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Trends and Causes of Historical Wetland Loss, Sabine National Wildlife Refuge, Southwest Louisiana

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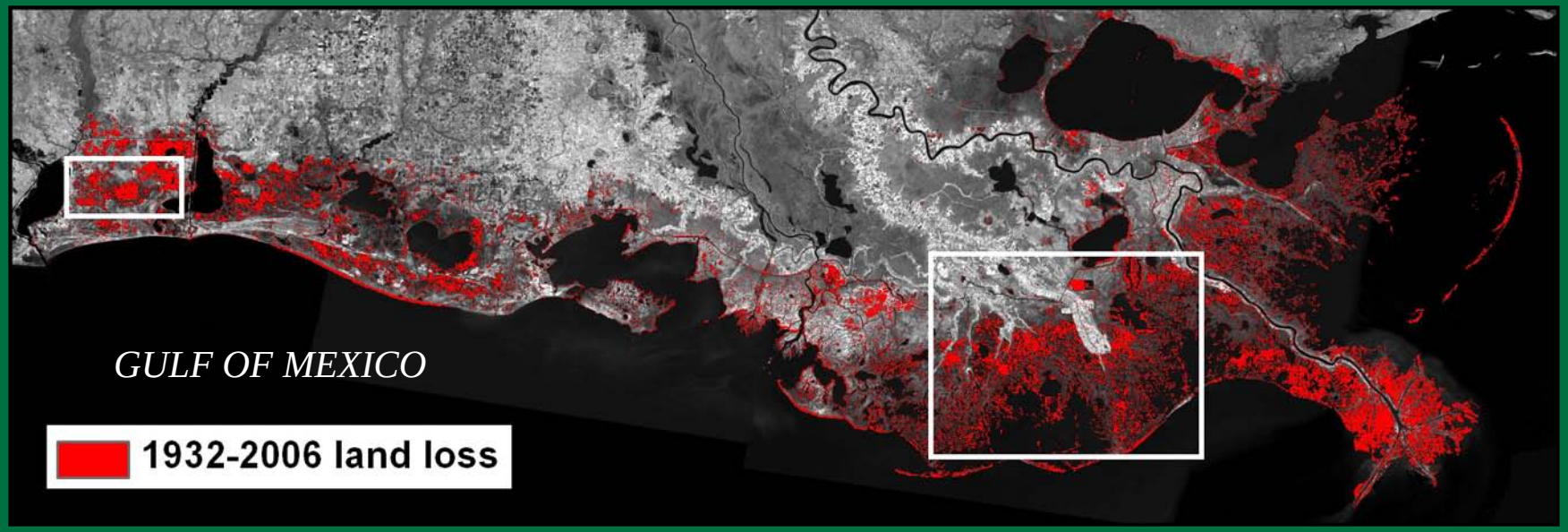
U.S. Department of the Interior
U.S. Geological Survey

Introduction – Louisiana Wetland Loss

- Coastal wetlands: > 5000 km^2 land loss since 1930s



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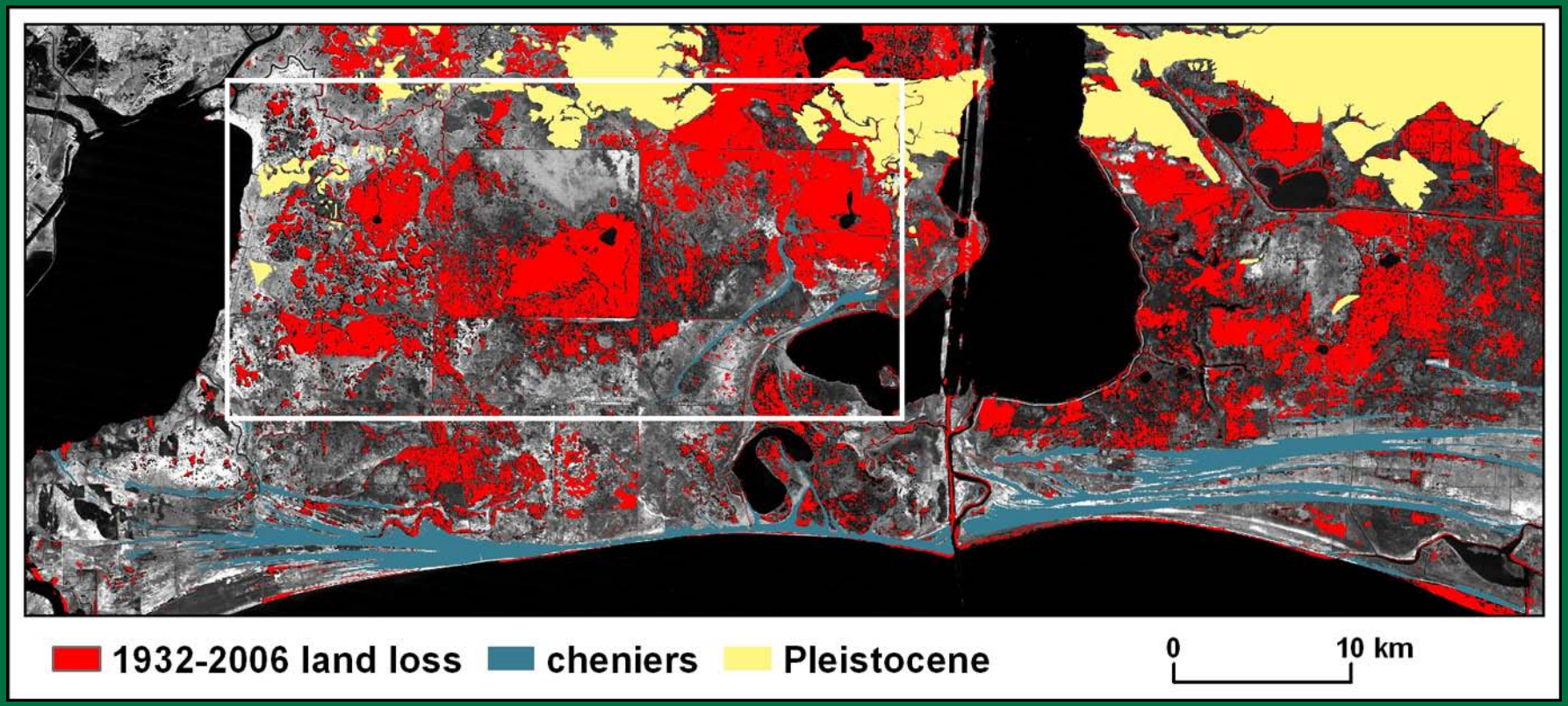
Sabine National Wildlife Refuge

- Different geologic setting and depositional style in western chenier plain than delta plain



