Detecting Chronic Effects Of Oil Development In Caddo Lake

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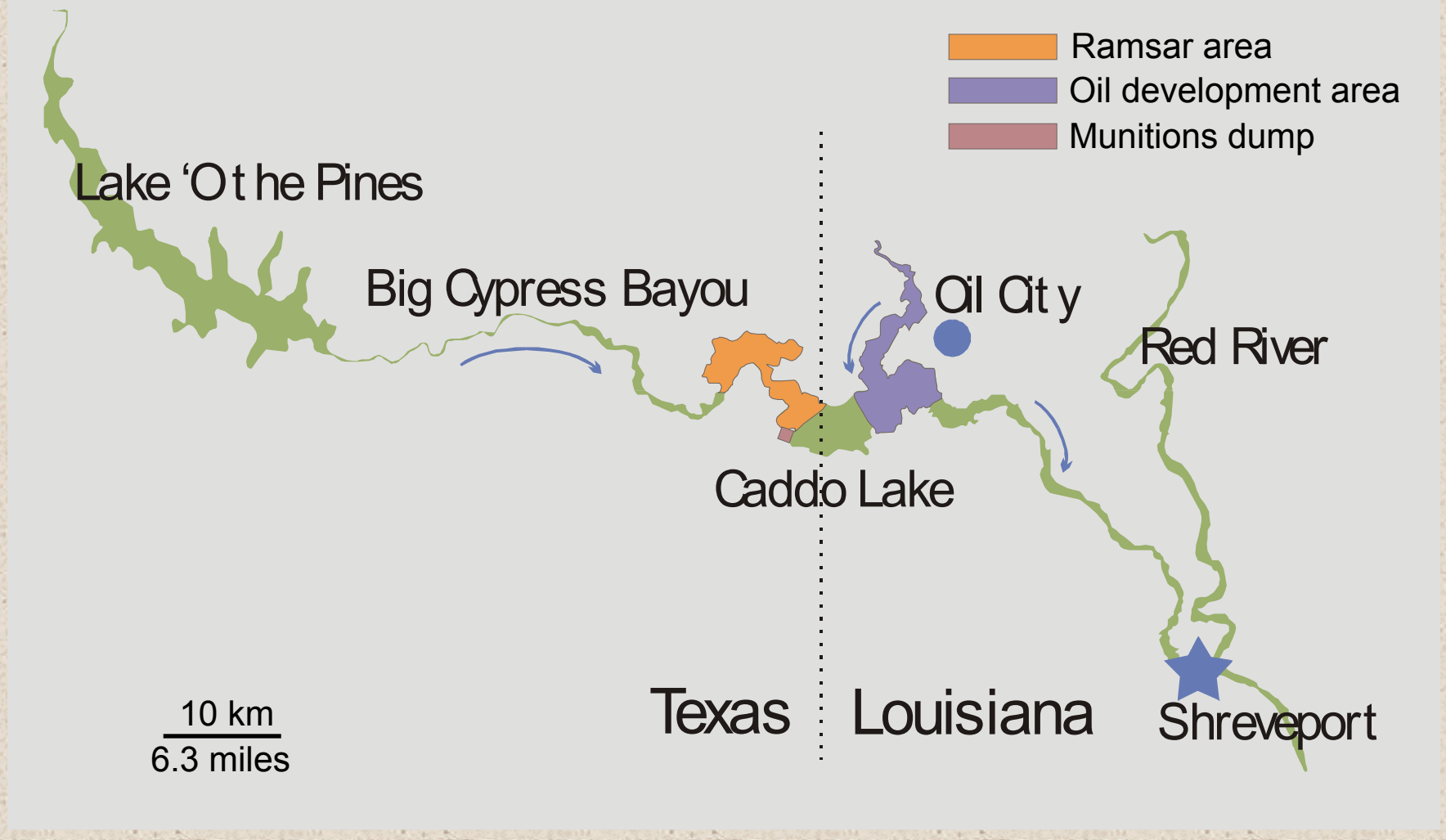
(OSRADP)



North-west basin of Caddo Lake in Ramsar watershed area.

Main basin of Caddo Lake.

Active oil head found in the North Arm of Caddo Lake.

