

# Marl Prairie vegetation response to 20th century land use and its implications for management in the Everglades

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# Marl Prairie Ecosystem History

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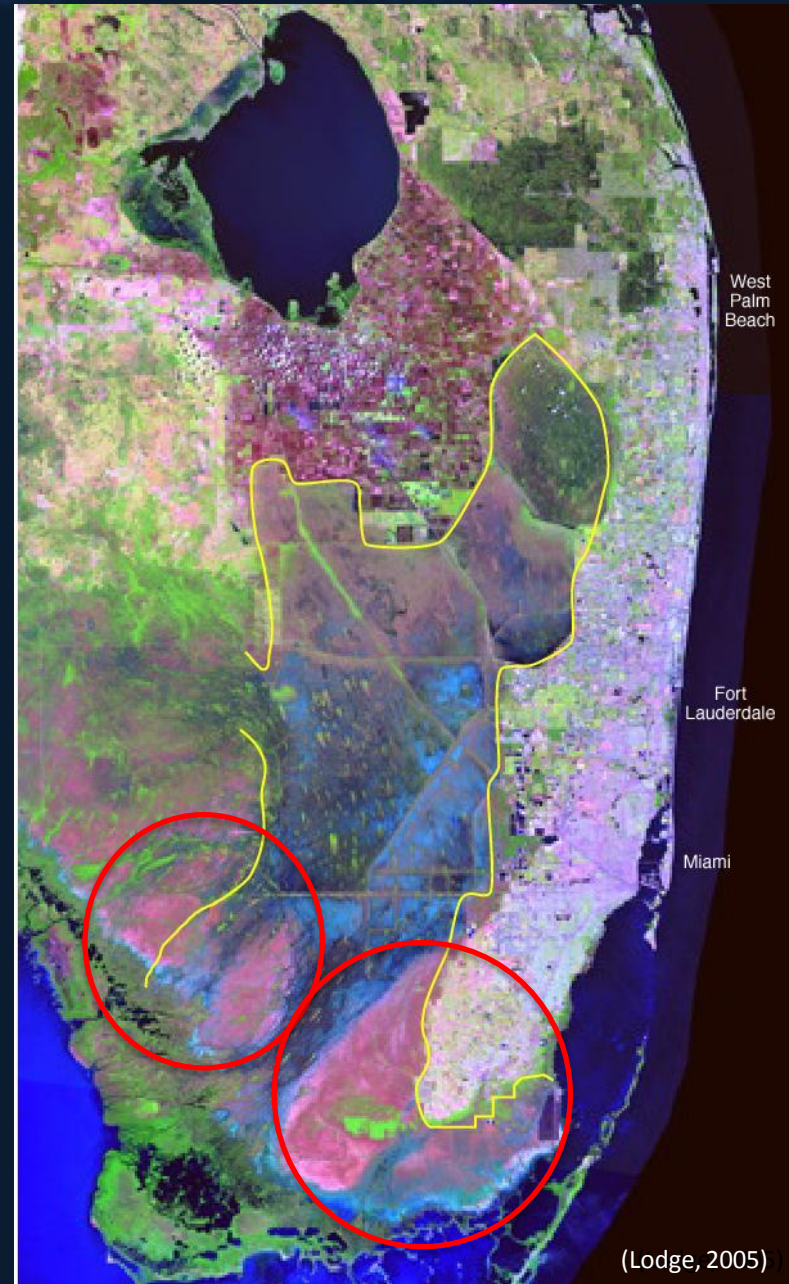
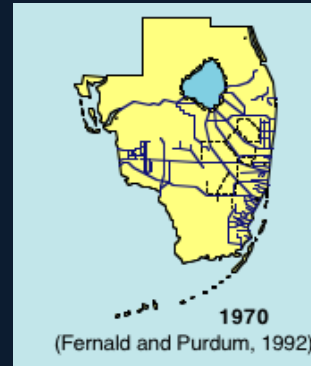
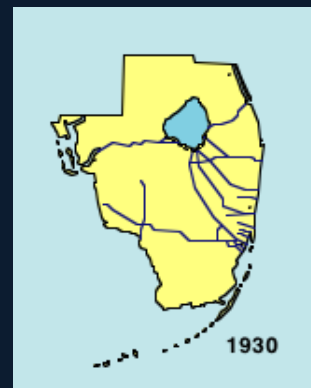
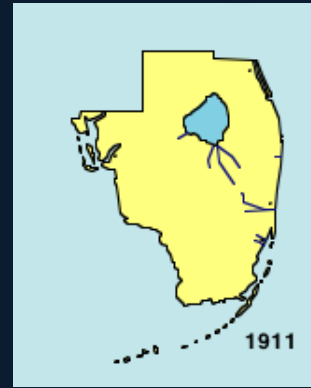
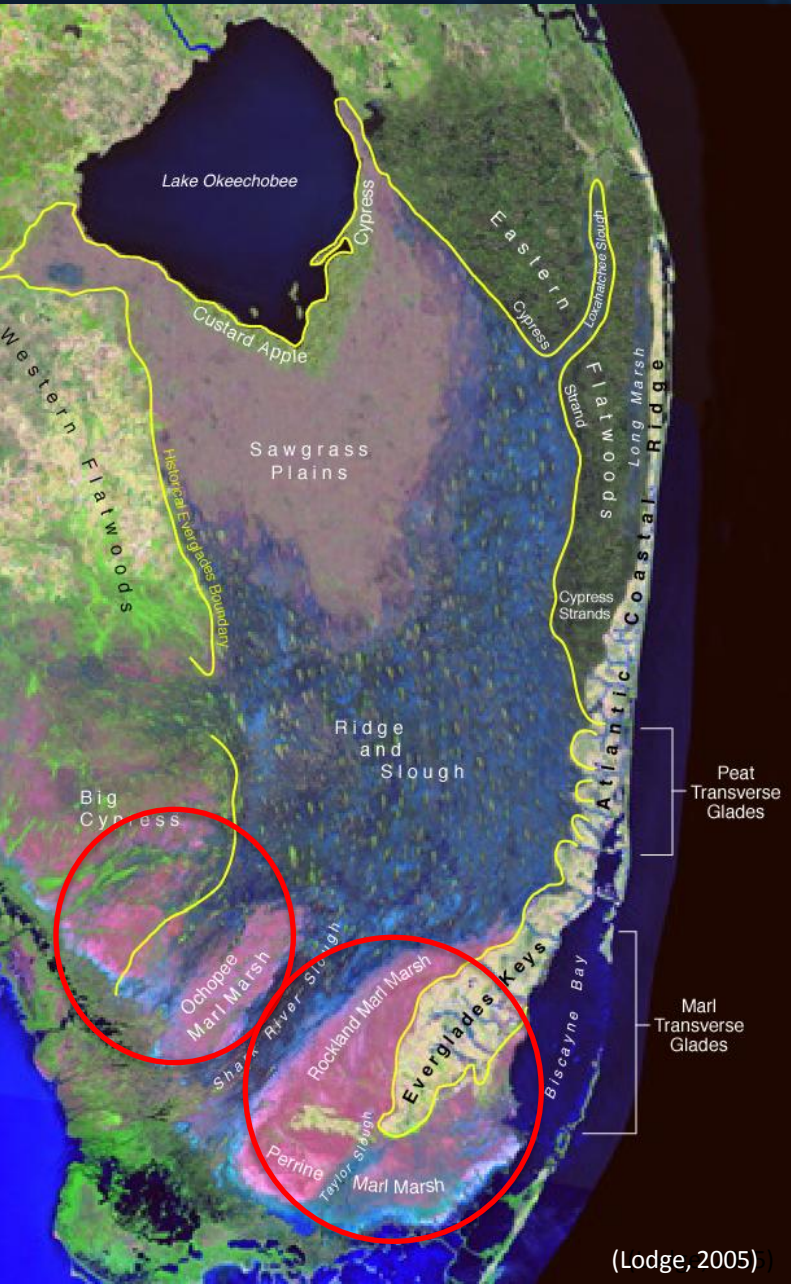
- Heterogeneous
  - Surface sediment
  - Down core sediment
  - Timing of marl accumulation
  - Past vegetation responses
- 20<sup>th</sup> century impact on vegetation
- Increase in fires with drying in 20<sup>th</sup> century?