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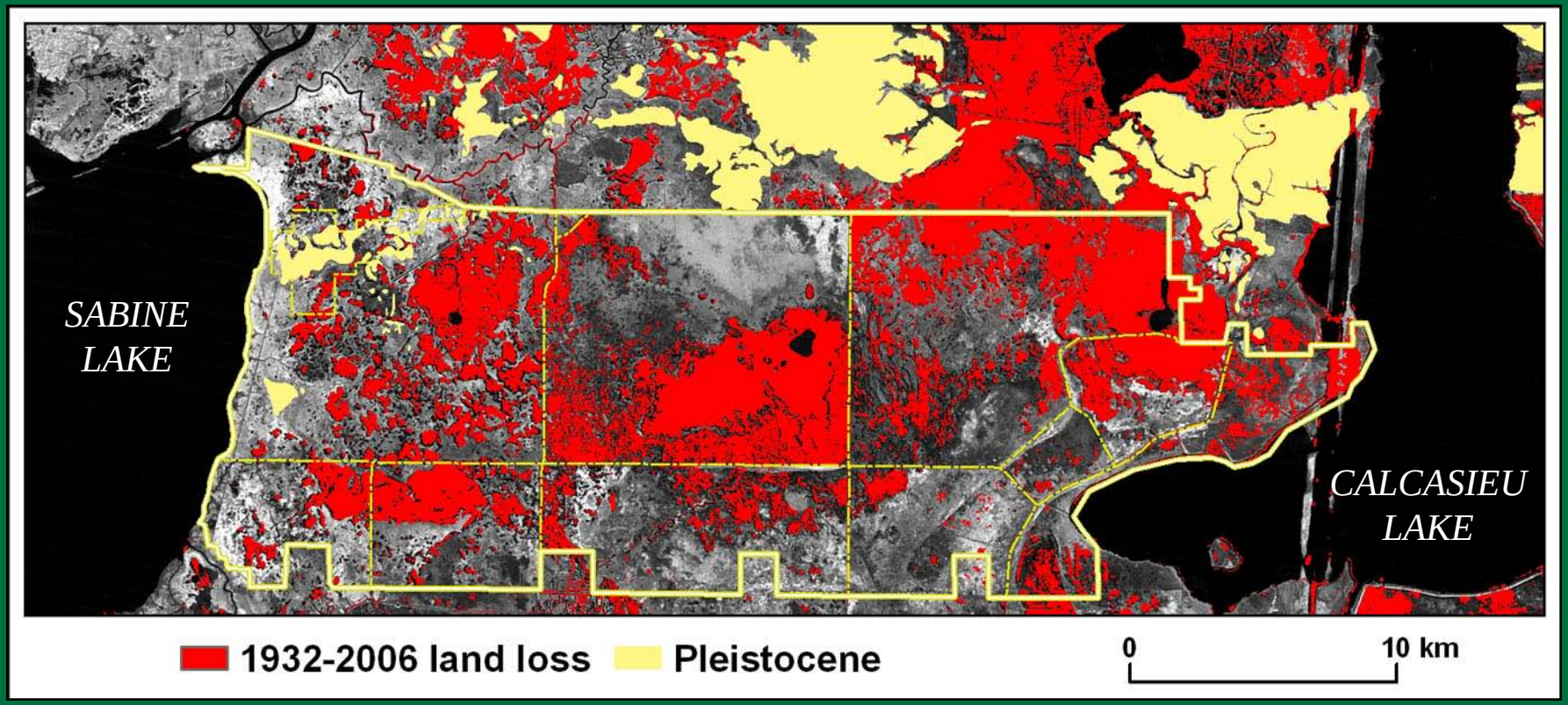
- Extensive interior wetland loss since 1950s



Objectives

- Assess temporal and spatial distribution of historical wetland losses in the western chenier plain
- Estimate relative importance of subsidence and erosion at SNWR wetland-loss study areas
- Compare attributes of land-area change between western chenier and delta plains

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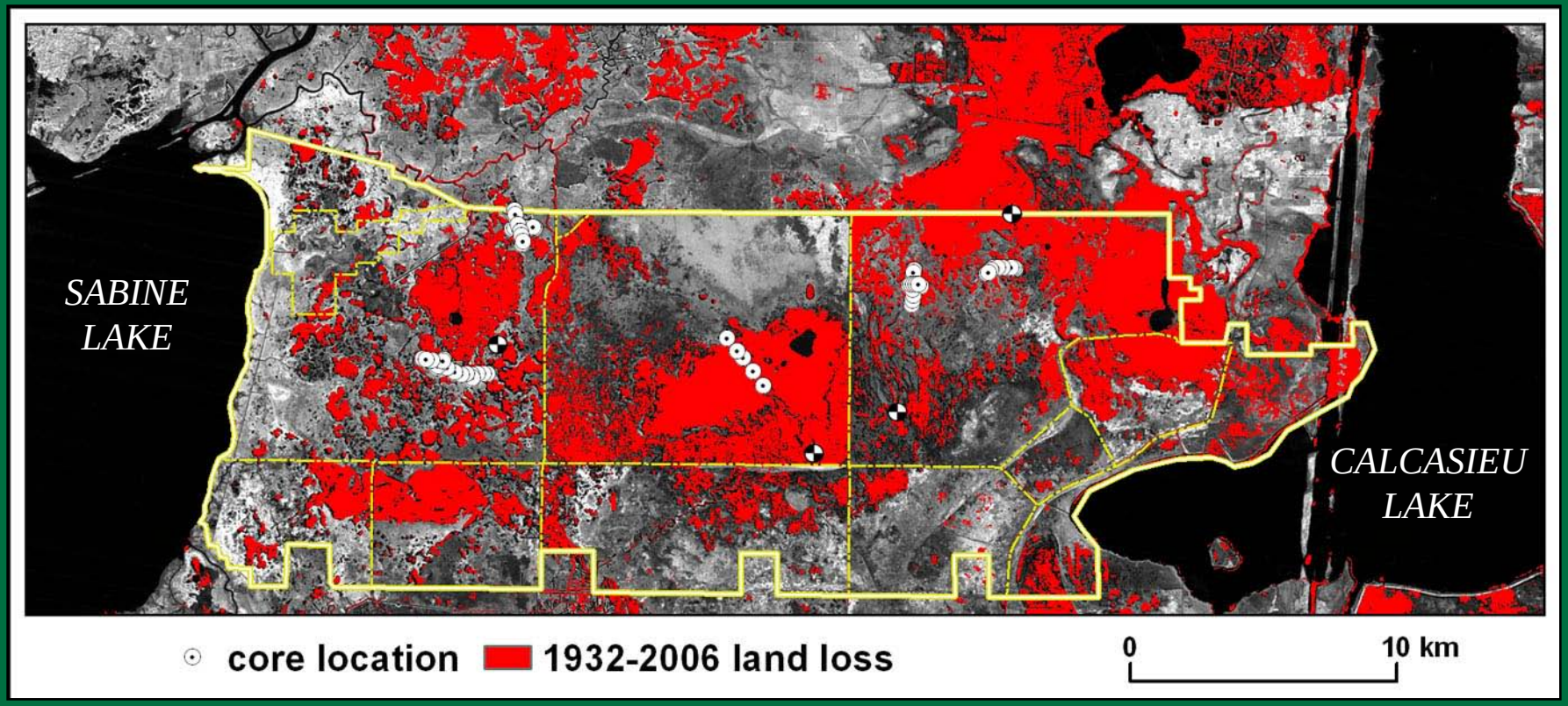
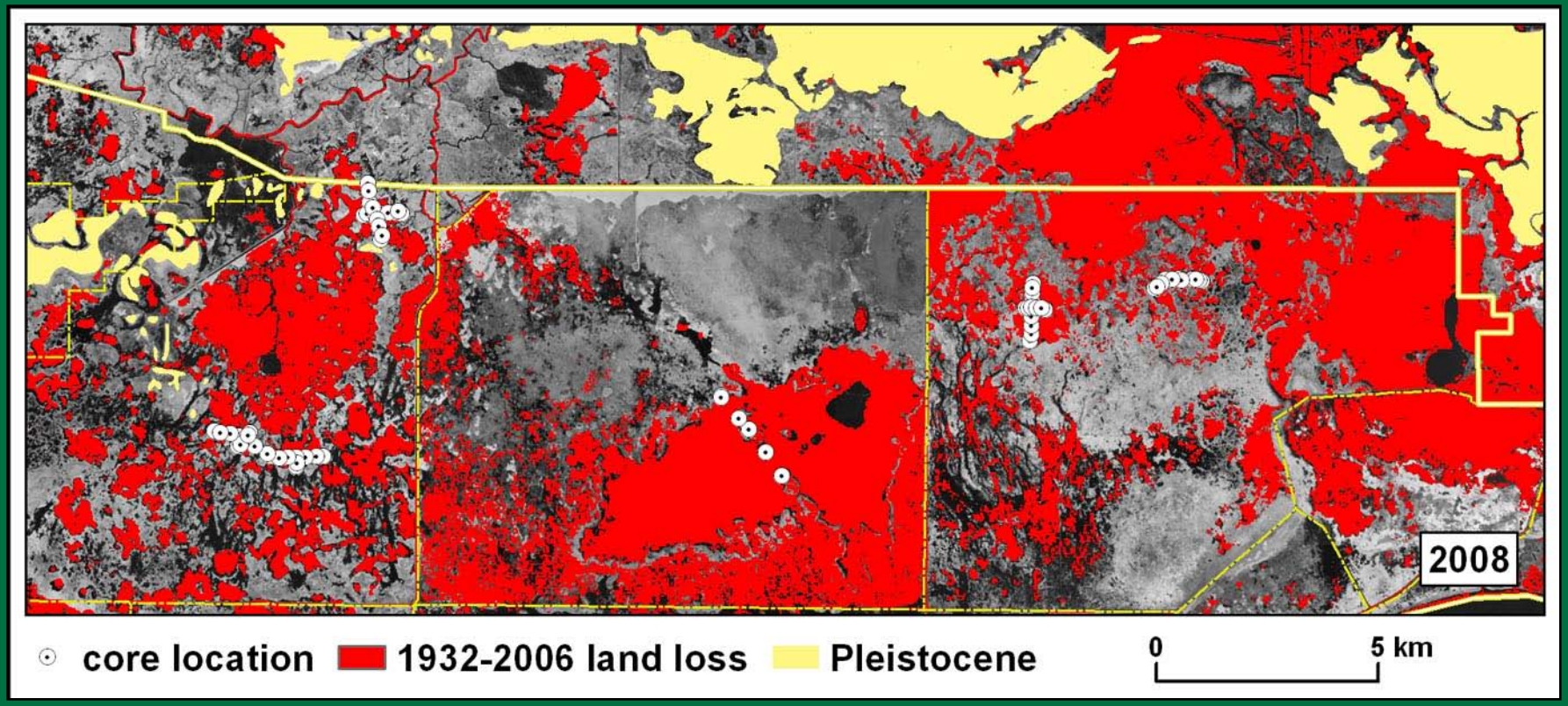
Datasets and Methods