Historical Marker for first oil well in Caddo La

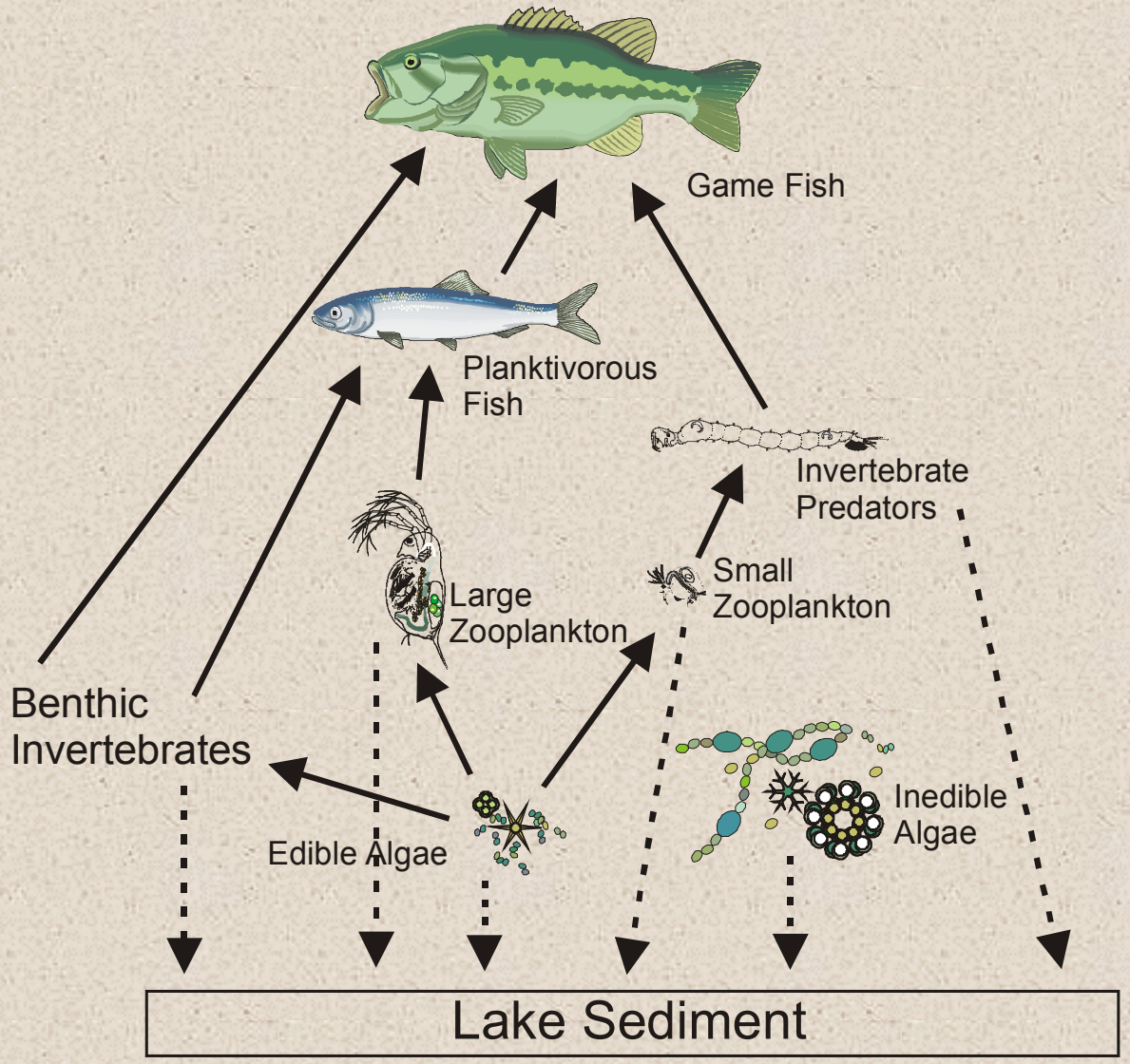
Some of the first wells in Caddo Lake.

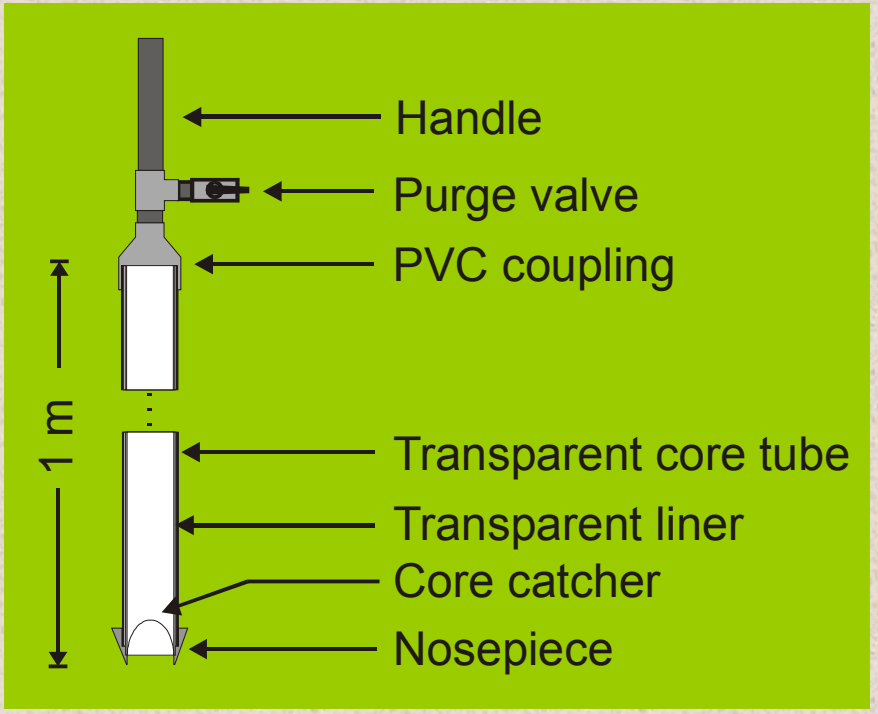
Extensive oil field in Caddo Lake.