# Controls on Vegetation Distribution in the Everglades

“Historic”/Pre-drainage

Water Management

Present



# What is a Marl Prairie?



Short hydroperiod (3-7 months)

Calcareous soil

High plant diversity (>100 species)

Dominated by grasses and sedges

~1,900km<sup>2</sup>/6,000km<sup>2</sup> of current Everglades



## Neighboring Communities

Wet Prairie

Fresh Water Marsh

Sawgrass Marsh

Big Cypress Slough

Cypress Strand

# The Cape Sable Seaside Sparrow (CSSS)

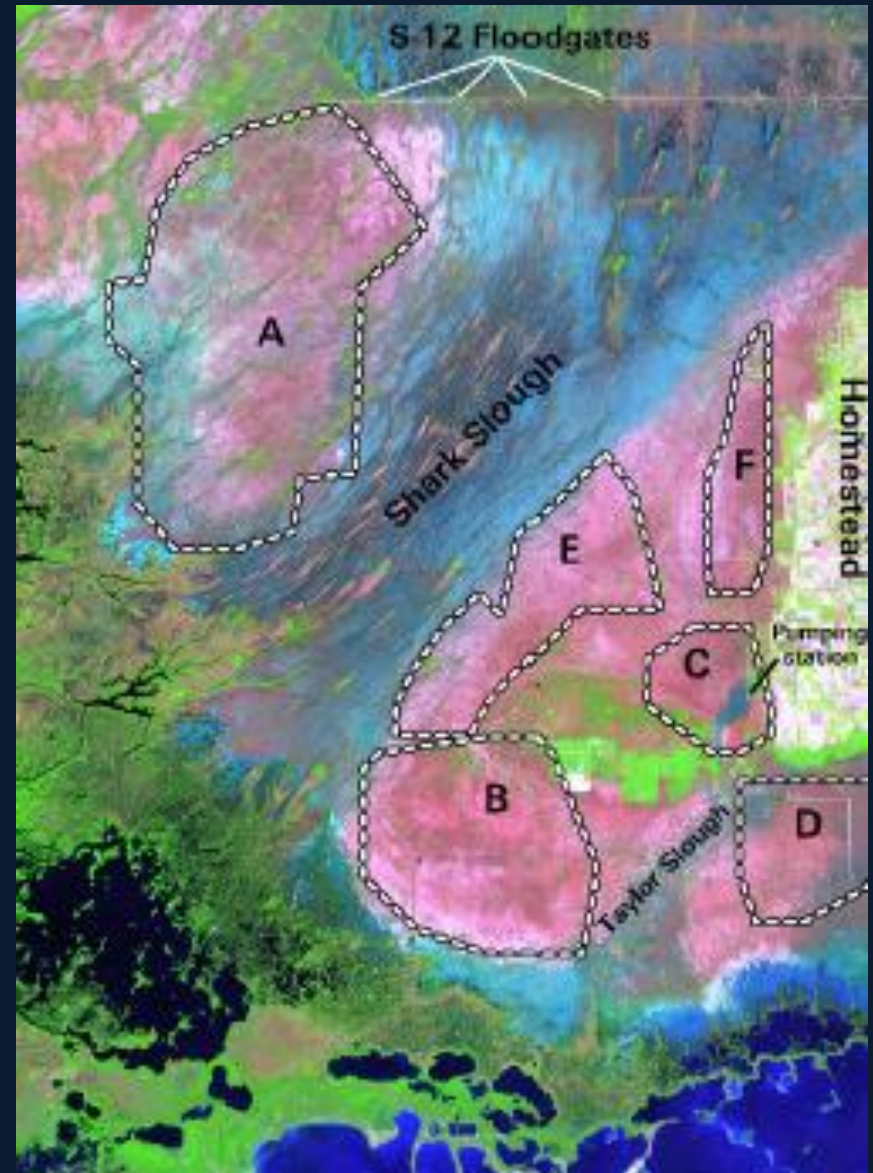
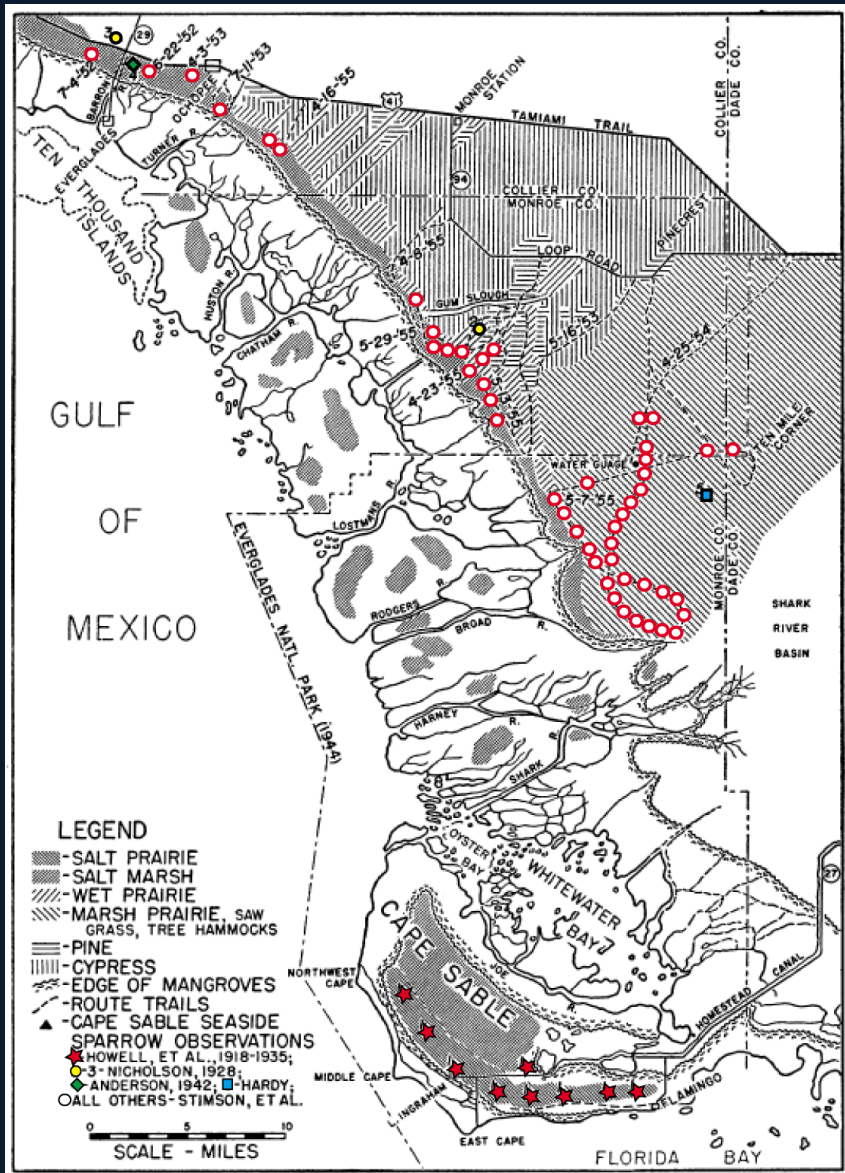
<http://www.nps.gov/ever/parknews/status-of-cape-sable-seaside-sparrow-2007-survey-report.htm>



