Geoscience in Coastal Ecosystem Restoration: Understanding Coast-Shelf Framework Geology, Offshore Sand Resources and Sedimentary Processes

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Abstract

Many U. S. coastal and nearshore regions have been altered and degraded by a wide variety of anthropogenic activities (e.g., dams, levees, dredging, sand mining, induced land subsidence, coastal engineering structures) carried out over the past 200 years. Many of these are having significant long term cumulative effects on coastal ecosystems. These activities primarily impact coasts by reducing the quality and quantity of sediment inputs, altering sediment transport processes, and accelerating sediment losses from the coast to the offshore. While these activities were done with good intentions, the often accompanying unintended consequences have resulted in anthropogenic effects on decadal and longer time scales and on spatial scales of 10s to 100s of square kilometers. The consequent impacts on coastal sediment budgets, combined with natural processes (e.g., storms, sea-level rise, sediment starvation), increase coastal zone dynamics and lead increasingly to higher risks and greater hazards for people and urban development in the coastal zone.

To mitigate coastal erosion and altered natural processes, system–wide ecosystem restoration is underway or being planned for many coastal regions, including San Francisco Bay, south Florida- Everglades and the Louisiana delta plain. However, planning and managing cost-effective and sustainable coastal restoration in Louisiana and elsewhere requires baseline information such as: scientific understanding of the entire coastal-wetland-inner shelf environment as an integrated system, including how the barrier coast, delta lobes, wetlands and shelf evolved during the Holocene transgression; and, how these systems are likely to respond to near-future coastal restoration and predicted accelerated sea-level rise and increased storminess.

Coastal-marine geoscientists have contributed significantly to understanding the history and evolution of coastal systems and the processes driving them, quantifying coastal change, and mapping the geomorphology and framework geology of offshore areas to assess and characterize the shelf sediments and locate and quantify marine sand resources. The continued integration of data and information from new technologies such as interactive mapping tools, hi-res geophysical surveys, Geographic Information Systems, Differential Global Positioning System navigation, sediment vibracores, integrated sediment data bases, and 3D morphodynamic models is critical for the success of ecosystem restoration underway in Louisiana, as well as other regions around the Nation.