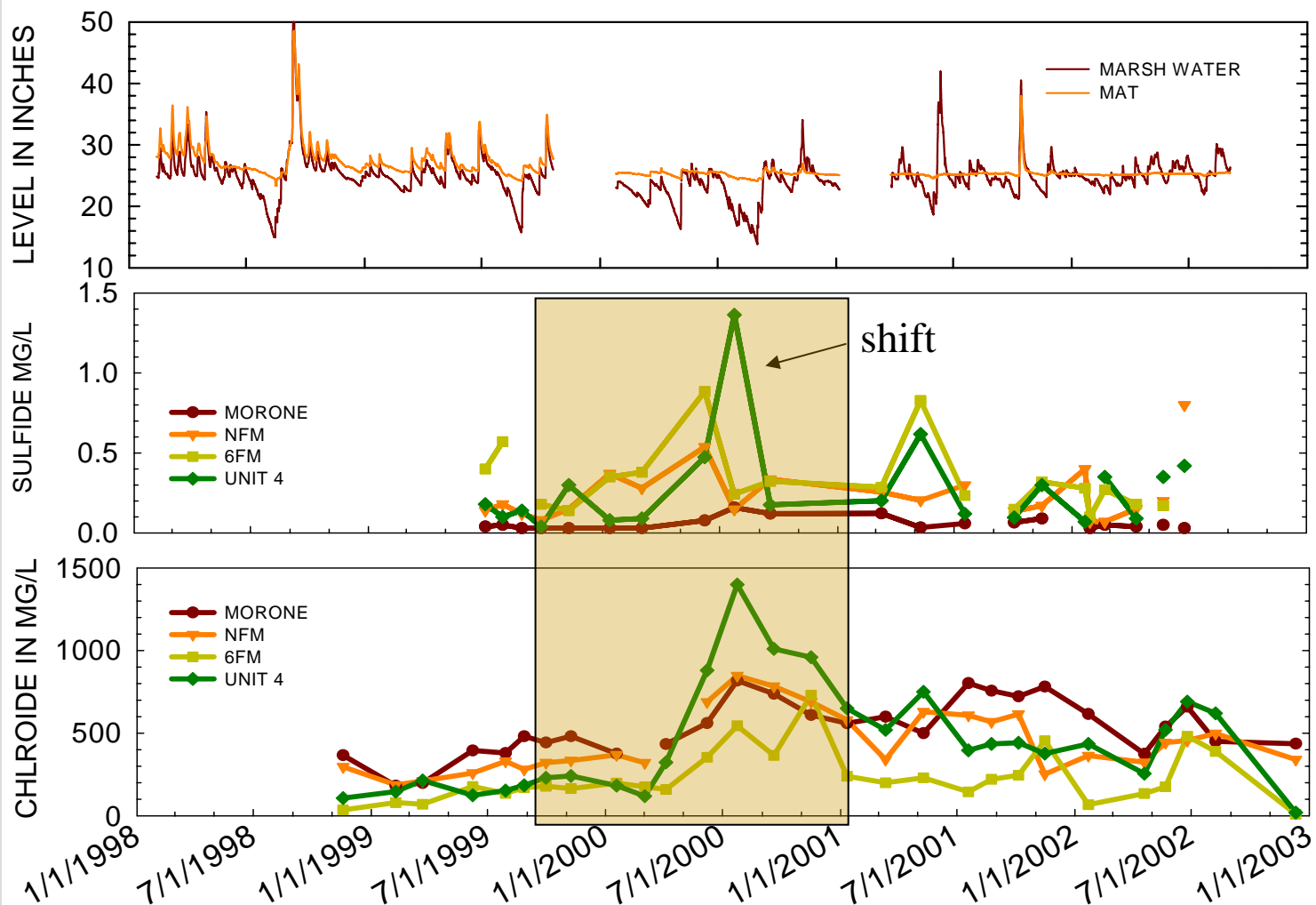
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In area with controlled river influx *P. HEMITOMON* MARSHES
(average of four locations)



In reference area (without river influx)