CSSS listed as T&E in 1967 due to limited distribution and threats to its habitat by land-use changes

Nesting bird, occupies marl prairies with short hydroperiods and sparse vegetation

# Cape Sable Seaside Sparrow Distribution: Early vs. Late 20<sup>th</sup> Century



# Objectives

Recent research indicates that sustained changes in hydroperiod played significant roles in structuring tree islands and the ridge and slough landscape.

These changes resulted both from natural climate fluctuations and anthropogenic alteration of Everglades hydrology.

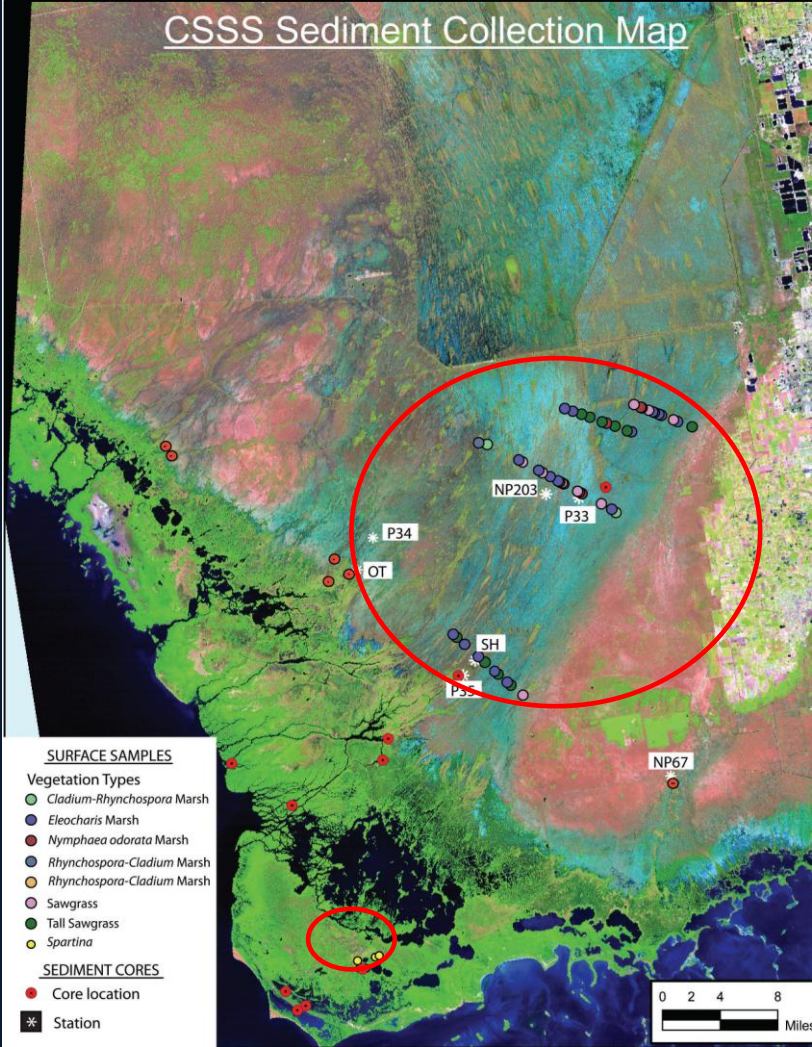
Examine the long-term history of marl prairie habitats of the Everglades which provide critical refuges for rare and endemic species, including the endangered Cape Sable Seaside Sparrow (CSSS).

This research is intended to document the longevity and stability of the marl prairie habitat using paleoecological proxies for vegetation and hydrology.

Strategies to stabilize and maintain habitats are an important component of Everglades restoration planning.

# Methodology

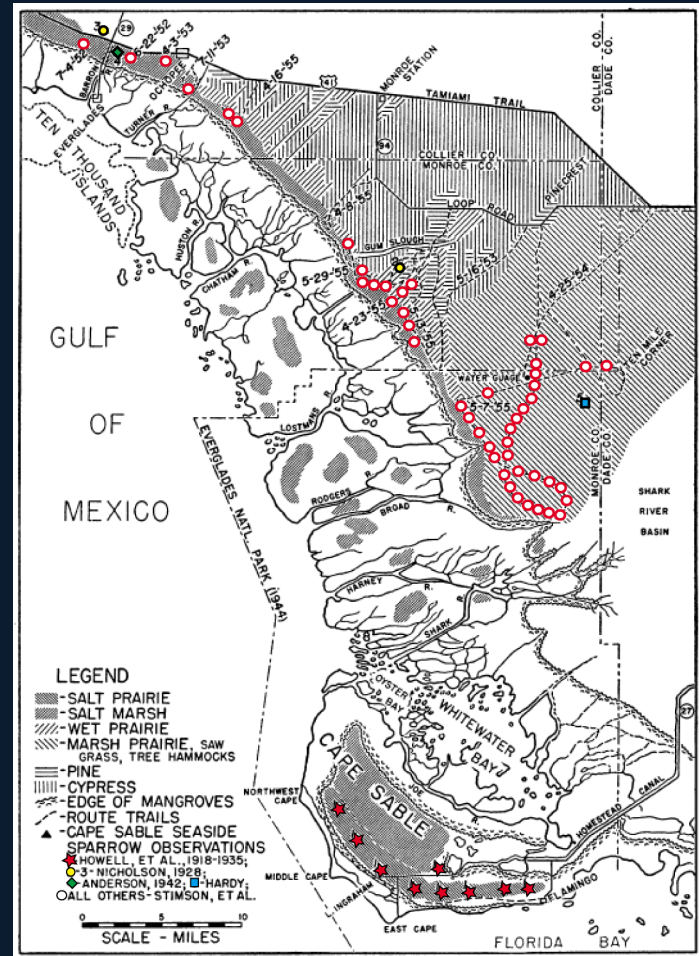
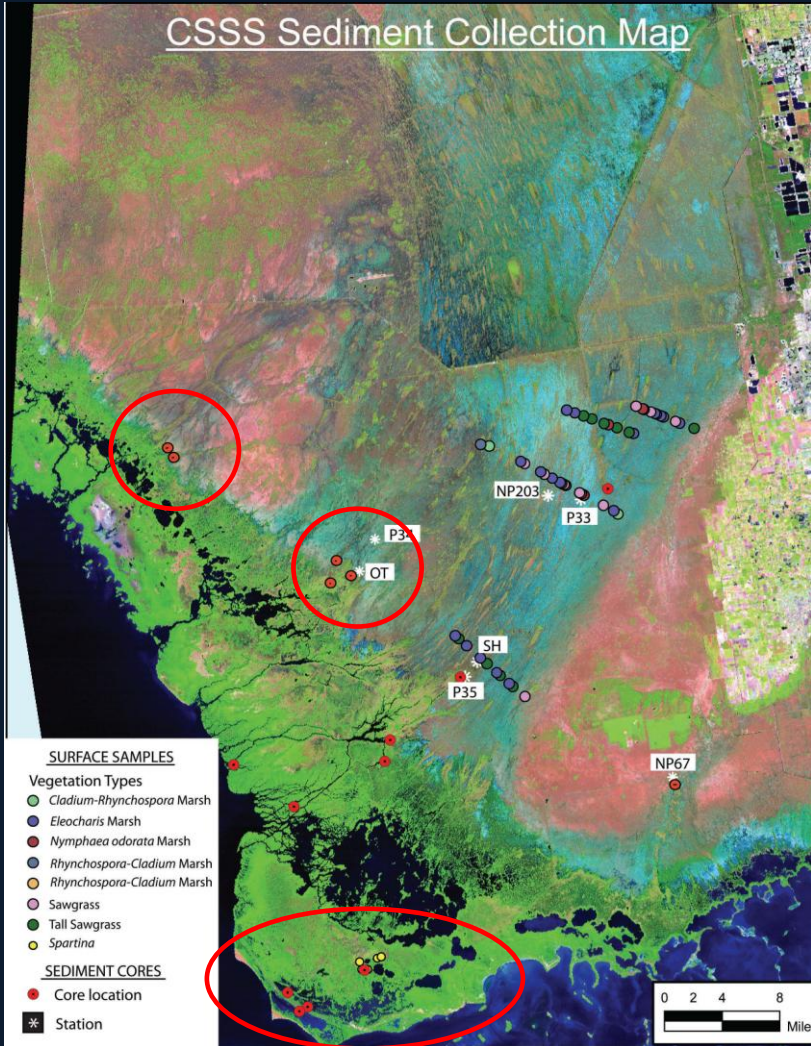
Collection of surface samples for calibration dataset





