

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

Abstract

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

¹U.S. Geological Survey, Florida Integrated Science Center, St. Petersburg, FL

²U.S. Geological Survey, National Wetlands Research Center, Baton Rouge, LA

Historical wetland losses at five representative hotspots in the Terrebonne Basin of the Mississippi River delta plain were investigated using National Wetlands Inventory (NWI) datasets, aerial photographs, satellite images, sediment-surface elevations, and sediment vibracores. Since 1956, the total emergent land area at the five study areas has decreased by about 50%, with the most rapid wetland loss occurring in the late 1960s and 1970s. Formerly emergent marshes at these wetland-loss hotspots are now submerged beneath water that averages 0.5 to 1 m deep. Correlation of the shallow-subsurface stratigraphy shows that land subsidence was the primary mechanism of wetland loss. Subsequent erosion of the submerged delta-plain marsh was relatively minor at most core sites.

The widespread and nearly simultaneous collapse of marshes across the Mississippi River delta plain appears to be an unprecedented event in the recent geological record. Average historical rates of subsidence determined from repeat leveling surveys between 1965 and 1993 range from 8 to 12 mm/yr. In contrast, average geological rates of subsidence over the last 5000 years calculated from radiocarbon analysis of peat deposits range from 1 to 5 mm/yr. Correlation of surface, subsurface, and production data strongly indicates that rapid historic subsidence and associated wetland loss on the delta plain were largely induced by the production of hydrocarbons and associated formation water. The results of this study provide a basis for understanding the processes and likely causes of historic wetland losses on the delta plain, which can be incorporated into the effective selection and design of coastal-restoration projects.