The Problem

- Chronic effects of oil development in freshwater lakes are not well understood
- Chronic effects may be difficult to identify because many disturbed ecosystems face multiple stressors
- Usually there are available few long-term, pre- and post-perturbation data

Lake Food Web Reconstruction

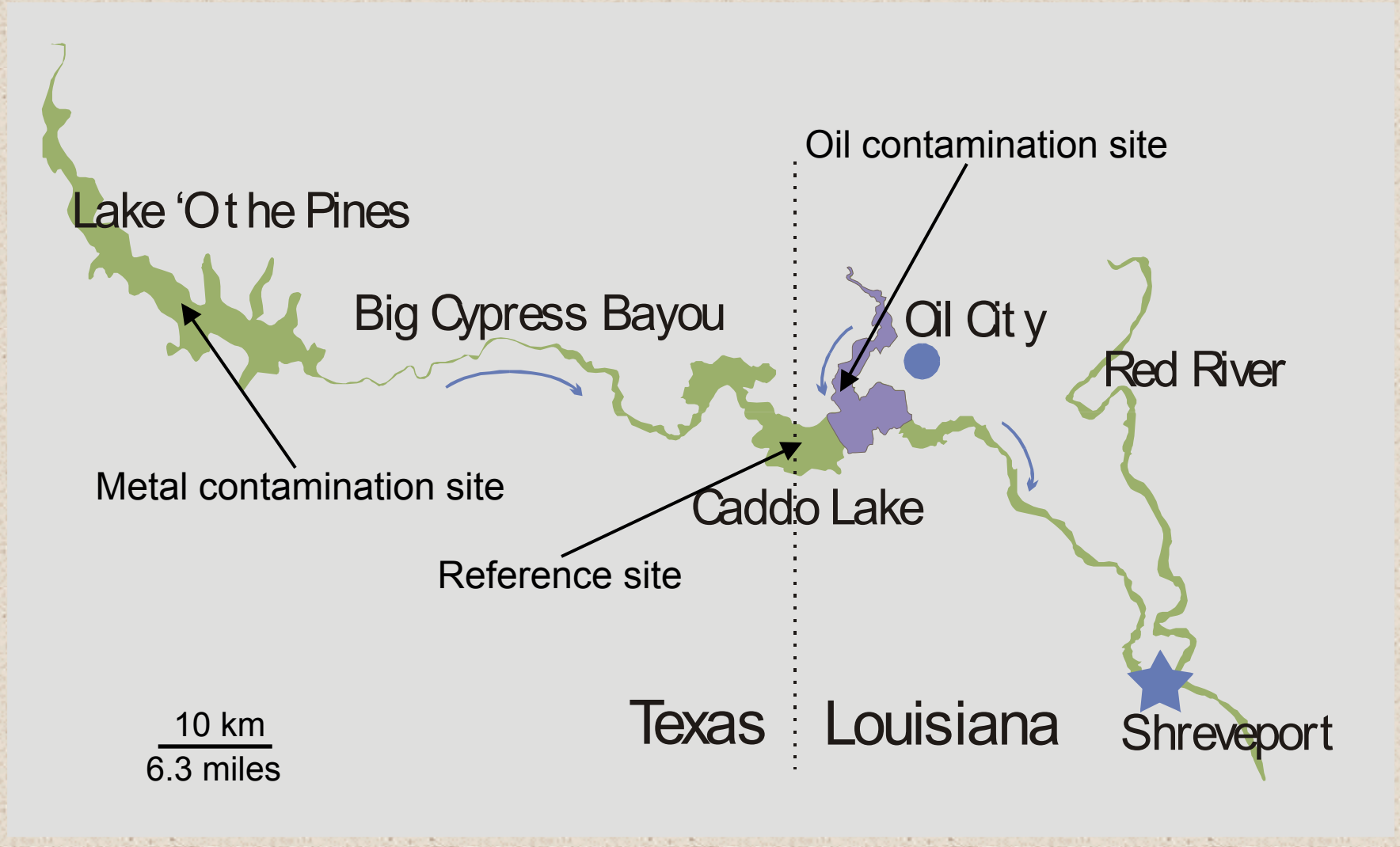




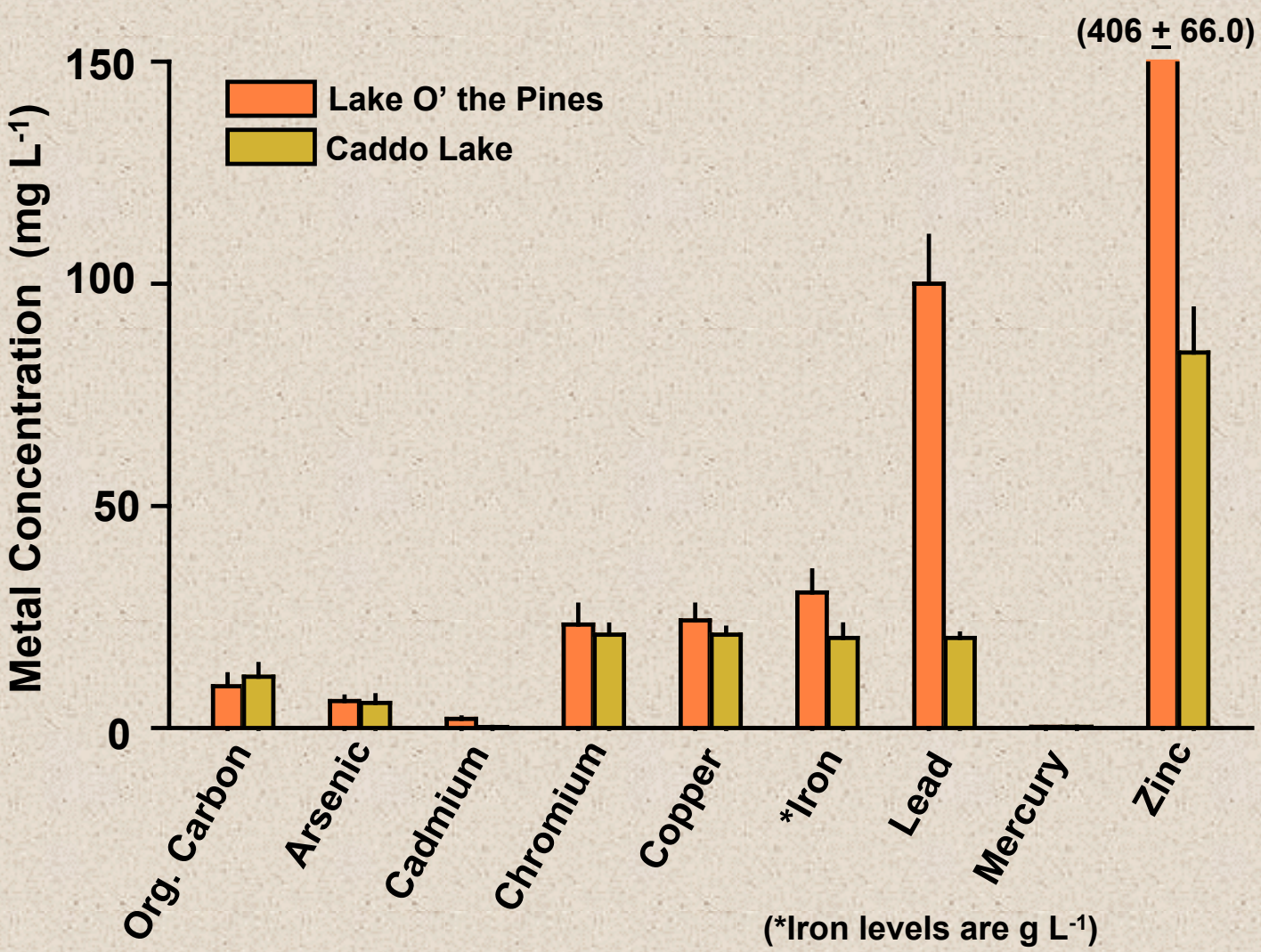
Core from Caddo Lake showing about 70 years of accumulation. (Army Corps of Engineers)

Applications Of Paleo-Limnology

- Impacts of agriculture,urbanization, and forestry
- Long-term estimates of fish production
- Effects of acid precipitation
- Determining frequency and intensity of droughts
- Studies of climate change
- Fish stock degradation due to overfishing
- Effects of different types of fish predation



Metal Contamination In LOP And Caddo Lake



Variables

Dating

- ^{210}Pb and ^{137}Cs using a gamma-ray counter

PAH's

- some residues of creosote are refractory
- detectable with HPLC

Metals

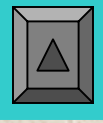
- metal contamination can be detected using AA