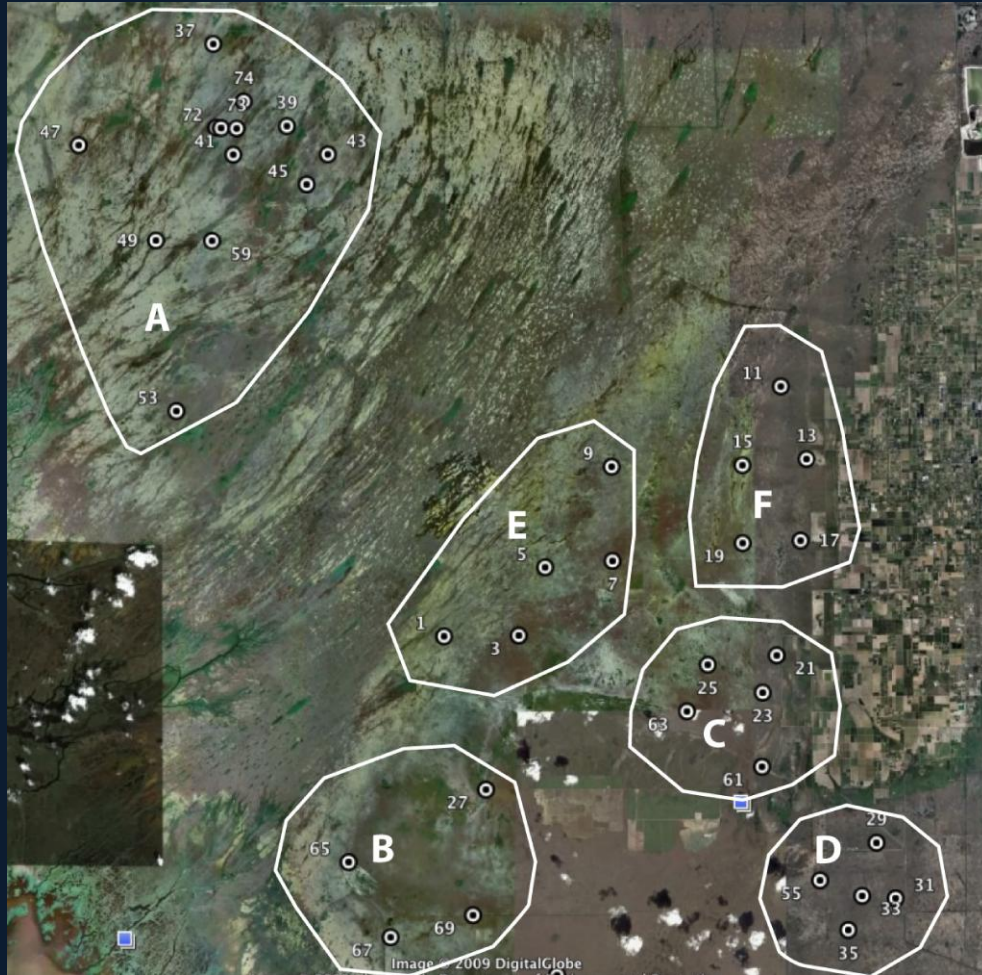
# Methodology

Collection of cores in historic CSSS habitat



# Methodology

Current CSS habitat



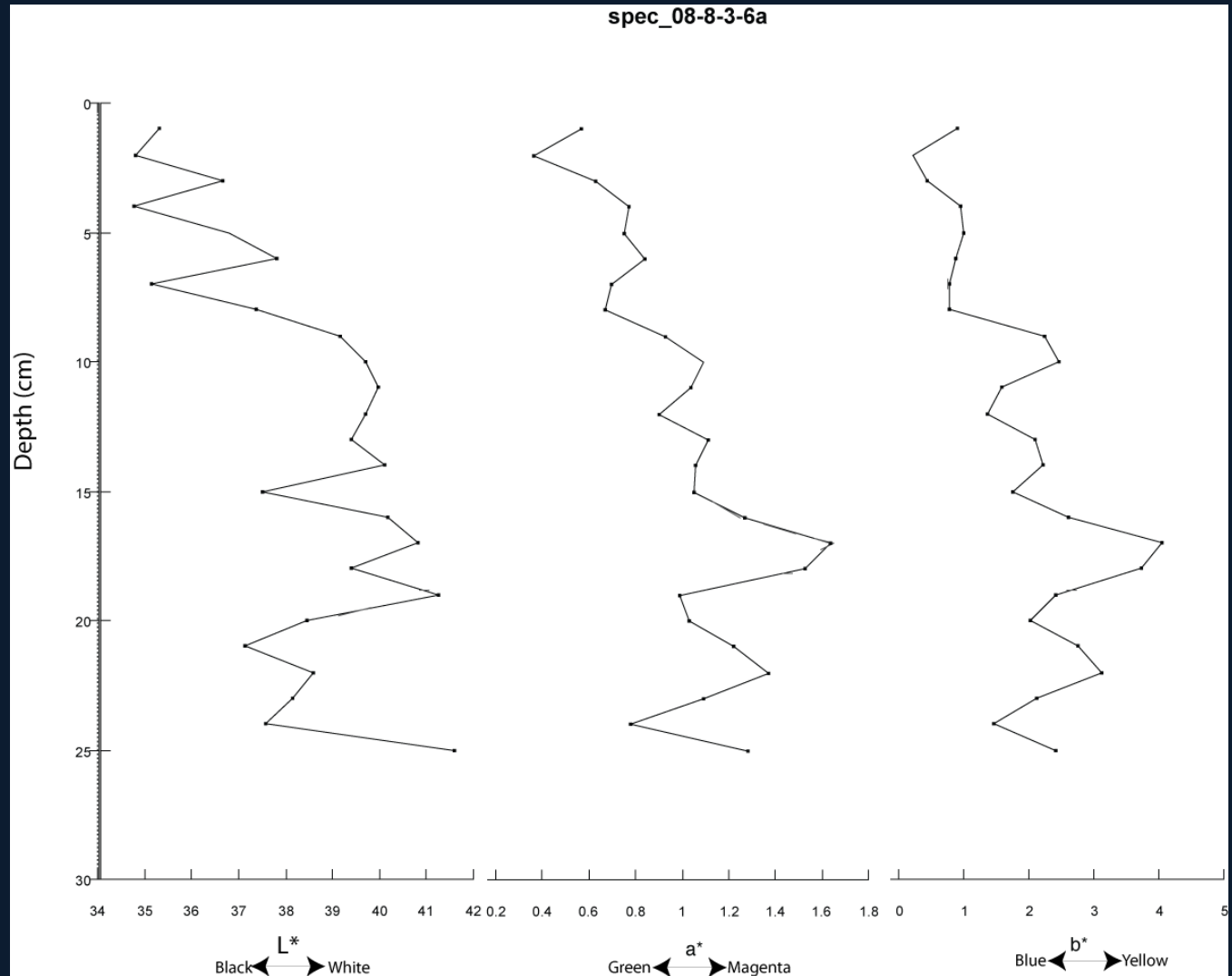
# Methodology

## Collection of sediment cores



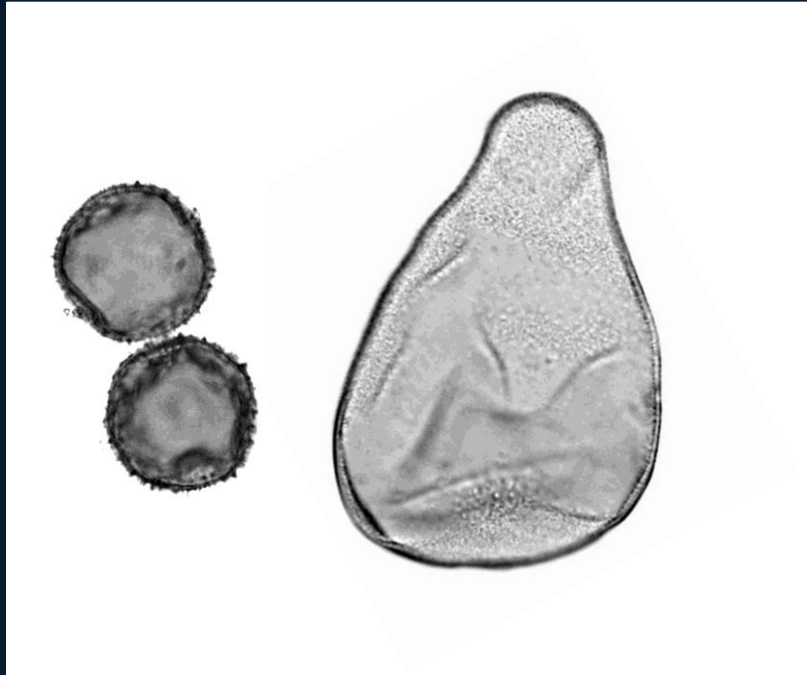