- Historical aerial photography
- Sediment cores
- Datum-corrected water depths and marsh elevations



Historical Wetland-Loss Trends

- Most wetland losses occurred between 1956 and 1978
- Some continued land loss in western SNWR through early to mid-1980s

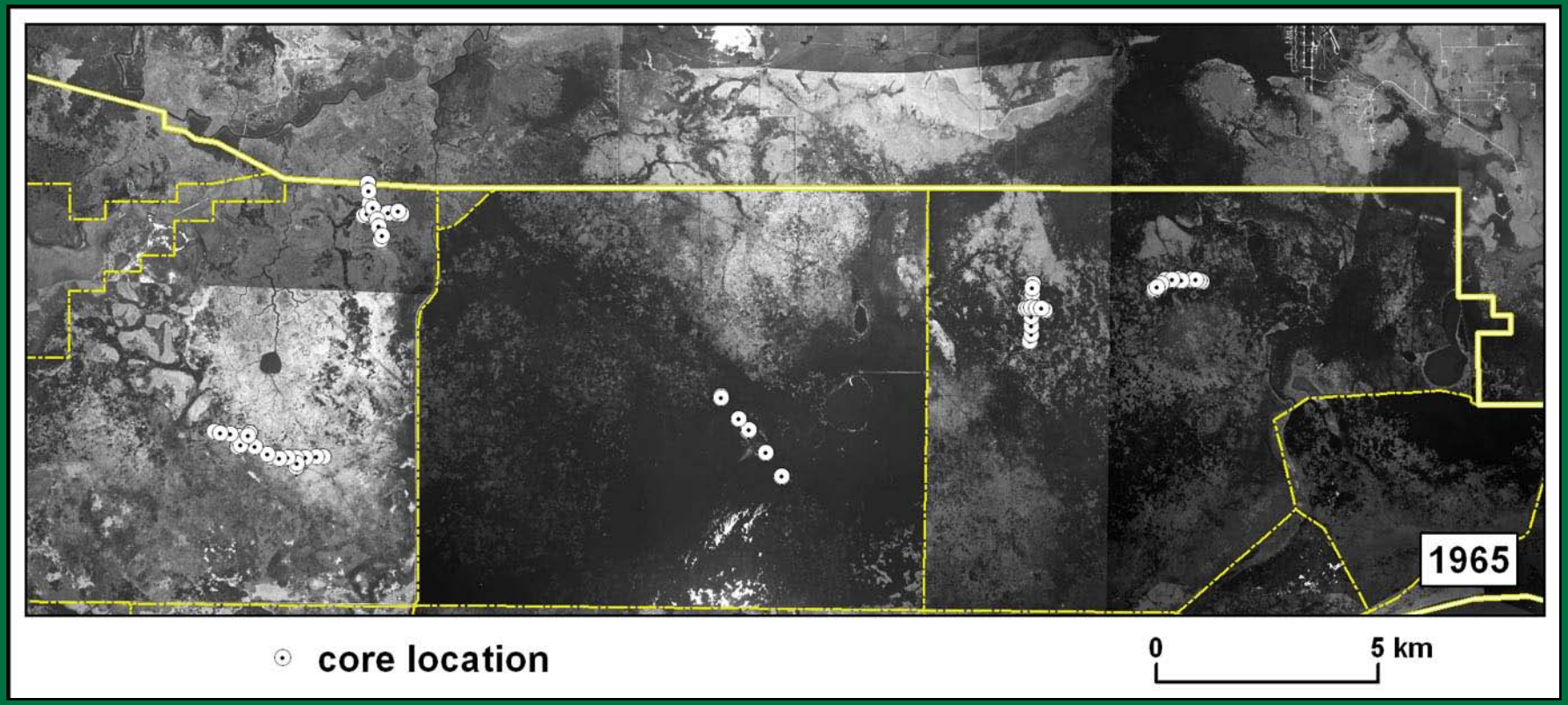


Historical Wetland-Loss Trends

