Constraining the Timing, Magnitude, and Likely Causes of Historic Subsidence and Wetland Loss, Mississippi River Delta Plain, South-Central Louisiana

Julie C. Bernier¹, Robert A. Morton¹, and John A. Barras²

¹USGS Florida Integrated Science Center, St. Petersburg, FL
²USGS National Wetlands Research Center, Baton Rouge, LA
Introduction – Louisiana Land Loss

- Delta plain: \( \sim 4000 \text{ km}^2 \) land loss since 1930s
Objectives

- High-resolution temporal analysis of land-water changes at selected wetland-loss hotspots
- Quantify subsidence vs. erosion at wetland-loss hotspots
- Compare historical vs. geological delta-plain subsidence
Delta Plain Land-Loss Hotspots

- 1956-2005: 255 km² land → open water
Delta Plain Land-Loss Hotspots

- Peak land-loss rates: 2-4x higher than background
Example: Pointe Au Chien Study Area

- 1956-2005: ~46 km² land → water
Example: Pointe Au Chien Study Area

- 1956-2005: ~46 km$^2$ land $\rightarrow$ water
Example: Pointe Au Chien Study Area

- 1956-2005: \(~46\ \text{km}^2\) land \(\rightarrow\) water
Example: Pointe Au Chien Study Area

- 1956-2005: ~46 km$^2$ land $\rightarrow$ water
Example: Pointe Au Chien Study Area

- 1956-2005: ~46 km² land → water
Example: Pointe Au Chien Study Area

- 1956-2005: ~46 km$^2$ land → water
Pointe Au Chien Study Area

- 1960s to early 1980s: rapid land loss
Pointe Au Chien Study Area

- Core sites transect historic marsh surface
Pointe Au Chien Study Area

- Core sites transect historic marsh surface
Pointe Au Chien Study Area

- Core sites transect historic marsh surface
Pointe Au Chien Study Area

- Core sites transect historic marsh surface
Pointe Au Chien Study Area

- Correlate organic (marsh) sediments to estimate subsidence and erosion relative to emergent marsh
Pointe Au Chien Study Area

- 75-115 cm subsidence vs. 0-14 cm erosion
Pointe Au Chien Study Area

- 75-115 cm subsidence vs. 0-14 cm erosion
Delta-Plain Oil-and-Gas Production

- Good temporal correlation of peak hydrocarbon production and peak wetland loss rates
Delta-Plain Oil-and-Gas Production

- Good temporal correlation of peak hydrocarbon production and peak wetland loss rates
Conclusions and Implications

- Most recent land-loss rates comparable to pre-1970s background rates

- Subsidence is primary mechanism of wetland loss
  - Historic subsidence rates >> geological subsidence rates

- Current research:
  - Investigate hotspots that developed more recently and/or not immediately adjacent to oil-and-gas fields
  - Subsidence vs. erosion around existing water bodies?
  - Extend study to chenier plain