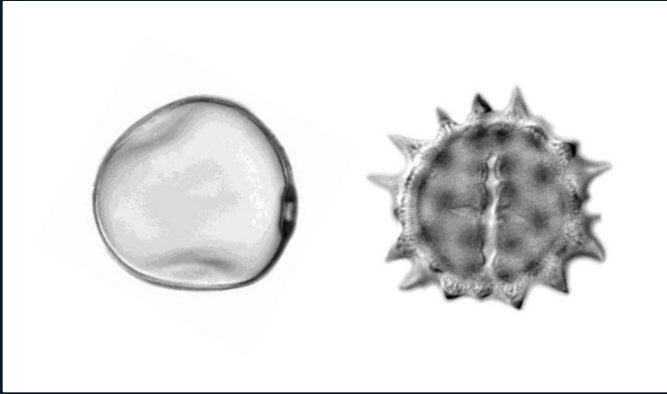
# Methodology

- Core/sediment description (sediment type, color)
- Carbon-14 dating and Lead-210 dating



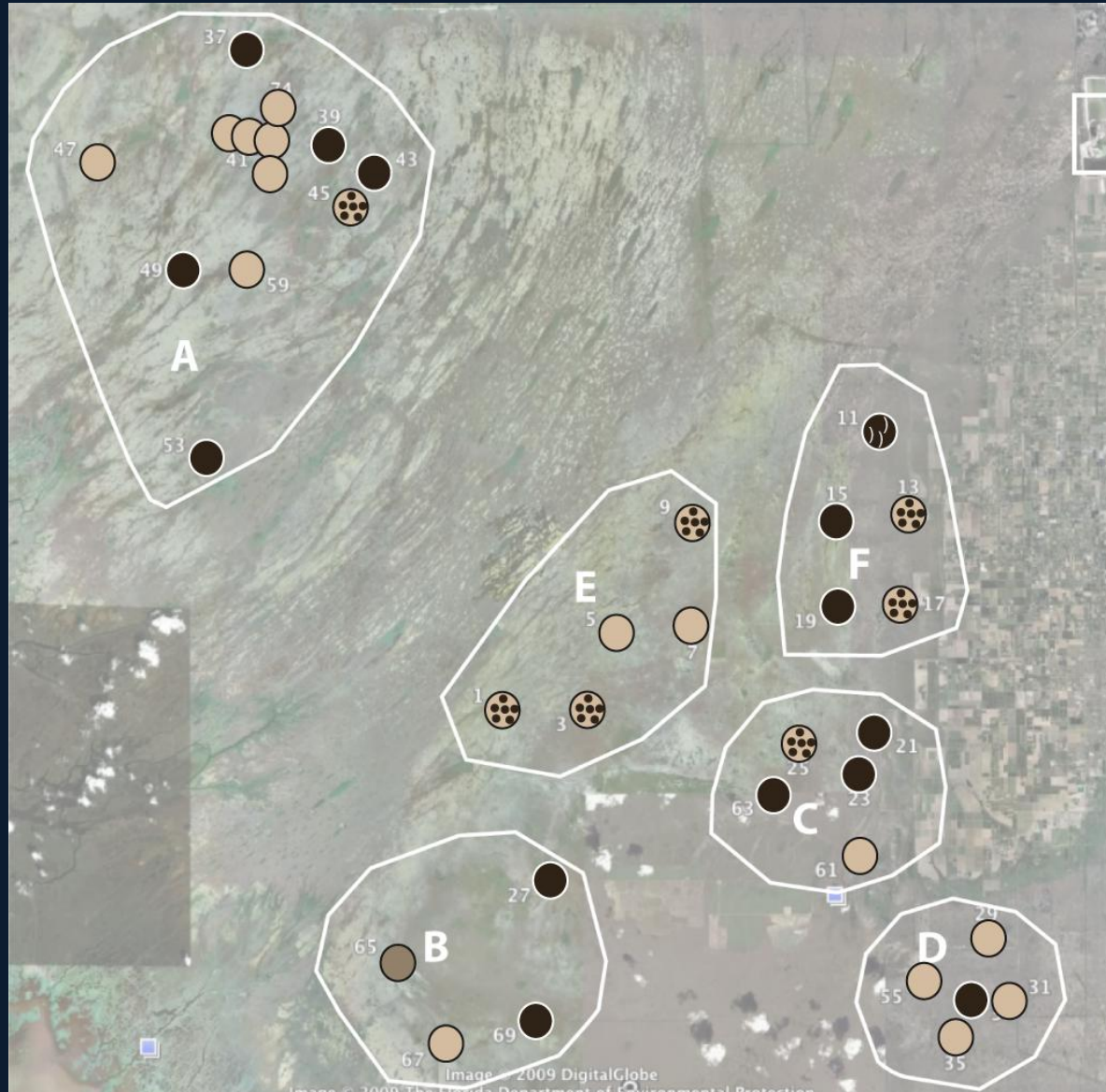
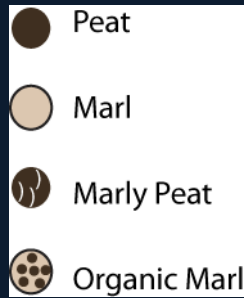
# Methodology