- 1955 – mostly continuous emergent marsh

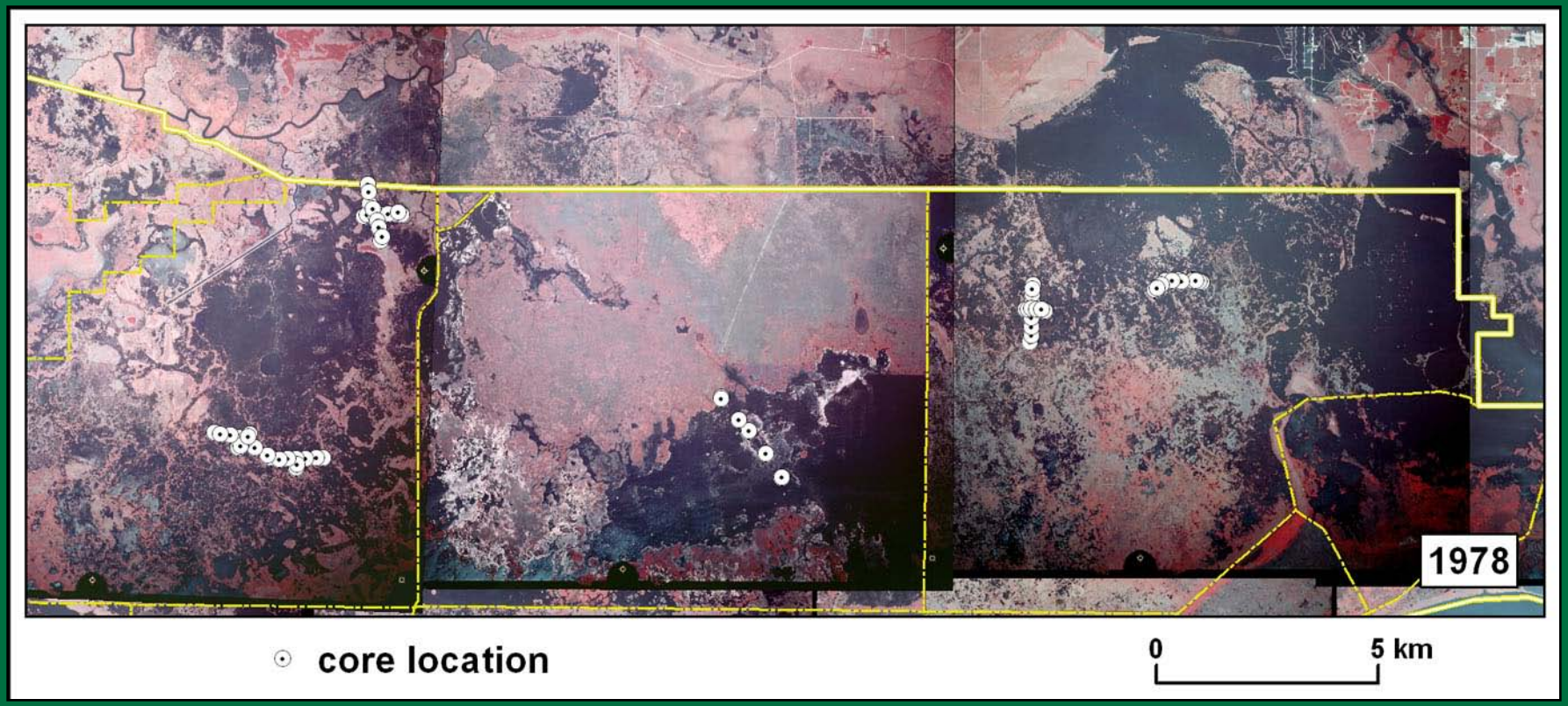
Historical Wetland-Loss Trends

- 1965 – some broken and flooded marsh



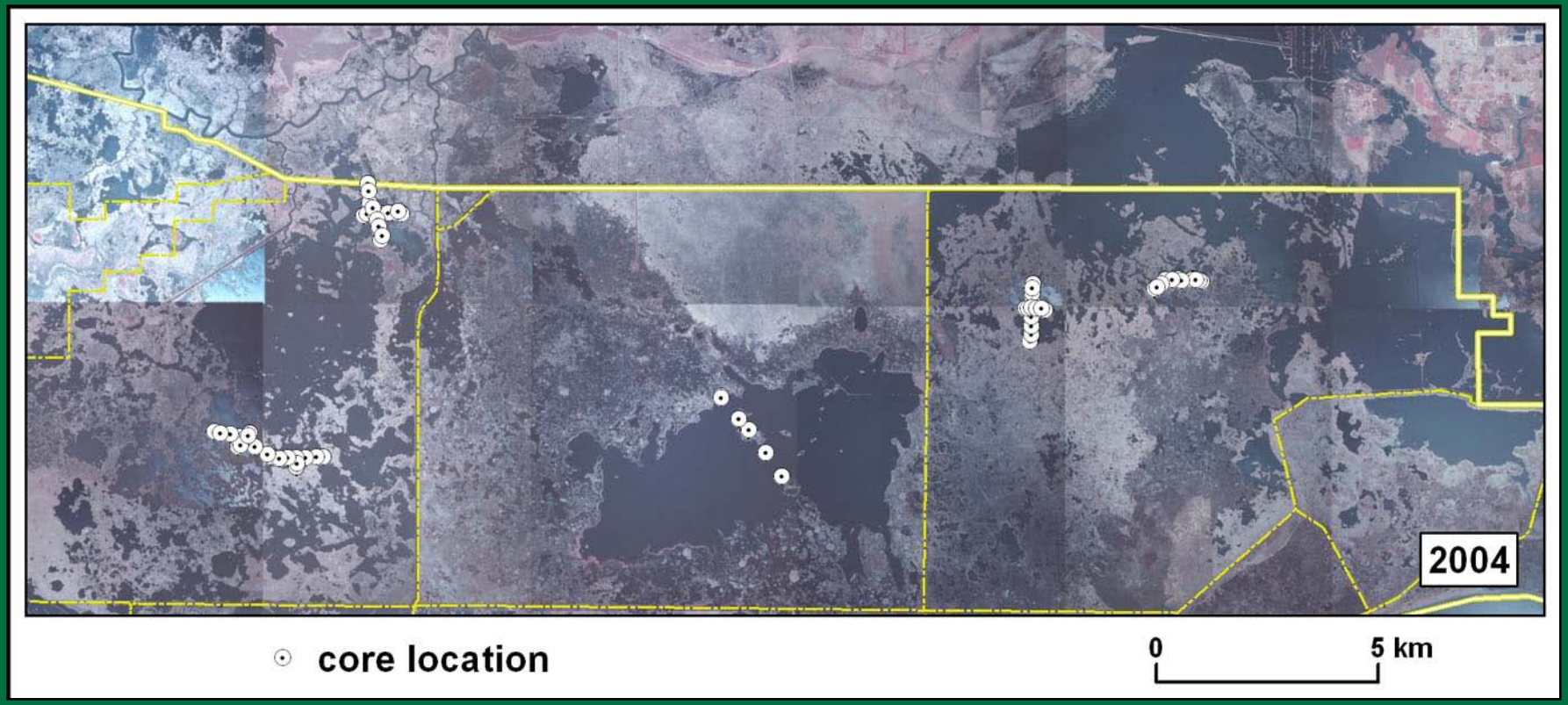
Historical Wetland-Loss Trends

- **1978 – large expanses of open water; submerged wet marsh still visible in Unit 5**



