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Northern Gulf of Mexico: USGS Science Contributions to a Resilient Coast, 2006–2011

The devastating hurricane season of 2005 challenged the U.S. Geological Survey (USGS) to develop a science base for resource managers and policy makers that could provide an understanding of the multiple stressors and influences affecting the northern Gulf of Mexico coast and to track changes in linked coastal systems. The complexity of the Gulf Coast requires a science strategy for data collection and data reporting that is consistent across regional ecosystems and that can be applied to both short-term and long-term responses to stressors.

The overarching goal of USGS Gulf Coast science in the post-Hurricane Katrina environment is to provide scientific information, knowledge, and tools to local, state, and federal agencies so that constructive decisions about land resource use, management practices, and future development in the coastal zone and adjacent watersheds can be made. Those decisions can promote restoration, increase coastal resilience, and mitigate risks associated with both human-induced and natural hazards.

The USGS is developing an integrated program that incorporates interdisciplinary information in order to address the following questions:

- What are the impacts on the Gulf Coast from extreme storms? What is the current vulnerability of the coastline along the northern Gulf of Mexico?
- What are the processes, both natural and human-induced, that affect coastal vulnerability?

Tidal wetlands in the northern Gulf of Mexico.

Sea oats line a northern Gulf Coast beach.

- How will coastal rebuilding and restoration plans affect coastal resiliency?
- How can this information be used to help sustain economic and natural resources and mitigate the effects of future storms?

Short-term Science Goals, 2006

In the short term, the Gulf Coast provides a "natural laboratory" in which to study the effects of extreme storms on coastal resilience. In 2006, the goals of the USGS studies were to:

- Assess the short-term environmental impacts of the 2005 hurricanes on coastal systems.
- Provide data and information to local, state, and federal agencies relevant to the recovery process.
- Begin the long process to understand and forecast coastal change throughout the region, and determine how that understanding can benefit coastal regions nationwide.

Priorities for the USGS in the weeks and months after Hurricanes Katrina and Rita were to:

- Recover perishable data and baseline information.
- Effectively manage information storage and communication with local, state, and federal agencies.
- Document the extent of change to the physical landscape as a result of the hurricanes.
- Develop a rapid response surge network.

Long-term Science Goals, 2007–2011

The USGS is completing an assessment of baseline data against which change will be measured, and defining components of resilient and healthy coastal zones. Whereas the hurricanes of 2005 provided a natural laboratory in which to study the short-term effects of storms on coastal systems, science, in the long-term, must provide sustainable and integrated data to assess regional systems over time.

USGS long-term goals for the storm-impacted Gulf Coast include developing a more complete understanding of ecosystem dynamics, as outlined below:

- **Coastal ecosystems as habitats for wildlife**

  The USGS is studying data to understand the impacts of past storms and is developing models to predict future impacts of storms on coastal ecosystem habitats.

- **Coastal landscapes and the interactions between shorelines, barrier islands, and submerged resources**

  On the basis of the documented change to the physical landscape as a result of the 2005 storms and continued reconnaissance and surveys, the USGS is developing models to predict future landscape change from episodic events and from long-term processes.

- **River systems and the interactions between river transport and surface-water hydrology, including nutrient and contaminant inputs**

  The USGS is assessing the vulnerability of the Gulf Coast to hazards associated with altered surface-water hydrology and river transport, and developing strategies to respond to these interactions.

Ecosystem damage with significant habitat loss by Hurricane Katrina in the Pearl River Basin, Mississippi.

Mountains of debris line the Mississippi and Louisiana coastal regions after Hurricanes Katrina and Rita.

- **Coastal communities and the role science plays in assessing their vulnerabilities**

  The USGS is using images showing the extent of land cover changes from the 2005 storms to assess the vulnerability of coastal communities and provide information to local, state, and federal agencies for the development of hazard mitigation plans.

Cooperative Programs and Partners of the USGS in the Northern Gulf of Mexico

LACPR: Louisiana Coastal Protection and Restoration
http://lacpr.usace.army.mil/

Louisiana Coastal Area Ecosystem Restoration Project
http://www.mvn.usace.army.mil/prj/lca/

USGS National Coastal Program Plan
http://marine.usgs.gov/coastal-plan/

The Gulf of Mexico Alliance—Governors' Action Plan
http://www.dep.state.fl.us/gulf/plan.htm

Mississippi Coastal Improvements Program
http://mscip.usace.army.mil/

US Climate Change Science Program
http://www.climatescience.gov

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