Foodweb

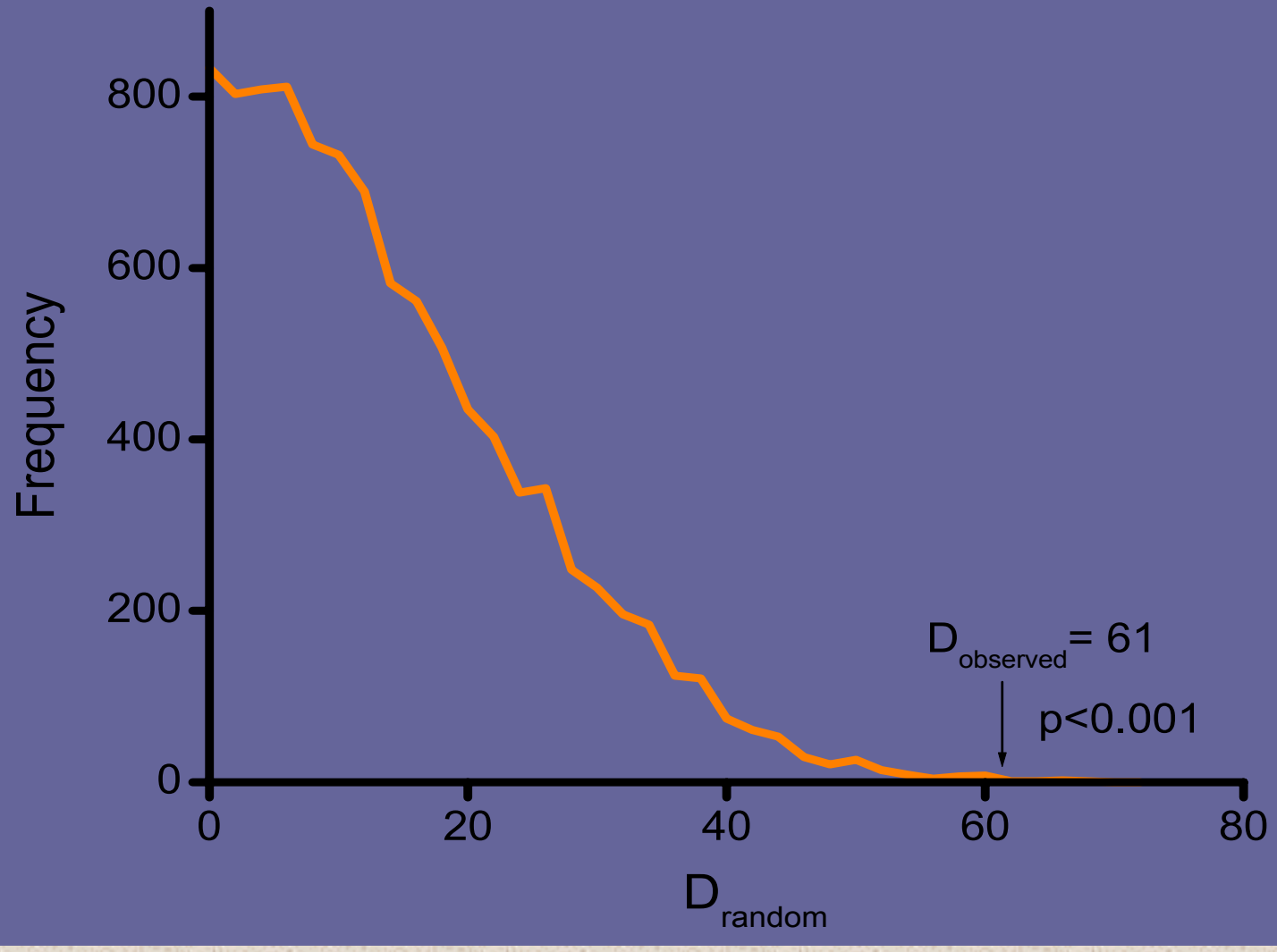
- various degradation products of phytoplankton phytopigments are detectable with HPLC
- lignins produced by rooted plants are also detectable with HPLC
- invertebrate hard-parts can be studied by light microscopy

A Solution

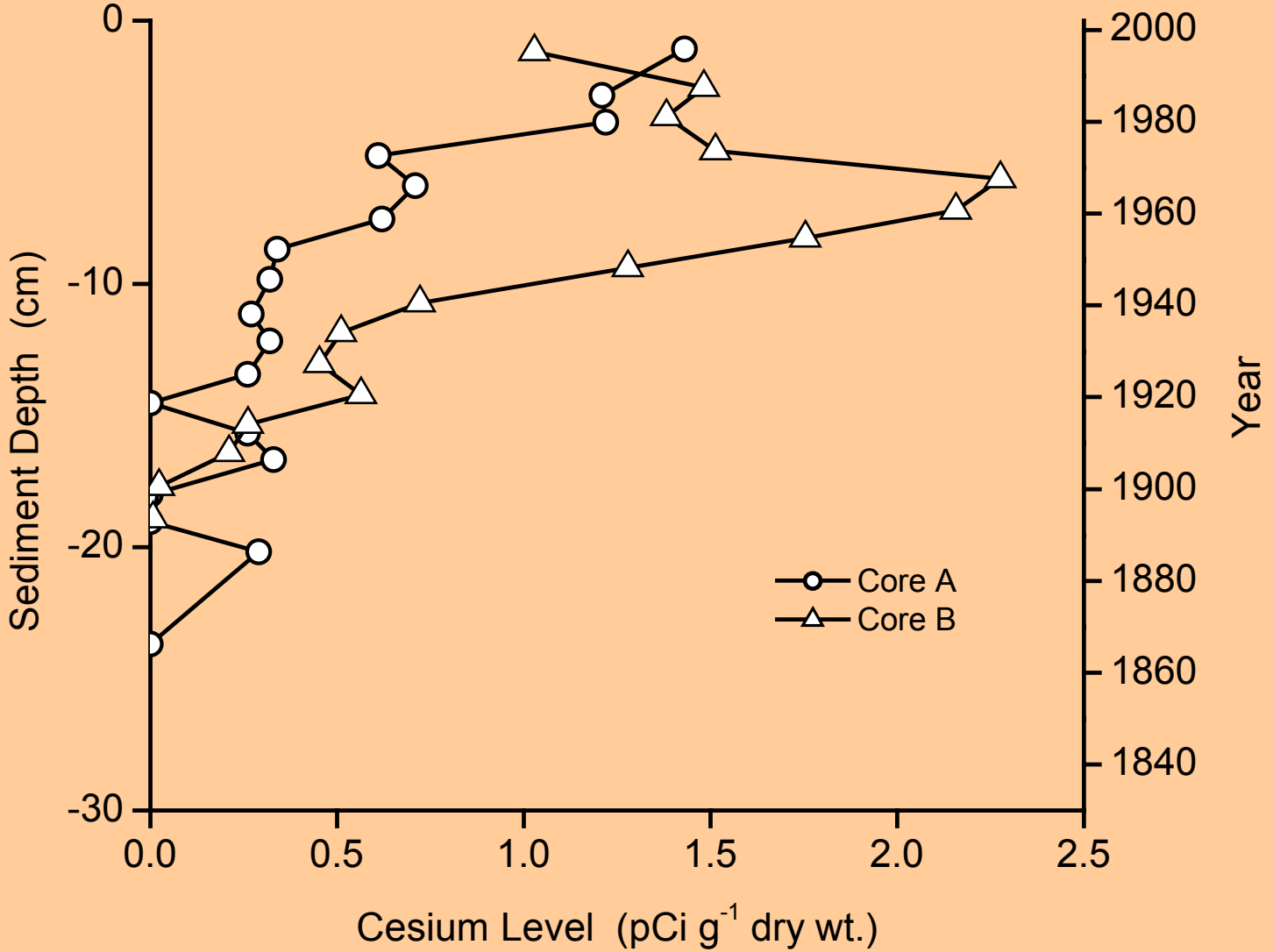
- Use sediment records to re-create long-term data.
- Compare sediment profiles before and after perturbation
- Compare sediment profiles in impacted and reference systems

