

Case Study 14: Large-Scale Restoration of Barrier Island Systems and Cultural Resource Protection through Sediment Placement, *Gulf Islands National Seashore, Mississippi*

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Several Gulf Islands National Seashore barrier islands along the Mississippi coast will be restored as part of the Mississippi Coastal Improvements Program. Image credit: NPS.

Goals

The large-scale project known as the Mississippi Coastal Improvements Program (MsCIP) is intended to restore multiple barrier islands and protect cultural resources within Gulf Islands National Seashore by recreating sediment transport processes and replacing a portion of sediment lost to dredging and storm impacts.

Challenges and Needs

In 2005, Hurricane Katrina caused significant erosion of park barrier islands along the Mississippi Gulf Coast. These islands were already vulnerable due to impacts of regional dredging and earlier hurricanes. Since the late 1880s, navigation channels have been constructed and maintained in the area, disrupting sediment transport and availability to barrier islands that are now part of the park. Park barrier islands have lost 24–64% of their land mass since 1848 according to surveys, with the greatest losses on East and West Ship Islands. Ship Island was breached in 1969 by Hurricane Camille, creating Camille Cut and separating East Ship Island from West Ship Island. Hurricane Katrina expanded Camille Cut to 5 km (3 mi) in width and caused significant shoreline erosion around Fort Massachusetts on West Ship Island. To restore the geomorphic integrity of the islands, sediment is needed.

Expected climate change impacts, including relative sea level rise and increased storm frequency and intensity, will increase the vulnerability of the islands and associated natural and cultural resources (e.g., historic Fort Massachusetts and the French Warehouse archeological site). This will impair the island's ability to reduce the size of storm waves approaching the mainland, change the salinity regime that is currently favorable to oysters in the Mississippi Sound, and alter habitats that currently support migratory birds and endangered species such as sea turtles, Gulf sturgeon, and piping plovers.

Responsive Actions

The Mississippi Coastal Improvements Program, which began in 2007, is a large-scale project that will guide restoration of the barrier islands to reduce future storm and hurricane damage to the coastal area, minimize saltwater intrusion, protect fish and wildlife, and mitigate erosion. This project is led by the US Army Corps of Engineers (USACE) with the participation of numerous other agencies. The plan includes directly renourishing West Ship Island to protect Fort Massachusetts; renourishing East Ship Island and filling in Camille Cut to recreate a continuous Ship Island; and restoring the natural regional sediment transport processes by modifying future placement locations to better place material dredged from Horn Island Pass into the active littoral drift zone. Regional sediment transport processes will move sediment alongshore to renourish barrier islands to the west of the deposition site.

Project planning included science and modeling efforts, agency and political issues, and many opportunities for public input. The USACE has been very active in soliciting the assistance of partner agencies and team members with appropriate expertise. The project has progressed steadily, although it has, not unexpectedly, been slowed by the bureaucratic complexity of a multiagency and cross-jurisdictional project. Project implementation has also been delayed by the search for sediment sources that are of sufficient quality and quantity, including debate over whether it is appropriate to use an area known as Sand Island as a sediment source.

By 2011, approximately 0.4 million cubic m (0.5 million cubic yd) of sand had been pumped onto West Ship Island to complete the \$6 million north shore portion of the project. The draft supplemental environmental impact statement for the barrier island restoration portion of the MsCIP project was released in March 2014; dredging and nourishing costs are estimated at \$368 million. The southern (Gulf) shoreline of East Ship Island will be renourished with 4.2 million cubic m (5.5 million cubic yd) of sediment. Filling in Camille Cut to rejoin East and West Ship Islands will require approximately 10.3 million cubic m (13.5 million cubic yd) of sediment; this is intended to be a one-time effort with no additional placement planned as part of MsCIP if the cut breaches again after all of the fill has been placed.

Responsible management of the barrier island system requires additional data regarding the nearshore habitats and resources. The US Geological Survey mapped the nearshore seafloor between 2009 and 2013 to describe bathymetry, substrate, and underlying stratigraphy within the jurisdictional boundaries of the Gulf Islands National Seashore at East and West Ship, Horn, and Petit Bois Islands, Mississippi. The National Park Service (NPS) is monitoring the placement of sand on the eroded north shoreline of West Ship Island, where cultural resources are located. Other components of the project have not begun yet (such as the reintroduction of sand directly into the Camille Cut area) but monitoring, including sand tracer studies, will occur in those locations as well. The MsCIP monitoring and adaptive management plan (draft expected in September 2015) includes the use of monitoring results to guide future actions, such as changing the placement of sediment dredged from Pascagoula Pass and Horn Island Pass. In the long term, these areas will be monitored to understand whether the actions have been successful in accreting sand, recreating natural transport processes, and protecting cultural resources.

Project planning has taken more than seven years to complete. This case study is an example of the following adaptation strategies:

- Enhancing connectivity, migration corridors, and areas under protection external to the park
- Reducing non-climate stressors (e.g., sediment management)
- Coordinating planning and management across institutional boundaries
- Conducting/gathering additional research, data, or products
- Reintroducing and supporting natural processes (sediment transport and budget of the barrier island ecosystem)

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