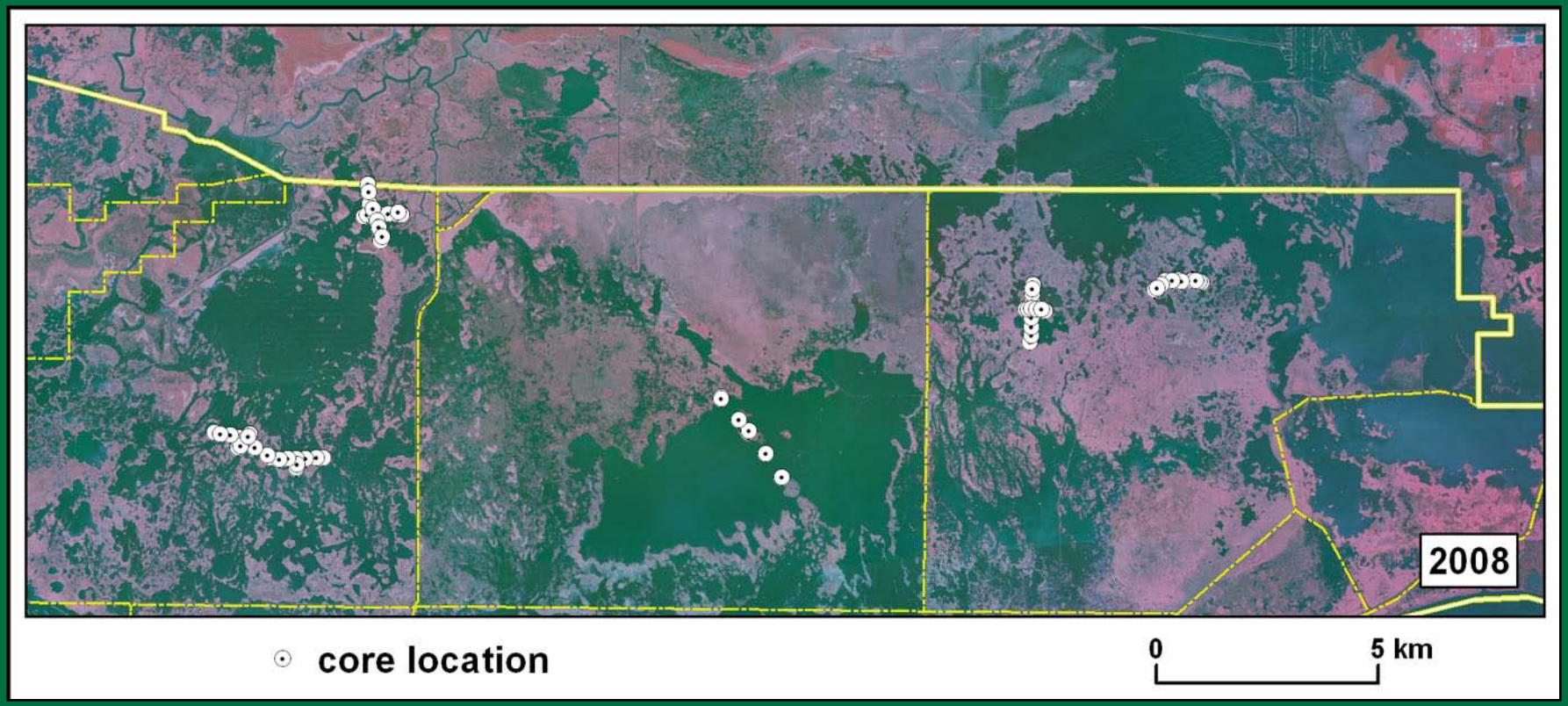
Historical Wetland-Loss Trends

- 2004 – little additional land-area change



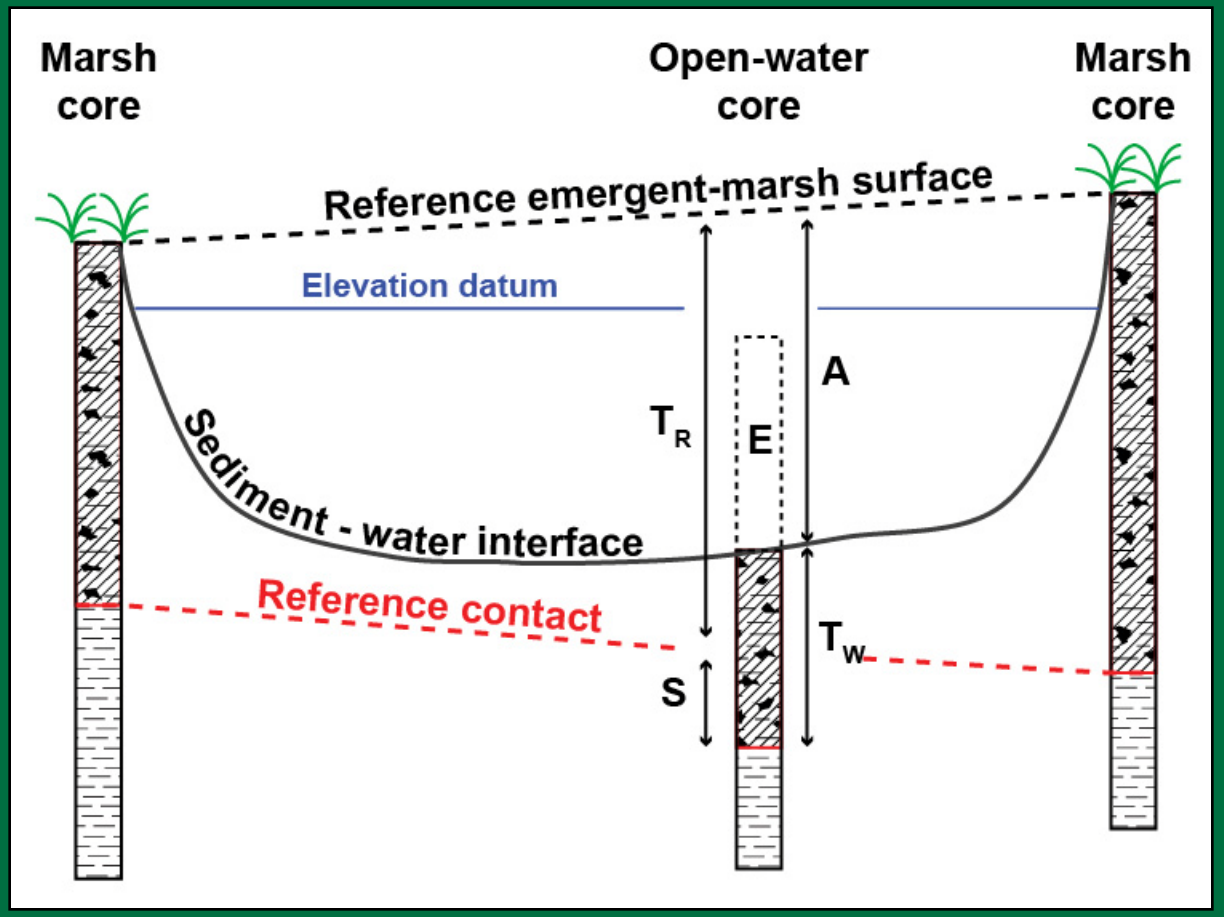
Historical Wetland-Loss Trends

- 2008 – orthogonal-elongate ponds and marsh shear resulting from Hurricanes Rita (2005) and Ike (2008)