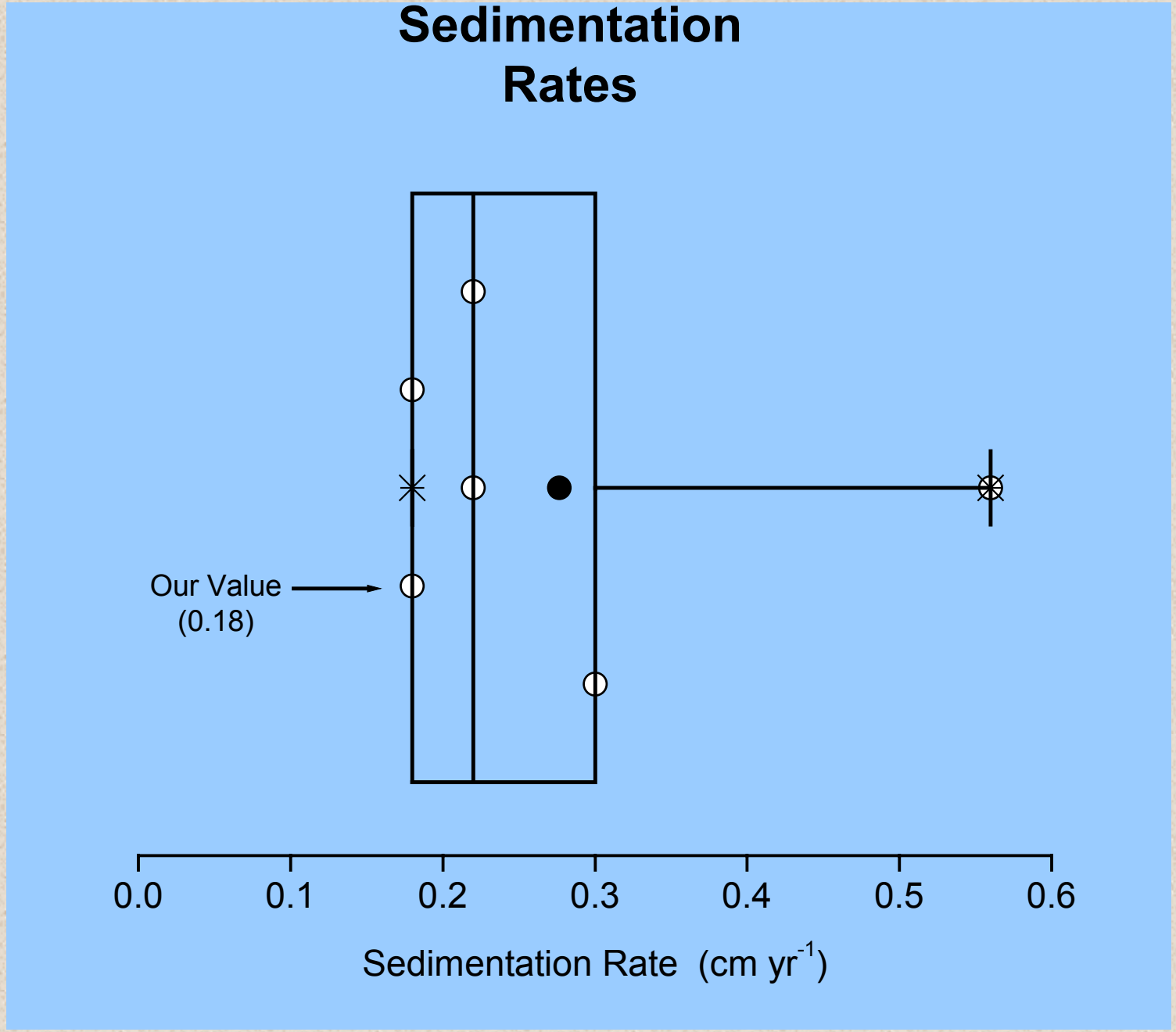


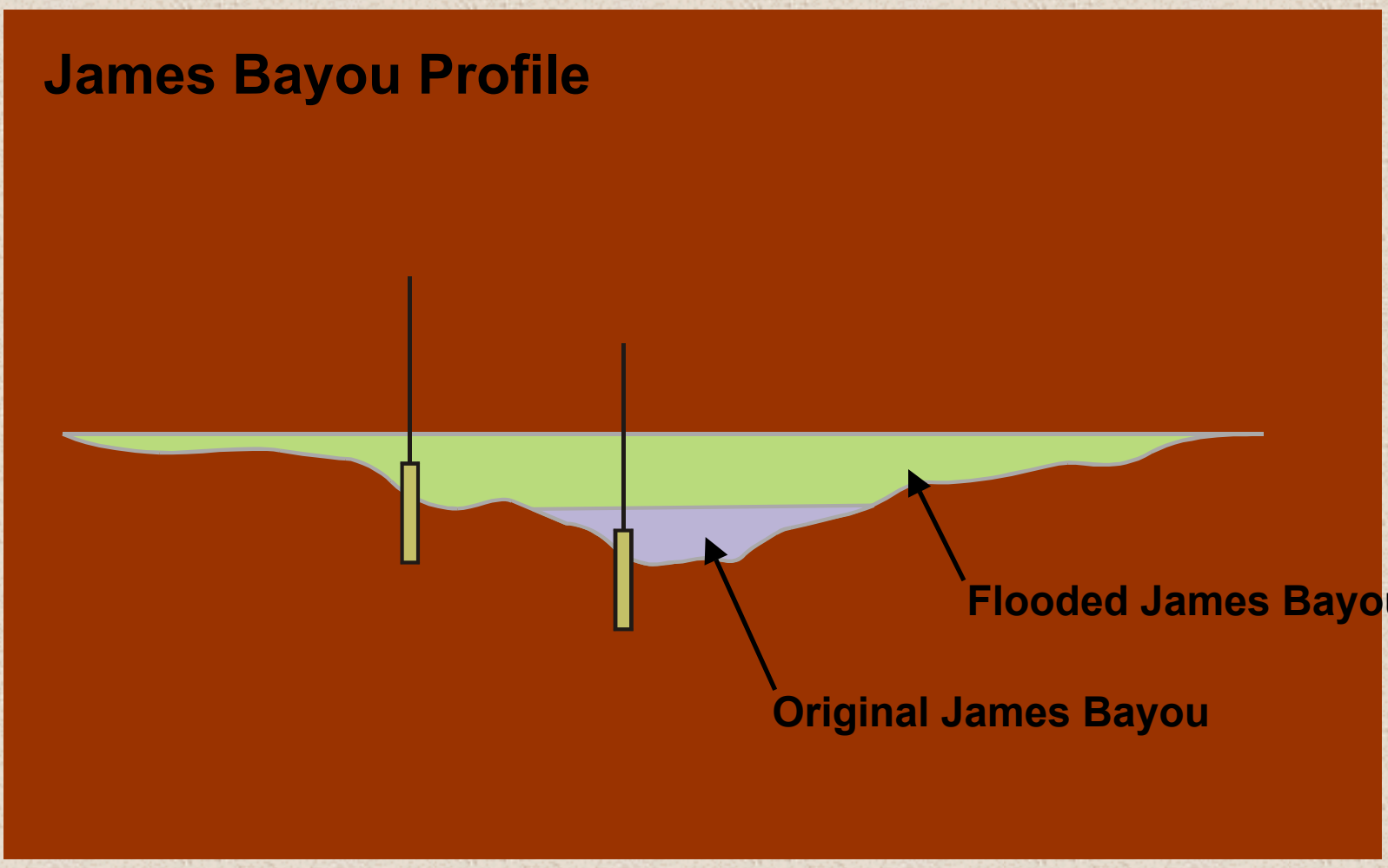
Statistical Analyses – Randomized Intervention Analysis



Cesium Dating Results







Summary

- Acute effects of oil development in Caddo Lake occurred (1920-19
- Chronic effects may continue today due to creosote
- Lake history can be re-constructed using paleo-limnology.

- Cores can be dated successfully.
- Sedimentation rates low and variable.

- Now underway: ^{210}Pb dating, phytopigments, invertebrate hard pa
- Bottom features will be revealed using geo-referenced, side-scan

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Lake History

Before 1850

- Caddo Lake exists as an ephemeral water body.
- The lake area was always at the least a wet marsh.
- A lake would form whenever a log-jam blocked the outflow river.