EXTREME DROUGHT

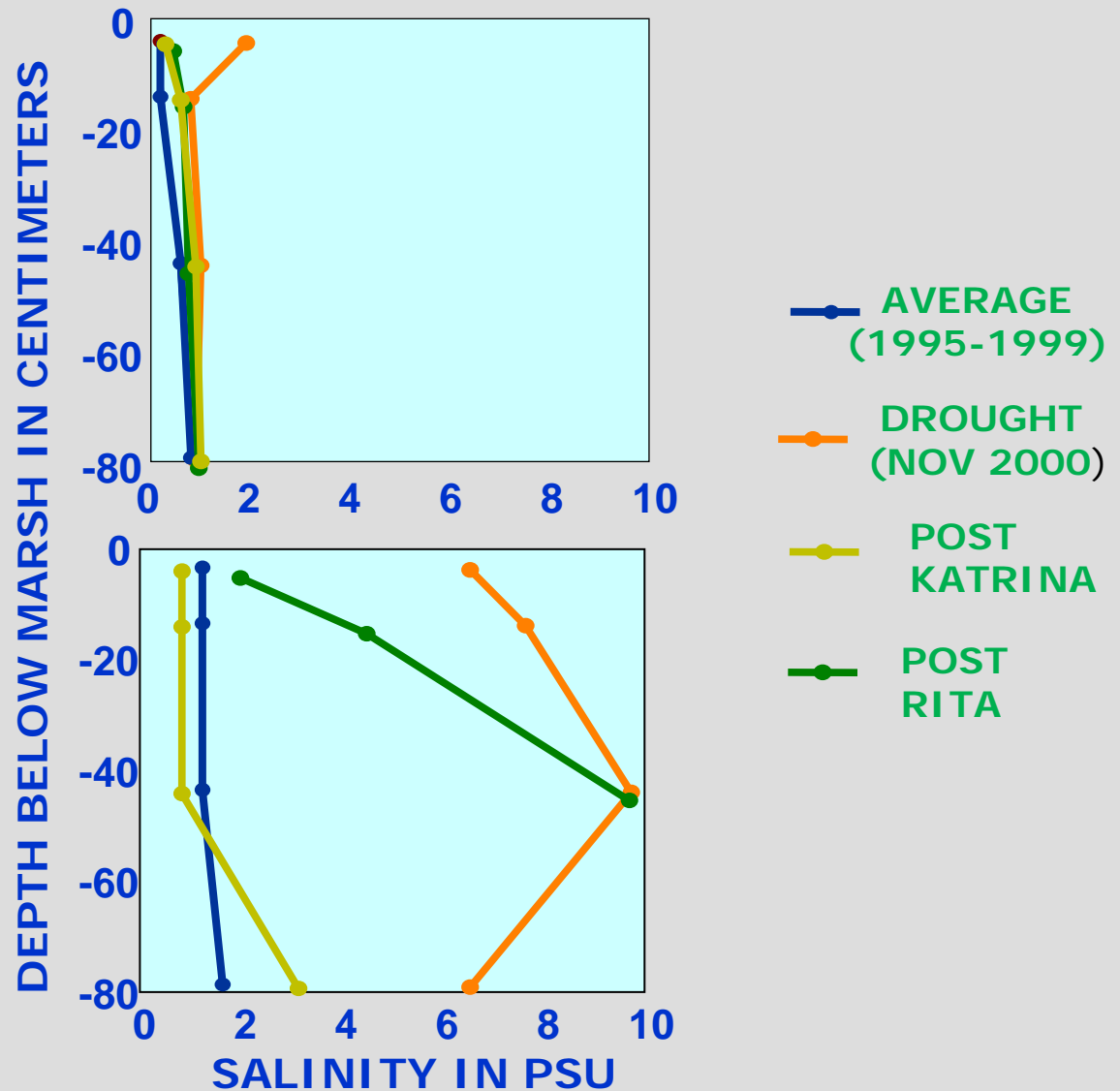
SOIL QUALITY: EXTREMES BASED ON MARINE INFLUENCE



P. hemitomom

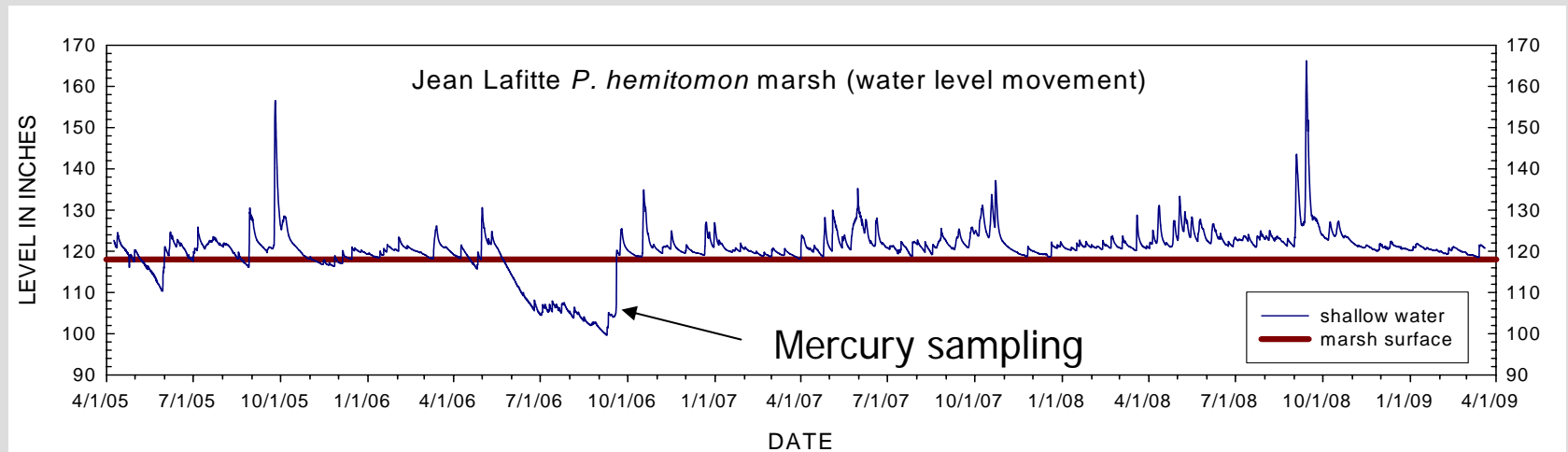
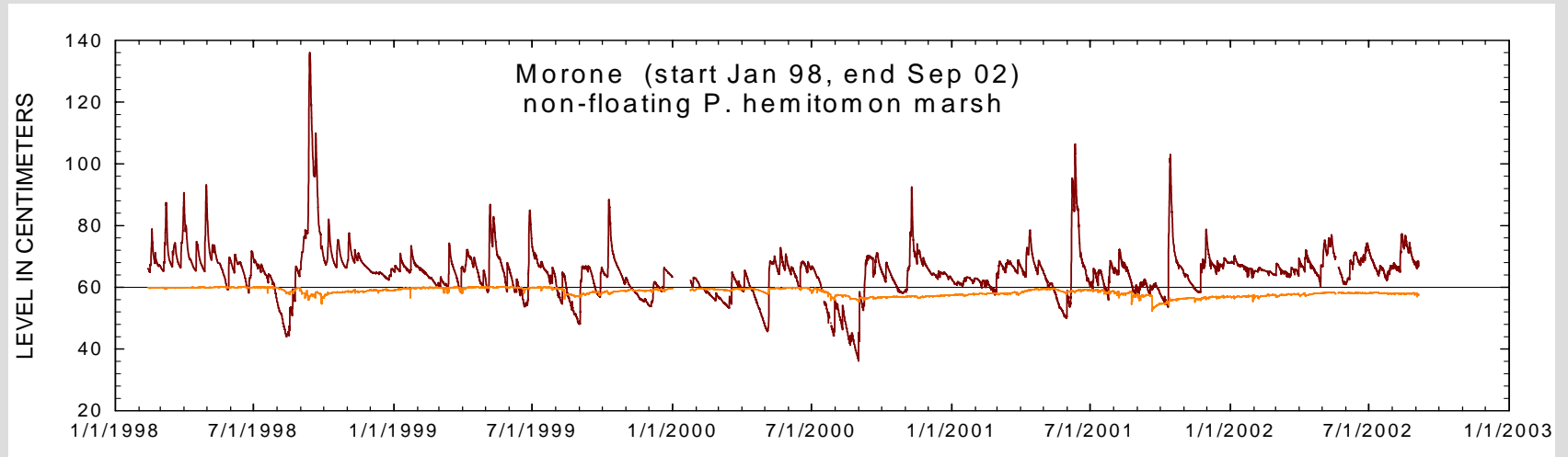


S. patens



JELA: BARATARIA PRESERVE

Interior marsh water-level fluctuations; note impounded condition with occasional short drawdowns, and long periods of inundation



RESEARCH NEEDS

- Improved techniques to characterize organic matter quality
- Understanding processes that control organic matter quality: linking porewaters to organic matter quality
- Complete overlap with understanding mercury cycle