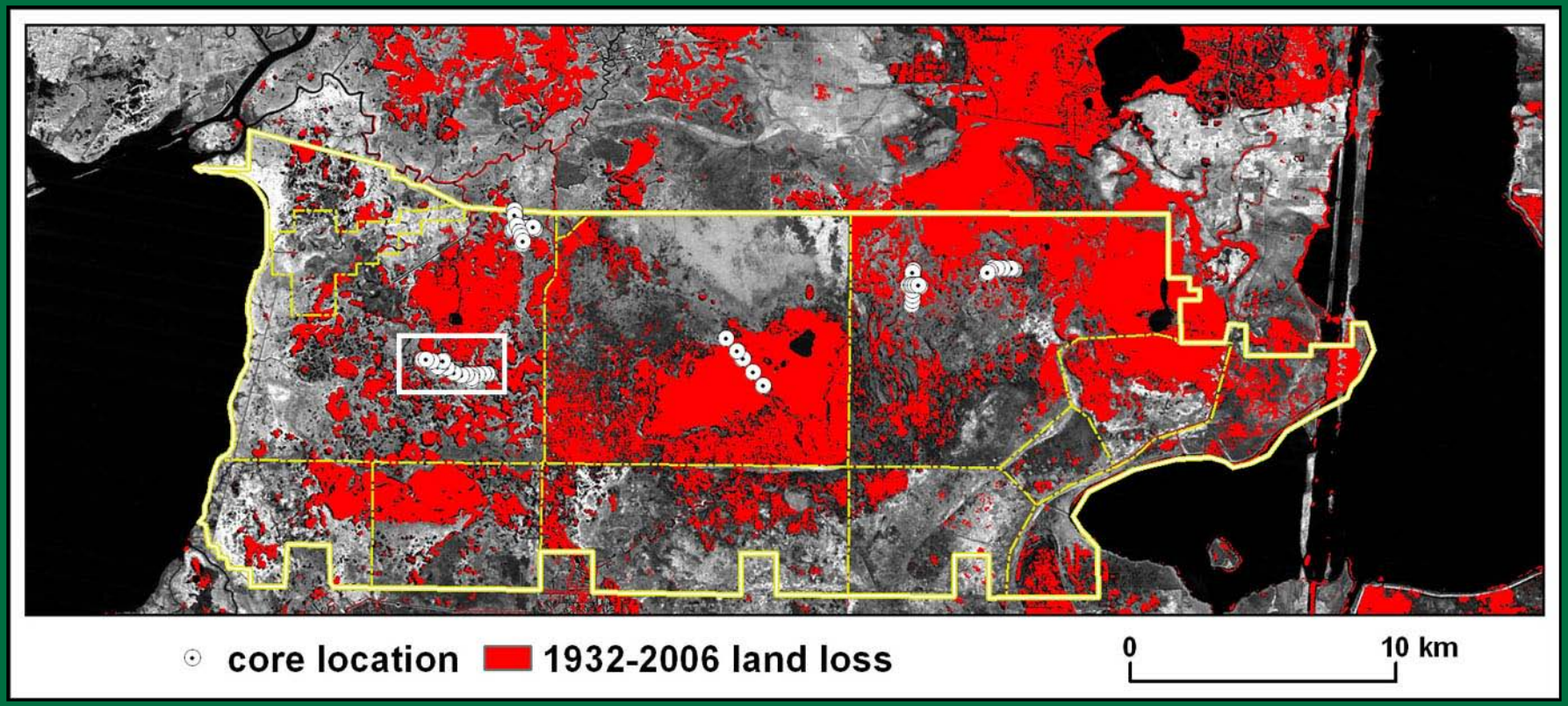
Processes of Historical Wetland Loss: Estimating Subsidence and Erosion

- Correlate thicknesses and elevations of shallow stratigraphic units to estimate subsidence and erosion



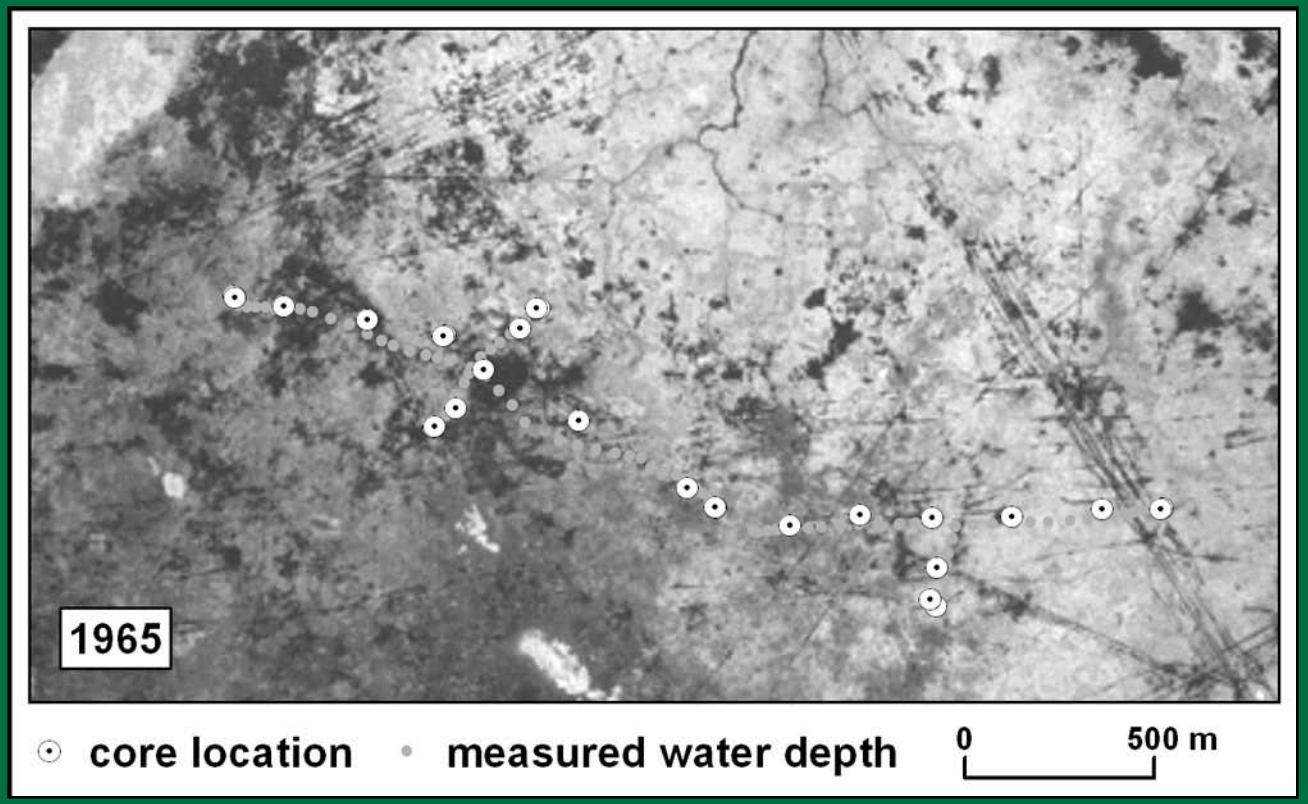
Historical Subsidence and Erosion of SNWR Marshes

- Core sites transect historically emergent marshes



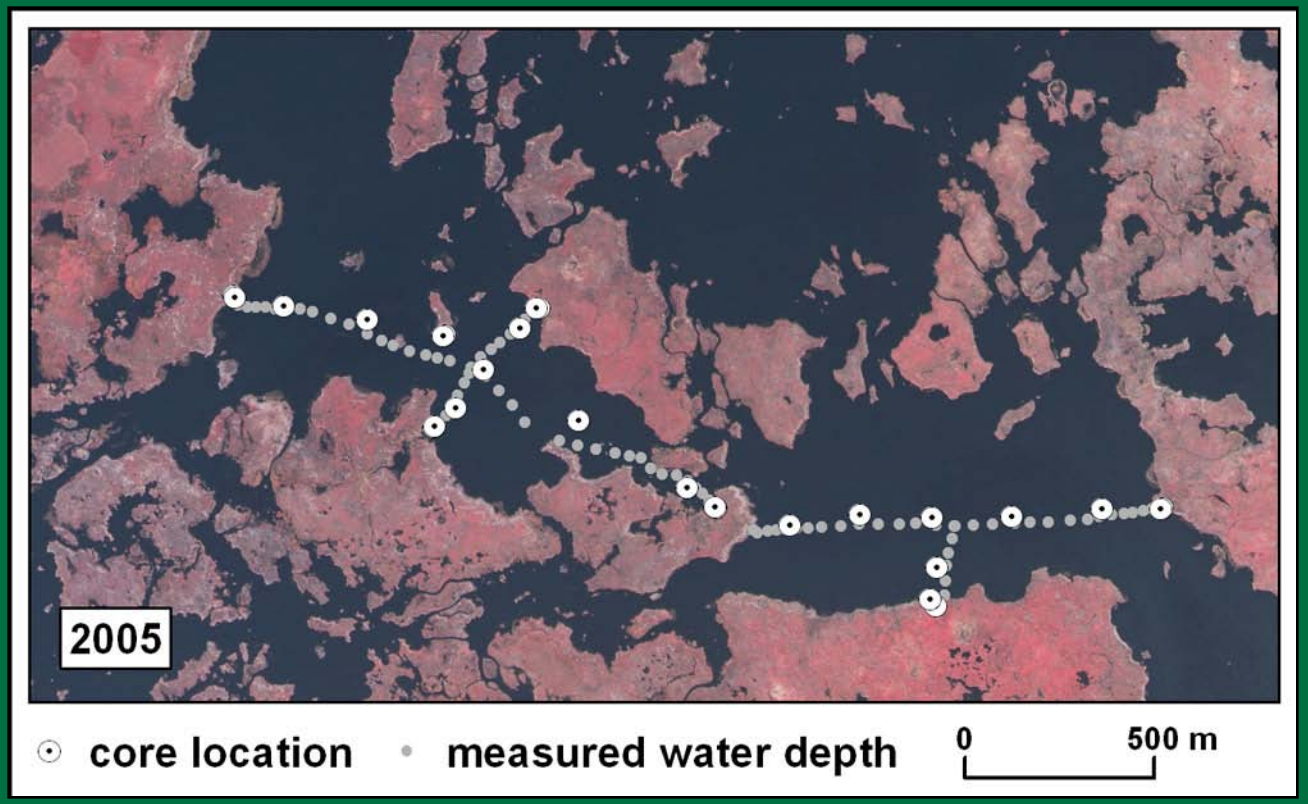
Historical Subsidence and Erosion of SNWR Marshes

