U.S. Geological Survey Fact Sheet

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Biogeochemical cycling of carbon and related elements in the coastal wetlands of Louisiana

Forty percent of United States coastal wetlands are in Louisiana. Formed by the Mississippi River, these wetlands comprise the largest active deltaic system in North America. They support 30 percent of the Nation's annual commercial fish and shellfish harvest and bring in more than 680 million dollars a year to the Louisiana economy. The wetlands also support a multimillion-dollar outdoor recreation industry that includes fishing and hunting. Two-thirds of the Mississippi flyway ducks and geese winter in these wetlands. The coastal wetlands provide protection from storms and hurricanes for more than 1.4 million people who live in the Louisiana coastal zone. Louisiana coastal wetlands constitute a valuable national resource that is rapidly disappearing.

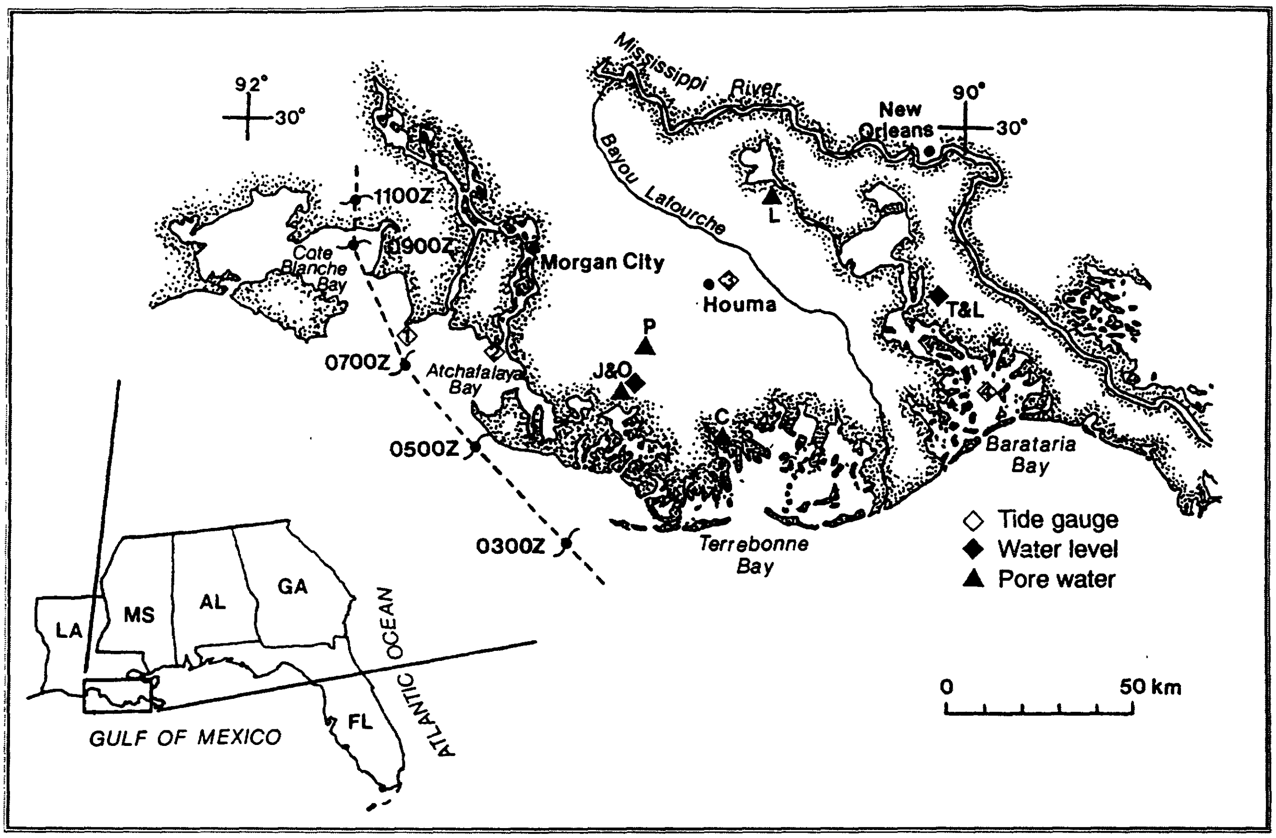
Coastal wetlands contribute to the global carbon cycle because of their high biological productivity, storage of organic carbon, and emissions of greenhouse gases such as methane (CH_4). To develop predictive models relating methane emissions to changes in global climate, it is important to understand the processes that affect carbon cycling in coastal wetlands.

Coastal wetlands, consisting of fresh, brackish, and saltwater marshes, support unique plant communities and are an intricate network of ecosystems in which immediate influences of global warming may be detected. Many of these wetlands are under stress. For example, coastal marshes in Louisiana are eroding into open lakes and ponds at a rate of about 65 km^2 each year. These losses of wetlands are due to human and natural causes such as oil and gas withdrawal, saltwater intrusion through canals, reduced sediment input due to water control and diversion of the Mississippi River, compaction of sediments, and subsidence. Transient events such as hurricanes or winter storms also affect vegetation and the accumulation of sediment in coastal marshes. In addition, the sea level is projected to rise about 0.5–1.0 meter during the next 100 years due to global warming. This sea-level rise will create new wetlands and convert freshwater wetlands to brackish or saltwater marshes.

To provide information necessary for global climate modeling, U.S. Geological Survey scientists are studying the cycling of carbon and related elements along a salinity gradient in the coastal wetlands of Louisiana. The primary objectives are to (1) quantify spatial and temporal variations of methane fluxes and organic carbon and methane storage in fresh, brackish, and saltwater marshes; (2) identify seasonal differences in pore water concentrations of related elements (e.g., nutrients and sulfur) and how they influence methane generation and carbon diagenesis; (3) examine the sedimentary record for possible trace-element indicators of past depositional environments or transitions between fresh, brackish, and salt marshes; and (4) assess the effect of Hurricane Andrew on sediment accumulation and changes in pore water chemistry (redox status, nutrient concentrations, mobilization of elements, and organic matter diagenesis) at the marsh sites and implications for hurricane influences on the sedimentary record.

The compositions of interstitial pore-water and solid-phase material and the methane fluxes from a fresh, brackish, and saltwater marsh in Terrebonne Basin, Louisiana, were determined four times between May 1991 and May 1992. In August 1992, Hurricane Andrew passed through our sampling sites and came ashore about 50 km west of Morgan City. Pore-water samples were collected at all of our sites about 55 days after the hurricane and at the brackish site about a year later.

Hurricane Andrew caused lateral movement and stacking of vegetation and sediment, erosion, and conversion from wetlands to open water at the brackish marsh. Pore water results from the brackish site indicate increases in organic matter decomposition and salt content after the storm. In contrast, sediment was deposited in the saltwater marsh, and there was little change in pore-water chemistry before and after the hurricane.



Location of several USGS (▲) and National Biological Service (◆) study sites in coastal wetlands of Terrebonne and Barataria Basins, Louisiana. The path of Hurricane Andrew (ɸ) is indicated as it approached the Louisiana coast on August 26, 1992 (Universal Consolidated Time).

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