Analysis of downcore pollen assemblages and calibration with modern analogs



# Variability of Surface Sediments within Modern CSSS Subpopulations

Surface sediment type varies considerably within CSSS subpopulations



# Variability of downcore sediment profiles within Modern CSSS Subpopulations



marl over peat



all marl

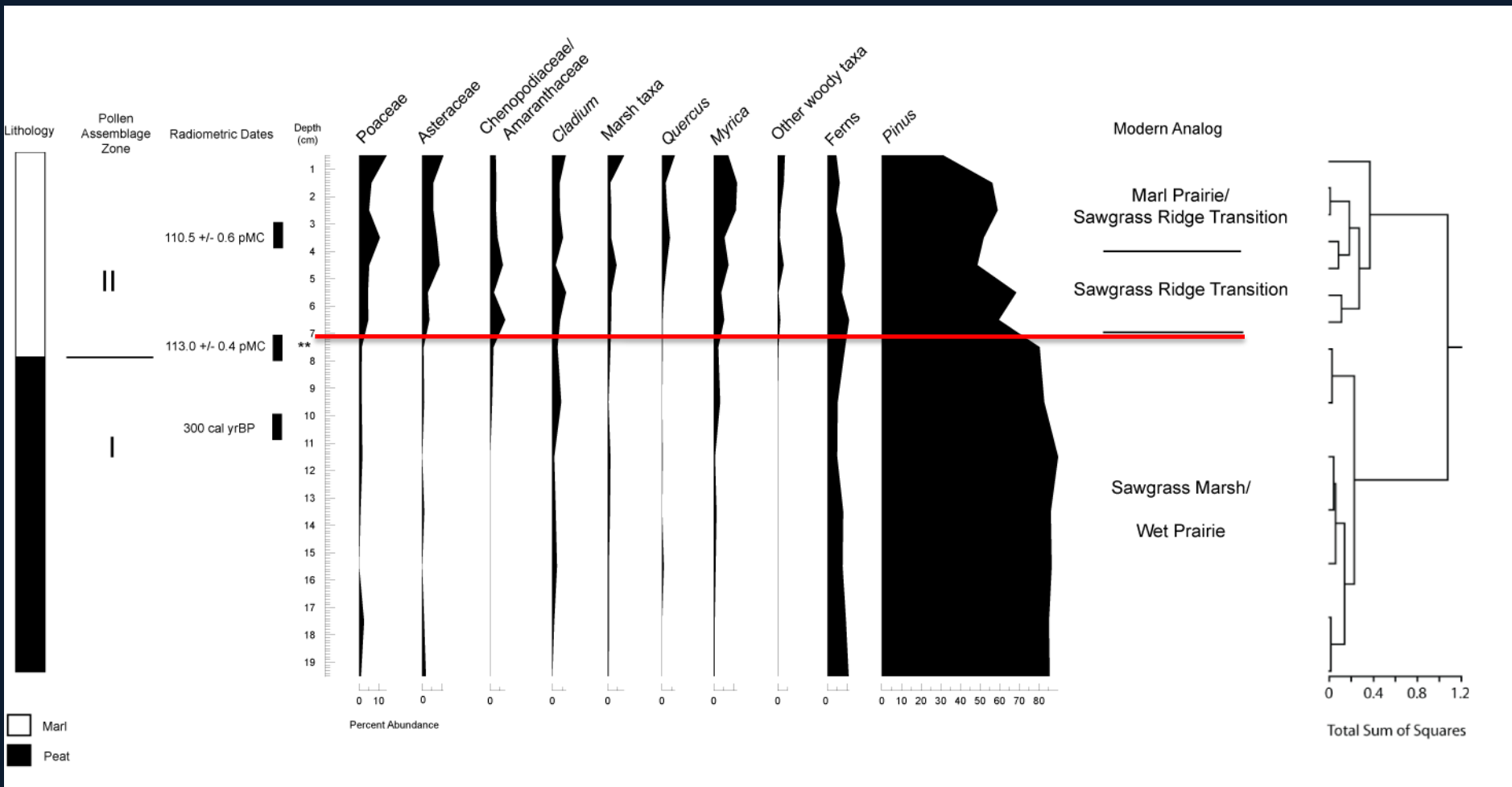


peat over marl



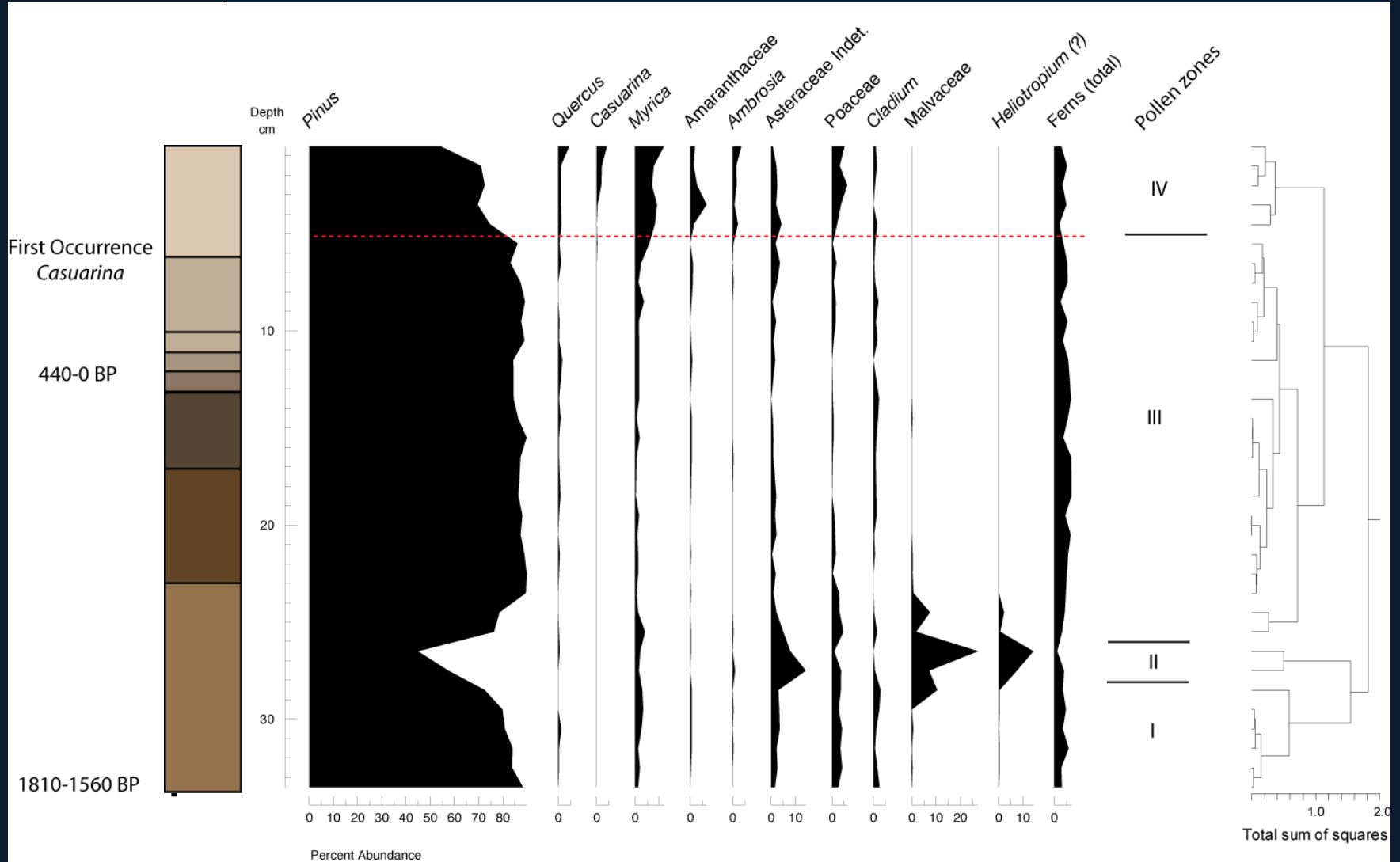
organic rich marl

# Percent Abundance of Pollen of Major Plant Taxa, Core 03-9-16-6, CSSS Population A, Big Cypress National Preserve



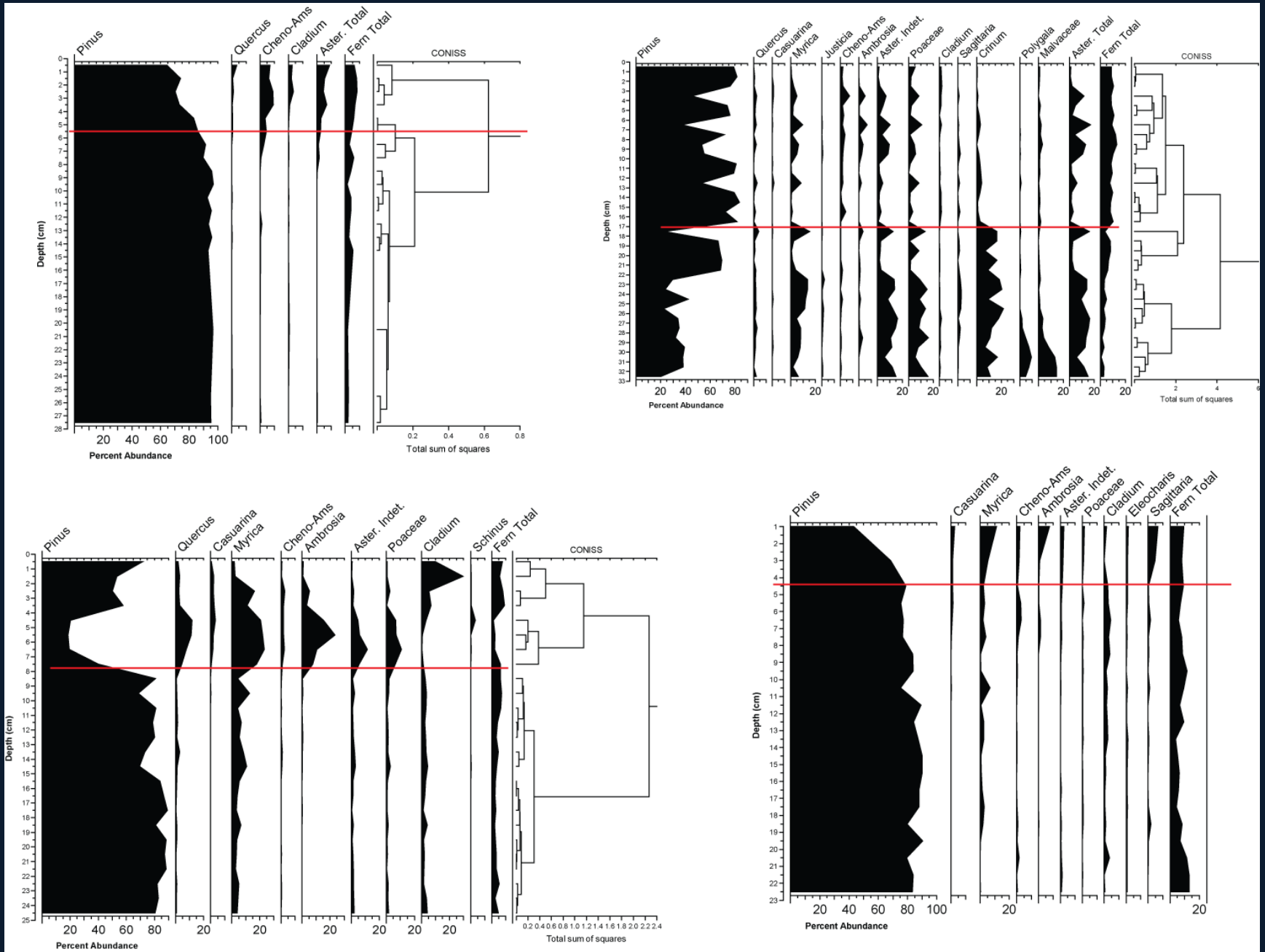


# Percent Abundance of Pollen of Major Plant Taxa, Core 08-5-19-8, CSSS Population B, Everglades National Park



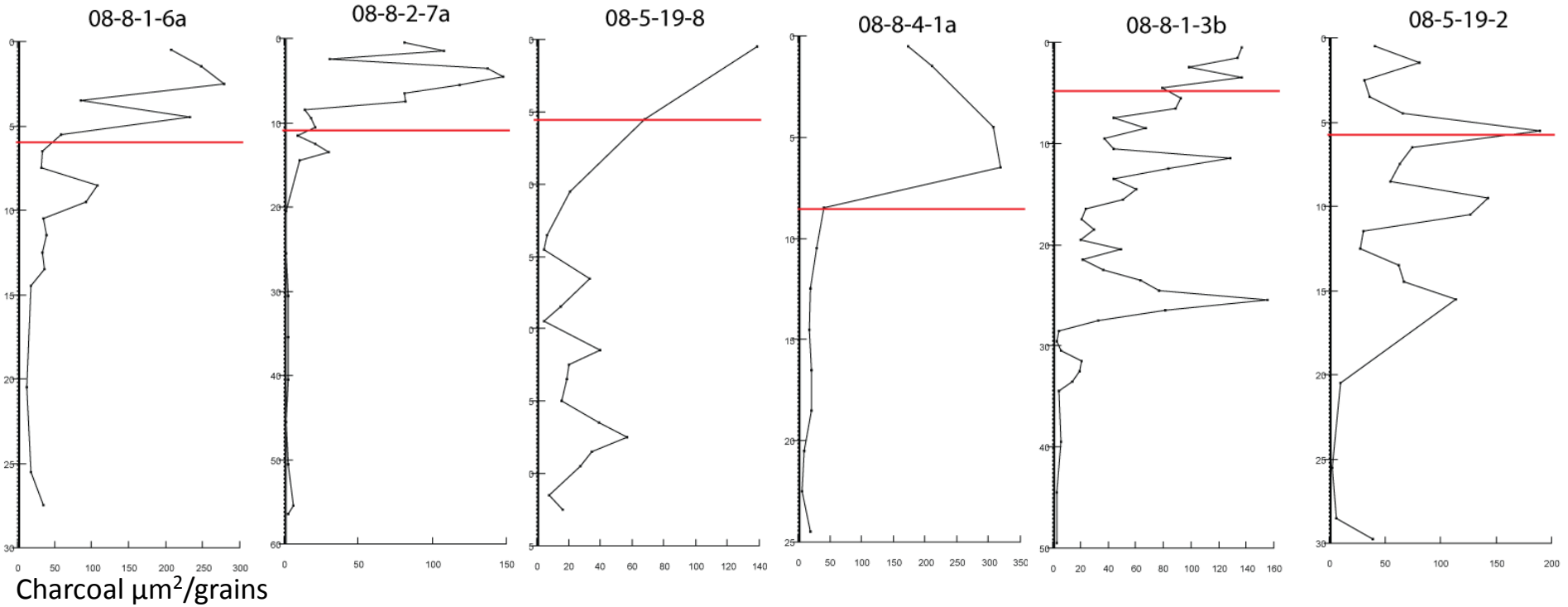


# Many cores... the same pattern



# Marl Prairie Fire History

## Microscopic charcoal results



Population F

Population D

Population B

Population D

Population E

Population C

# Conclusions

Surface sediments vary between and within modern CSSS populations

Timing of marl accumulation varies