- 1965 – mostly continuous emergent marsh; some initial fragmentation and ponding on marsh surface



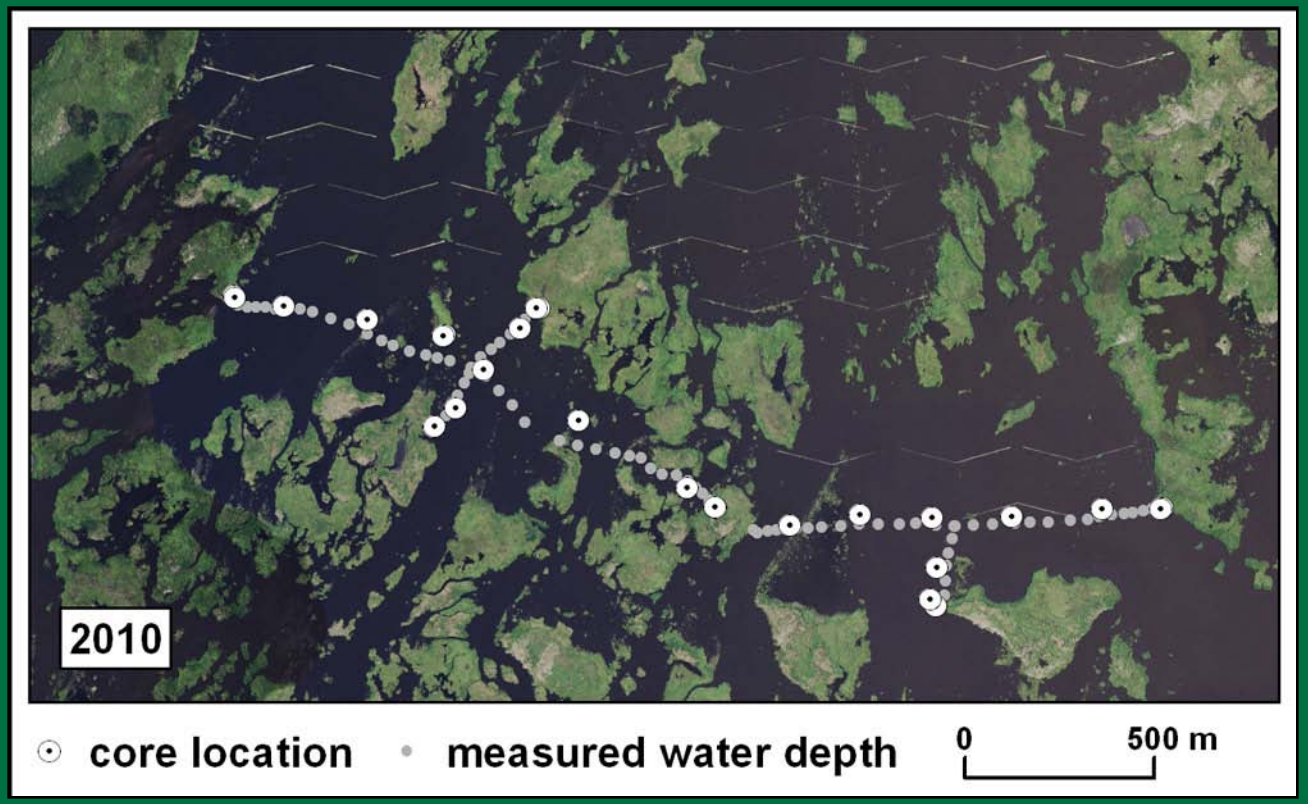
Historical Subsidence and Erosion of SNWR Marshes

- 2005 – large open-water body around Greens Lake; fragmented marsh and open water along core transect



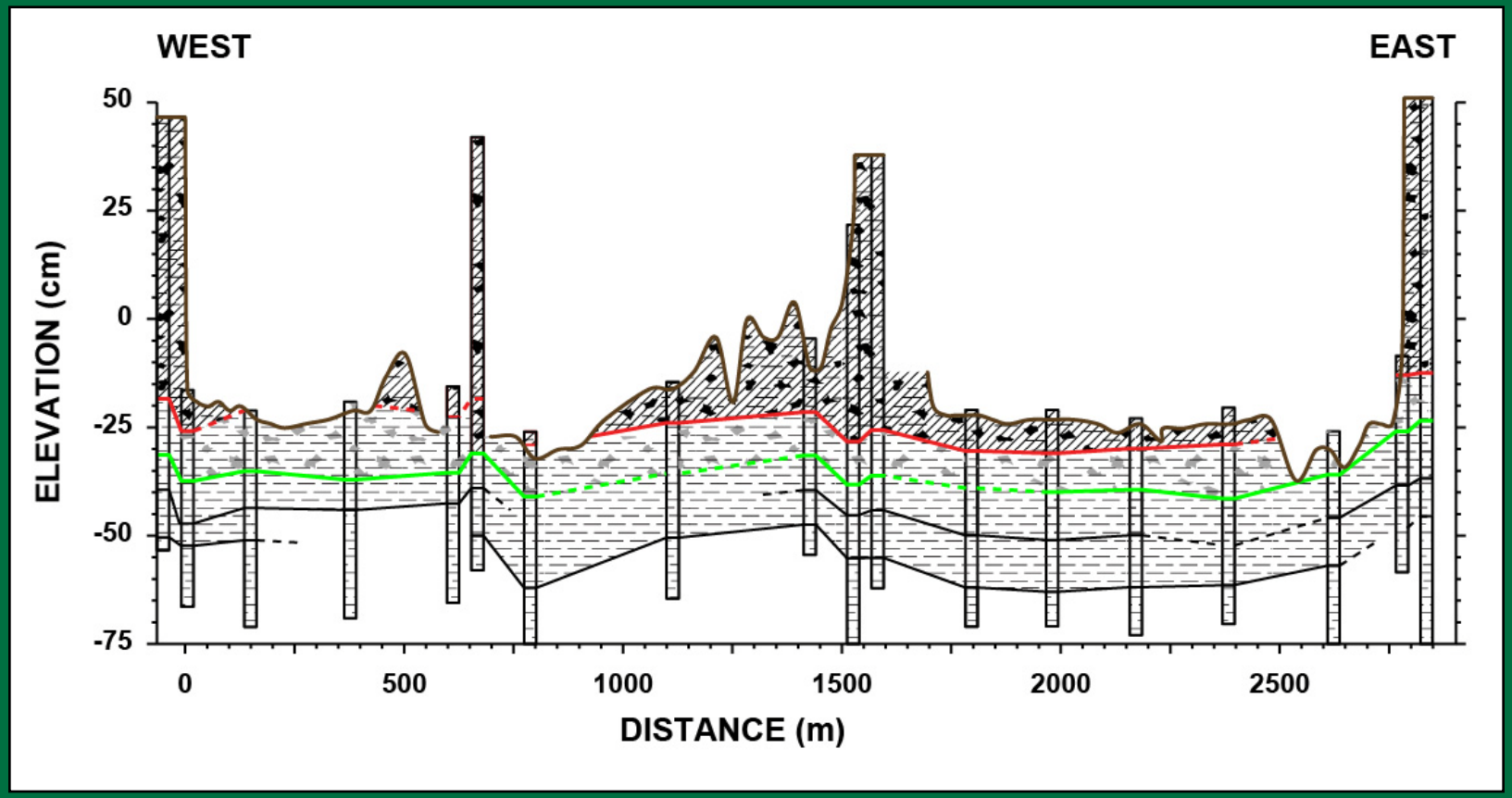
Historical Subsidence and Erosion of SNWR Marshes

