

USGS Reports Latest Land-Water Changes for Southeastern Louisiana

The USGS National Wetlands Research Center is reporting that a total of 118 square miles of land has been transformed to new water areas in a 9,742 square mile area from the Chandeleur Islands to the Atchafalaya River. This area encompasses the basins of Breton Sound, Mississippi River, Pearl River, Pontchartrain, Barataria, Terrebonne and the western quarter of the Atchafalaya basin.

This land-water change is from the fall of 2004 to the fall of 2005, after Hurricanes Katrina and Rita. These numbers are similar to ones reported to the task force of the Coastal Wetlands Planning, Protection and Restoration Act in November by USGS, but they now also include land-water changes for the eastern quarter of the Pontchartrain basin, including the Chandeleur Islands. The data, acquired by analysis of Landsat 5 Thematic Mapper (or TM) satellite imagery, have also been further verified by additional satellite-image analysis, two small plane overflights, limited field investigations, and peer review.

The permanency, however, of the new water areas may not be known for several growing seasons. Some of the shallow areas may recover rapidly while others may remain open ponds. For example, new green vegetation was observed in storm-impacted areas over most of southeastern Louisiana during the small plane overflights.

The combined land-water changes caused by Katrina and Rita exceeded all such changes in coastal Louisiana from previous recent hurricanes combined such as Hurricanes Andrew (1992), Lili (2002) and Tropical Storm Isidore (2002), as identified with Landsat satellite imagery. The change from land to water between the fall of 2004 and 2005 in the Breton sound basin was equivalent to 60% of the total land-to-water change in the sound area between 1956 and 2004.

Moreover, the change from land to water in all of coastal Louisiana east of the Mississippi River from 2004 to 2005 was 72.9 square miles, exceeding the

60-square miles projected to occur from a period of 50 years (2000-2050) by the Louisiana Coastal Area Ecosystem Restoration Study.

The Breton Sound basin's water area increased by 40.9 square miles; Terrebonne basin by 19.4 square miles; Pontchartrain basin by 19.1 square miles; the Mississippi River basin by 17.8 square miles; Barataria basin by 17.6 square miles; and the Pearl River basin by 4.4 square miles. The only area where land did not change to water was the Atchafalaya basin.

New water bodies and expanded water bodies formed on the eastern side of the Mississippi River basin; the northwestern portion of the Breton Sound basin, from Delacroix to Caernarvon; the northern and eastern shorelines of Lake Borgne; and along the north shore of Lake Pontchartrain from Mandeville to the Mississippi border, including extensive impacts in the Pearl River basin.

Many of the new water areas consist of shallow ponds where the marsh surface has been sheared or ripped to the root mat or to the underlying firm substrate of clay by storm surge. Littering some of the sheared areas are marsh balls (rolled up marsh vegetation) and other debris, not large enough to be identified by the satellite imagery used to detect land-water changes.

Other areas appear as large shallow ponds or lakes with areas of exposed mud flats that vary in size depending on water level. Groups of small interconnected ponds have been expanded in some areas by the shearing of the intervening marsh. The TM satellite may identify some of these shallow impact areas as either land or water, depending on tidal and meteorological conditions when the image was taken. Multiple images over time along with field investigations will be required to determine the permanency of new water areas.

Areas of floating fresh marsh and some scrub-shrub were completely removed in the northern Pearl River

basin, while a series of shears was cut across the southern portion of the basin.

The fresh marsh in northwestern Breton Sound basin was completely rearranged, displaying multiple shears that trended in a northwest-southeast direction. Large deposits of wrack accumulated adjacent to or on top of spoil banks and natural distributary channels and often completely surrounded willows and shrubs. Shallow mudflats, sometimes peppered by marsh balls and other debris, were present throughout the area. Over 90 percent of the new water area appearing after the hurricanes in Breton Sound occurred within marshes that had been previously classified as fresh and intermediate (that is, between fresh and brackish in salinity).

The more mineral-rich brackish and saline marshes appeared to have fared better, as indicated by the lack of large new water areas in central Breton Sound basin and the Bayou Biloxi marsh. Fringing shoreline erosion and marsh scouring, as well as the formation of small ponds, were observed in the brackish-saline marshes, while the greatest impacts occurred in the more organic fresh and intermediate marshes of the Mississippi River basin, upper Breton Sound basin and Pearl River basin.

Compression features (marshes compressed like an accordion or like pleats) of a mile or more long were observed in upper Breton Sound basin. Smaller but distinct compression features were also observed in the North Shore marsh.

Most areas west of the Mississippi River, with the exception of those east of Katrina's landfall, were impacted more by Rita than Katrina. Areas of significant shoreline erosion, possibly caused by Katrina's winds were, however, detected along the southern shorelines of Lake Salvador and Little Lake in central Barataria basin. Rita's surge rearranged Katrina's wrack (primarily marsh plant debris) in

upper Breton basin and caused the formation of limited new ponds and some expanded ponds from central Barataria basin across the Terrebonne basin to the Atchafalaya River. These impacts occurred primarily in fresh and intermediate marshes, although similar effects were observed in brackish marshes.

Rita's surge likely moved areas of floating fresh marsh in the western Terrebonne basin. Some areas of submerged and floating aquatic vegetation were possibly removed or shifted by the surge.

To analyze land-water change, USGS scientists in Louisiana use remote-sensing technology and geographic information systems. For this analysis, they compared land and water areas identified in Landsat 5 Thematic Mapper imagery from several dates in the fall for the years 2001, 2004 and 2005. This imagery was used to successfully identify new water areas ranging from several acres to over 1,000 acres as well as to identify areas of new land consisting of rearranged marsh, wrack or storm-deposited sediment. The imagery was collected by the USGS National Center for Earth Resources Observation and Science in Sioux Falls, S.D.

In the future USGS scientists and partner agencies will continue to study hurricane recovery, future land-water changes and restoration of land in southeastern Louisiana by using satellite imagery, high resolution digital imagery acquired from aircraft, and field investigations. The USGS will expand these efforts to include southwestern Louisiana, which was affected by Hurricane Rita.

For more information:

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