Ecological Effects of Sea Level Rise in the Northern Gulf of Mexico

NOAA's Center for Sponsored Coastal Ocean Research (CSCOR) has recently initiated a large-scale research project in the Northern Gulf of Mexico including the Panhandle of Florida, Coastal Alabama and Coastal Mississippi. The goal of this research is to provide managers with the scientific knowledge and tools, including ecological models, to prepare over the long term for the impacts of sea level rise and storminess with more certainty in scale and local detail. Improving the predictive understanding of ecosystem responses to sea level rise and increasing storm surge will allow coastal zone managers to more effectively assess alternative management strategies for mitigating future ecological and socioeconomic impacts of climate change.

Issue:
The Northern Gulf of Mexico coast benefits from a wealth of natural resources and an economy that depends on healthy coastal ecosystems. However, these ecosystems are being threatened by projected increases in sea level rise (SLR) and hurricanes. The impacts of SLR on the Northern Gulf's coastal areas will be dramatic. Low lying coastal areas, including barrier islands that line the Gulf Coast, can be expected to experience increased levels of flooding, accelerated erosion, loss of wetlands and low-lying terrestrial ecosystems, and seawater intrusion into freshwater sources. Rising sea level and erosion will also affect coastal habitats including wetlands and nearshore ecosystems such as beaches, sedimentary bottoms, submerged aquatic vegetation and oyster reefs, thus imperiling critical habitats for many of the commercially important fisheries, which depend on inshore waters for either permanent residence or nursery area.

A healthy environment is important to the oyster industry Spartina Marsh Apalachicola NERRS.

Spartina Marsh Apalachicola NERRS.

Management/Policy Issues:
Agencies are struggling to balance the pressures of coastal development with the conservation and protection of the coastal environment. Predictions of increased hurricane activity and rising sea levels already threaten shoreline habitats as well as productive wetlands that are prevalent in the Gulf of Mexico. Due to common interests, the Gulf of Mexico Alliance (GOMA) joined together the five Gulf States in a coordinated approach to improve the health of their coastal ecosystems and economies in ways a single entity could not achieve. After Hurricane Katrina devastated the Gulf Coast, the need to work together as a single entity was affirmed. The GOMA Habitat Conservation and Restoration Priority Team (HCRT) focuses on coastal wetlands and estuarine ecosystems that are threatened by a combination of human activities and natural processes such as hurricanes, subsidence and localized SLR. The HCRT is working

closely with CSCOR in supporting competitive research to provide the scientific basis to improve coastal conservation and restoration processes. Prior to funding this project CSCOR planned and vetted this project for several years within NOAA, including Sea Grant, OCRM, CSC, NERRS, CO-OPS, NGS, CSDL, Fisheries and with the coastal research and management communities in Florida, Alabama, and Mississippi.

Approach:
A multidisciplinary team led by the University of Central Florida will assess the risk to coasts and coastal habitats from sea level rise and coastal storms. The research team includes an Application Principal Investigator to lead the effort transitioning the research information and tools toward management application, including leading a Science to Application Committee (STAC) and coordinating annual management workshops. The study area includes three National Estuarine Environmental Research Reserves (NERRS): Apalachicola FL, Weeks Bay, AL, and Grand Bay, MS. Field and laboratory experiments as well as resulting ecological models will center in these reserves. The five-year project will apply existing models of circulation, sediment transport and biogeochemistry from the watershed to the sea, including waves and erosion. The ultimate prediction will be of sediment loadings to the estuary as a result of overland flow, shoreline and barrier island erosion, and salinity transport in numerous bay systems, all of which will be used to model the evolution of intertidal marshes. These models will make use of existing bathymetric and topographic data and related data sets, as well as numerous ongoing synergistic activities. Field and laboratory experiments will result in data needed to parameterize marsh and oyster habitat models.

Sand used in beach restoration. Photo credit: Gulf of Mexico Alliance Governors' Action Plan.

Expected Outcomes:
Project outcomes will enable the management community to prioritize risk management strategies, identify restoration locations that can be sustained over the long-term, reformulate set back requirements, improve guidelines for construction of breakwaters and other coastal infrastructure, and assess water resources impacts and protection needs. Products of this research will include maps that delineate new tidal boundaries as a result of SLR, estimates of sediment loadings from overland runoff to estuarine systems, and erosion rates, projections of changes in critical habitats (e.g., salinity distributions, marsh, beach, shellfish, submerged aquatic vegetations, land cover) and water resource impacts. These products will allow for a comprehensive forward-looking assessment of coastal ecosystem change in response to SLR that is not possible with current tools.
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Research Partners:
This project is led by Dr. Scott Hagen of the *University of Central Florida*, and includes other researchers from *University of Florida*, *Florida State University*, *Northwest Florida Water Management District*, *the University of South Carolina* and *Dewberry, Inc*.