- 2010 – erosional ponds formed by Hurricane Ike; marsh terraces constructed between 2004-2008



Historical Subsidence and Erosion of SNWR Marshes

- Erosion >> subsidence at most core sites
- Peat facies absent (eroded) at most open-water core sites



Historical Land-Surface Subsidence in the Western Chenier Plain

- Cameron tide gauge: 4.1 mm/yr RSLR from 1942-2005
  - Rapid rise in RSL (12 mm/yr) between 1954 and 1975
- Sabine Pass tide gauge: 5.7 mm/yr RSLR from 1958-2006
- Leveling surveys: 12-15 mm/yr between 1965 and 1982

- Subsurface fluid withdrawal in western chenier plain:
  - Peak hydrocarbon production in 1960s and early 1970s
  - High rates of water production sustained through 1990s

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Comparison of Wetland-Loss Parameters at SNWR and Delta-Plain Marshes

	SNWR	Delta Plain
Marsh Elevation	30 - 71 cm (avg. 44)	17 - 51 cm (avg. 36)
Peat Thickness	13 - 101 cm (avg. 51)	89 - 365 cm (avg. 145)
Subsidence	0 - 38 cm (avg. 14)	0 - 149 cm (avg. 59)
Erosion	0 - 61 cm (avg. 33)	0 - 181 cm (avg. 34)
1D Accommodation	13 - 88 cm (avg. 47)	35 - 202 cm (avg. 99)
Average Water Depth	-9 cm	-47 cm

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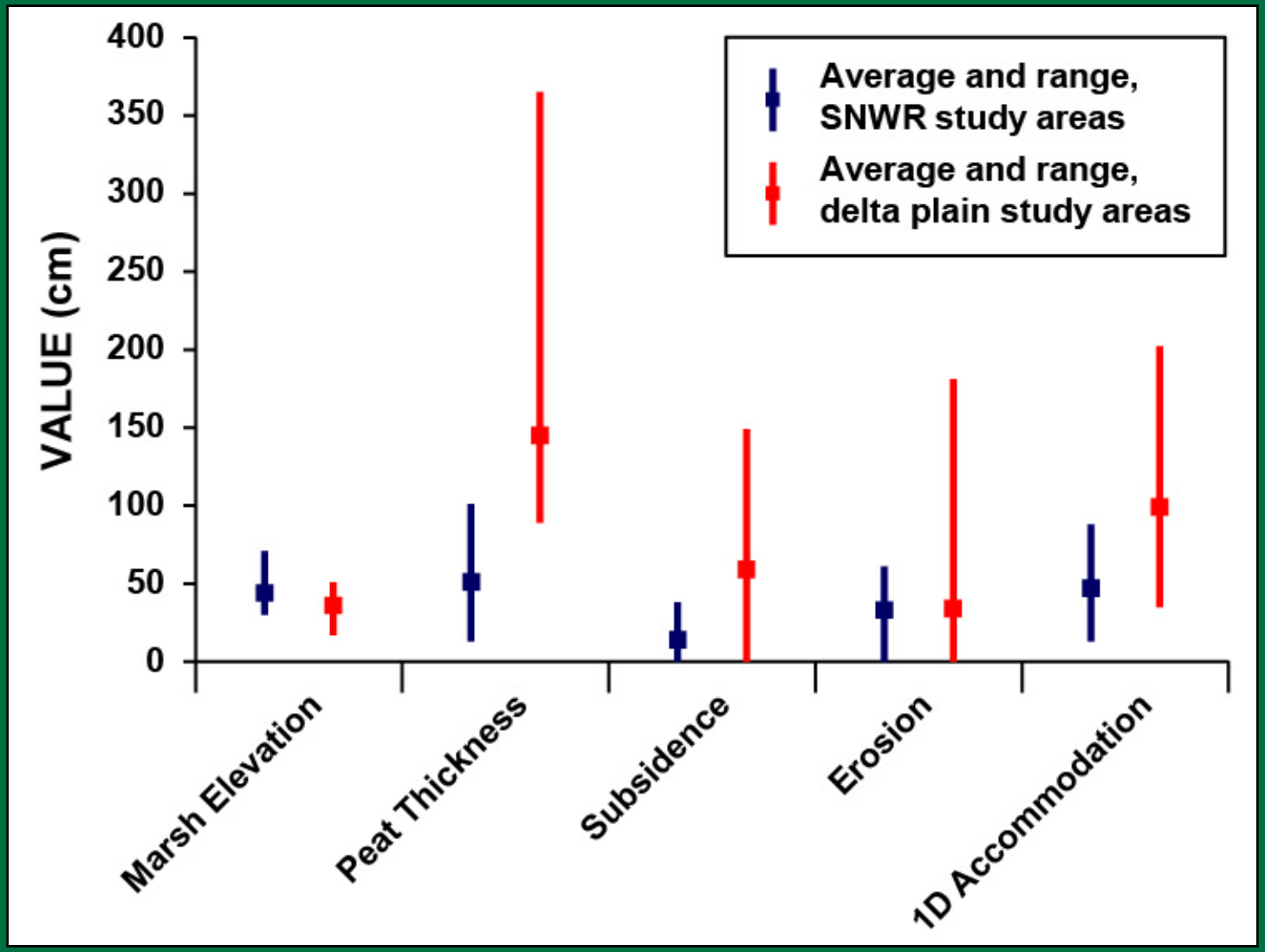
Comparison of Wetland-Loss Parameters at SNWR and Delta-Plain Marshes



Conclusions and Implications

- Most historical wetland loss in western chenier plain occurred between 1956 and early 1980s
- Land-area fluctuations and wet marsh in 1960s and 1970s imagery indicates historical wetland loss was initiated by land-surface subsidence
- Erosion >> subsidence at most SNWR core sites

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Conclusions and Implications

- Magnitudes of subsidence and total accommodation space formed in western chenier plain are less than in delta plain

- Similar temporal and spatial trends of rapid wetland loss and highest historical subsidence rates indicates historical wetland loss was likely initiated by deep subsurface subsidence in both western chenier and delta plains

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Ongoing Work

- Analyze bathymetric data (August 2010) to quantify 3D accommodation (volume) that formed as a result of historical wetland losses at SNWR

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