- Some sites it was initiated during the 20<sup>th</sup> century and corresponds to shifts to modern pollen assemblages.

- Other sites marl was initiated well before onset of water management practices, ranging from 300 to nearly 3000 cal yrBP.

Down core sediment types heterogeneous (marl, marl over peat, peat, peat over marl)

20<sup>th</sup> century water management had an effect on all pollen assemblages examined

- Toward modern conditions

At some sites, significant changes in pollen assemblages occurred during the last few millennia – probably tied to climate fluctuations

Microscopic charcoal increases after the 20<sup>th</sup> century, however some sites record similar increases in the past

# Climate Change and Management Considerations

The marl prairie landscape is not homogeneous

-different sediment types and marl accumulation timing

Varying hydrologic conditions at varying times through the late Holocene and 20<sup>th</sup> century initiated marl accumulation

This study demonstrates that plant communities within the current marl prairie habitat have fluctuated during the last few millennia in response to both natural hydrologic variability and anthropogenic modification of the ecosystem

-but modern landscape est. in 20<sup>th</sup> century?

However, 20<sup>th</sup> century water management may have had the greatest impacts

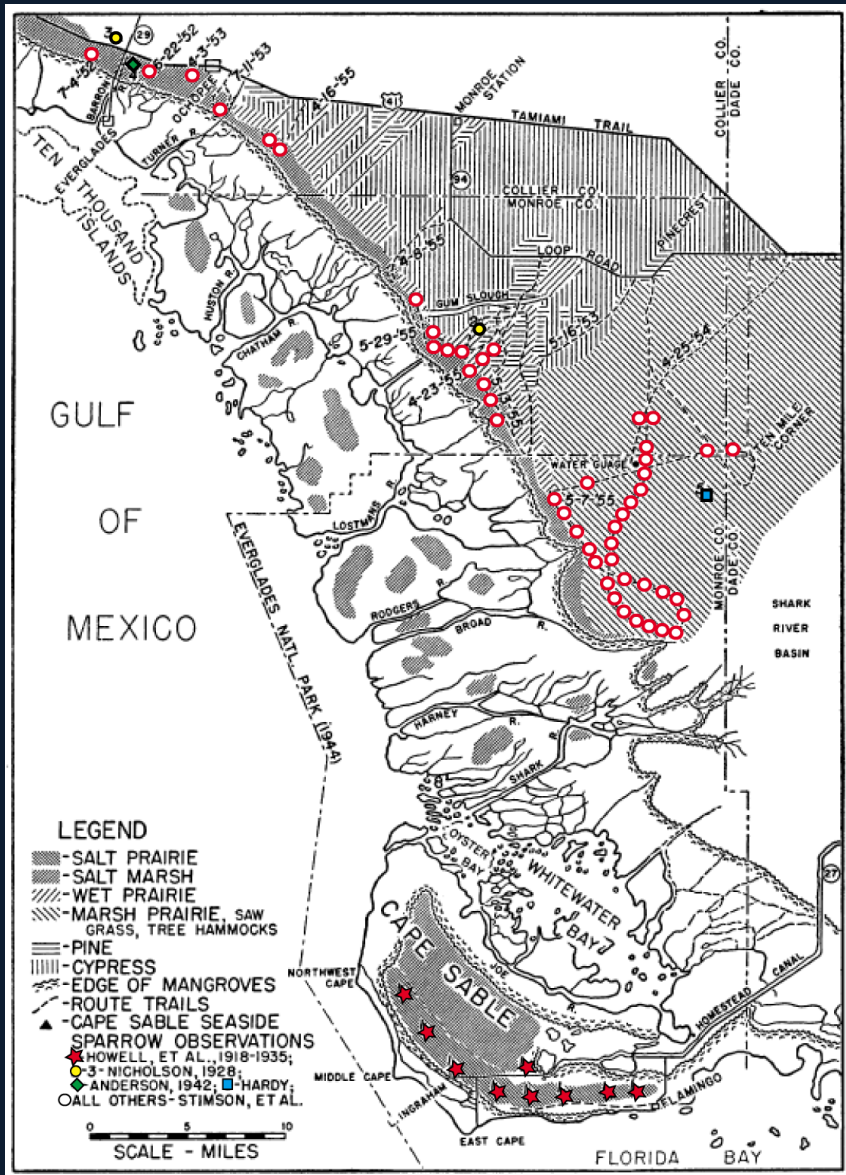
-must keep this in mind when managing current system

- Characterize spatial variability of surface sediments within each CSSS subpopulation
- Characterize temporal variability of sediment types at multiple sites within CSSS subpopulations
- Document temporal and spatial variability in vegetation and hydrology throughout current CSSS habitats using pollen and seed assemblages and stable isotopes
- Characterize temporal/spatial variability of sediment, vegetation, and hydrology in historic CSSS subpopulations
- Identify timing of vegetation and substrate changes during last few decades to millennia throughout CSSS habitat





# Historic Cape Sable Seaside Sparrow Distribution: 1918-1956



1918-1935: *Spartina* marshes on Cape Sable

1928-1942: *Spartina* marshes inland of mangroves

Post-1940: marshes inland of mangroves and initial expansion into Big Cypress