1850-1910

- Lake was formed by a large log jam.
- Army Corps of Engineers replaced the log jam in 1910 with an earthen dam.
- Dam served to raise the water level enough to float barges carrying drilling machinery.

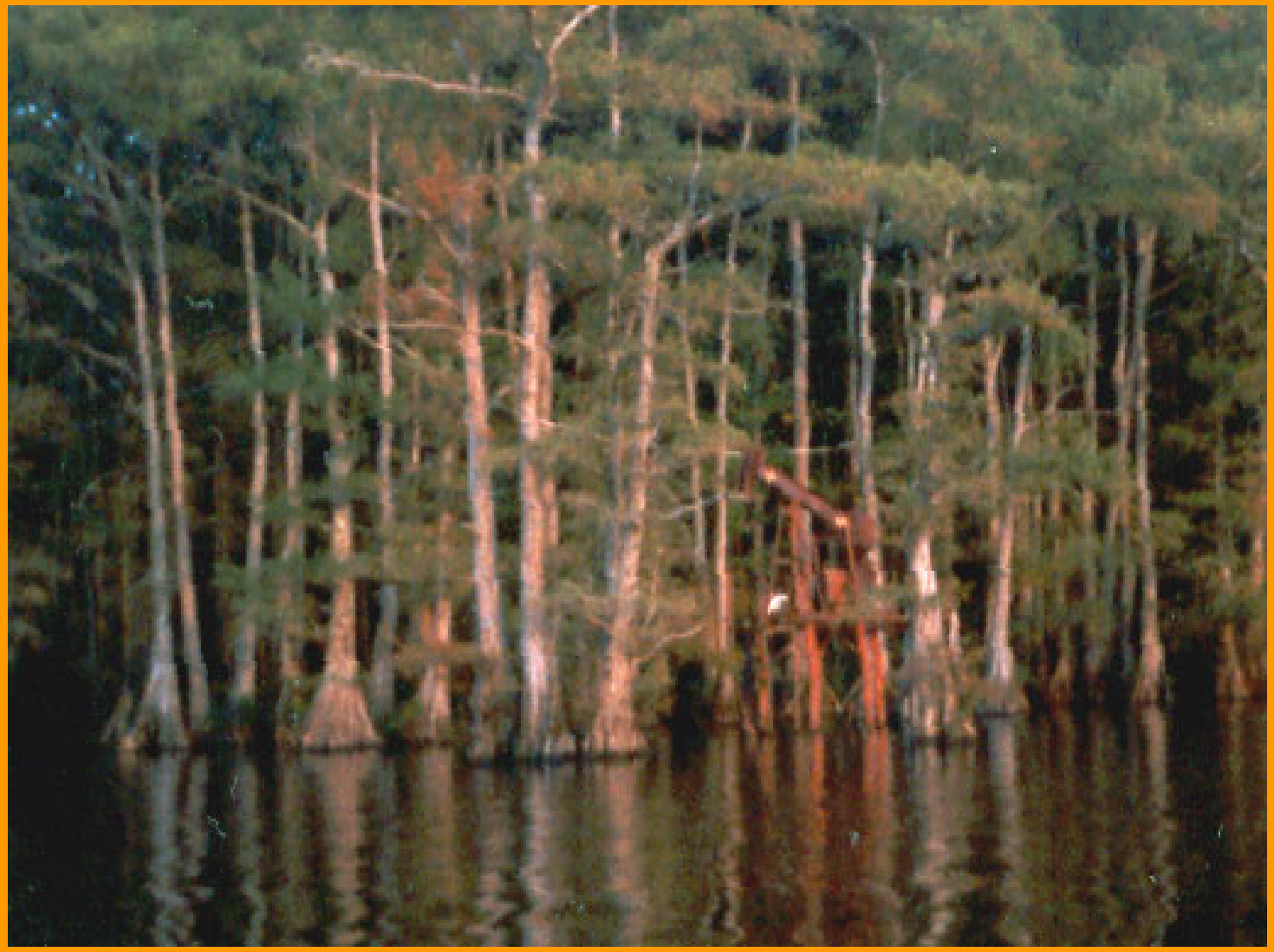
1920 – 1970's

- Hundreds of oil platforms installed in the lake, then decommissione
- Oil rigs constructed of creosote-soaked timbers.
- Decommissioned rigs were cut down and the timbers were left on the lake bottom.

Summary

- Caddo Lake is the first freshwater lake to have been subjected to oil development.
- Chronic effects of oil development may be caused by leaching of creosote from oil rig support timbers.
- Chronic effects are now only detectable by searching for clues in the lake's sediments.
- Cores from contaminated and reference sites will be dated. determinations of levels of phytopigments, metals, and invertebrate hard-parts will be performed.
- Differences in time-series between the two sites will be attributed to effects of oil development.
- A second comparison will be made between the creosote-contaminated site (Caddo Lake) and a metal-contaminate site (LOP)

Historical Marker for Caddo-Pine Island Oil Field.



A typical oil head located in the North Arm of Caddo Lak