

Protocol Development Summary

Protocol:

Monitoring Coastal Geomorphology and Landforms [short name: Coastal Dynamics]

Parks Where Protocol will be Implemented:

GUIS, PAIS

Justification/Issues being addressed:

Changing geomorphology (surface form; topography; elevation; dune volume; patterns of erosion and deposition; and shoreline position) is a high-priority vital sign for the two GULN barrier-island parks, GUIS and PAIS. Landform provides the physical foundation for all park surface ecosystems and natural resources, and changes dynamically as a result of changes in climate, relative sea level, storm events, and ongoing anthropogenic activities such as dredging, canalization, water withdrawal, and modifications in coastal sediment availability and distribution. Because coastal processes in the northern Gulf of Mexico impact both Gulf-side and bay side, and both winter storms and periodic hurricanes can alter the entire topographic make-up of these islands, the focus of this protocol is on monitoring whole-island changes in geomorphology, not simply shoreline position.

Specific Monitoring Questions and Objectives to be Addressed by the Protocol:

- Determine long-term trends in whole-island shoreline position, topography, sand volume, and patterns of erosion and deposition.

Basic Approach used in the GULN Vegetation Protocol:

The GULN approach to monitoring geomorphic change is based on the same airborne pulse lidar (Light Detection and Ranging) technology that will also be used to address multiple vegetation-related vital signs across network parks. For geomorphic monitoring, lidar will be used to create a three-dimensional, bald-earth topographic model of the mineral and water surface of sampled coastal landscapes. For details concerning the lidar system being used, topography mapping, and barrier island volumetric change see <http://ngom.usgs.gov/dsp/index.html>

Shoreline position change will also be measured using lidar data. Although there are several methods for defining shorelines from lidar data, we propose to use the method developed by USGS (Harris et al. 2006) and conduct the change analysis using the Digital Shoreline Analysis System (Thieler et al. 2009). For monitoring purposes, the exact method selected is not as important as applying the same technique consistently through time.

Data will be collected on yet-to-be-determined intervals, but are expected to be in the range of every 3-5 years, which will be consistent with other barrier island monitoring programs in the Gulf of Mexico. Ideally, data would not be collected immediately following severe storms. Realistically, however, the northern Gulf (and GUIS in particular) has been severely impacted by

a series of large hurricanes during the beginning of the current active hurricane period which began in 1995. By partnering with others who collect post-storm data, the GULN and NPS have been able to collect whole-island lidar datasets in a very cost-effective manner. In addition to contributing to long-term monitoring, these post-storm datasets help the parks with storm-recovery projects. The network will continue to support the parks with post-storm recovery and use these datasets for long-term monitoring until there is another mechanism to fund post-storm data collection. At that time, GULN will plan regular intervals between sampling events that are not associated with storms.

Principal Investigators and NPS Lead:

Protocol development is underway in collaboration with the USGS Coastal and Marine Geology Program (Dr. John Brock, Amar Nayagandhi). The GULN Network leads are Network Coordinator Martha Segura, GIS Specialist Jeff Bracewell, and Ecologist Dr. Robert Woodman.

Development Schedule, Budget, and Expected Interim Products:

Development of the coastal geomorphology protocol is linked directly to the GULN vegetation structure protocol since the same lidar data are used for both protocols. Documentation of lidar data collection and processing will be complete late in calendar year 2009. A draft protocol available for review is expected during FY2010.

Relevant Literature:

- Harris, M., J. Brock, A. Nayegandhi, and M. Duffy. 2006. Extracting shorelines from NASA airborne topographic lidar-derived digital elevation models: Reston, VA. U.S. Geological Survey Open-File Report 2005-1427. Available online at <http://pubs.er.usgs.gov/usgspubs/ofr/ofr20051427>
- Oakley, K. L., L. P. Thomas and S. G. Fancy. 2003. Guidelines for long-term monitoring protocols. *Wildlife Society Bulletin* **31**:1000–1002.
- Thieler, E.R., E.A. Himmelstoss, J.L. Zichichi, and Ayhan Ergul. 2009. Digital Shoreline Analysis System (DSAS) version 4.0—An ArcGIS extension for calculating shoreline change: U.S. Geological Survey Open-File Report 2008-1278. Available online at <http://pubs.usgs.gov/of/2008/1278/>.