



Using Advanced Mapping to Measure Changes in Mangrove and Seagrass Habitat over Time

Overview

In recent years, seagrass and mangrove deaths have accelerated in the Rookery Bay National Estuarine Research Reserve and other parts of southern Florida. Sea level rise, climate change, and severe weather (such as hurricanes) place significant stress on these habitats, which are already under pressure from urban development, road construction, boating, and pollution. The loss of these habitats poses a threat to the local economy, as they support the tourism and fishing industries, which drive economic development in local communities. In order to mitigate and reverse the damage to these habitats, Rookery Bay reserve staff are looking for new ways to measure which pressure has the most impact and determine the location and extent of damages.

In this project, staff from Rookery Bay Reserve are partnering with researchers at the University of South Florida College of Marine Science to study the degradation of underwater habitats and coastal wetlands. Using commercial satellite images from ultra-high-resolution cameras in space, laser topography maps collected from specialized aircraft (LIDAR data), and advanced high-speed computation, the team is updating existing habitat maps for the 110,000-acre reserve and creating new habitat maps. These maps will allow reserve staff to quantify changes to mangrove and seagrass habitats over the past decade and will guide reserve management priorities and future research on the causes of the decline.

Anticipated Benefits

- Improved understanding of how different pressures cause habitat change in Rookery Bay Reserve, including the damage and recovery that happens as a result of chronic and extreme events.
- Enhanced ability of managers from Rookery Bay Reserve and the adjacent Ten Thousand Islands National Wildlife Refuge to manage and restore seagrass and mangrove habitats.
- New high-resolution, automated mapping techniques that could be applied to other coastal areas.

Project Location

Rookery Bay National Estuarine Research Reserve, Florida

Project Duration

September 1, 2018 to August 31, 2019

Project Leads

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Project Type

Catalyst – Targeted investment for advancing collaborative science

Project Partners

- Rookery Bay National Estuarine Research Reserve
- University of South Florida

Project Approach

This project integrates the field knowledge of reserve staff and partners, including Ten Thousand Islands National Wildlife Refuge end users, and the habitat mapping and computational capabilities of the University of South Florida. Team members from the University of South Florida are currently developing mapping tools for other coastal habitats (including coral reefs) by combining high-resolution satellite images, field observations, and computer algorithms, and using high-speed computers to crunch these massive data quickly. The team is using these techniques to map seagrass and mangrove habitats in the reserve.

The project team will also conduct a field survey of the reserve, collecting GPS data to identify specific, target habitats to calibrate the satellite pictures. These habitats include seagrass, sand or mud bottom, hard bottom, forested mangrove, marsh grass, beach, salt flat, upland vegetation, and developed land. New and prior field research will help train algorithms to map land cover types within the reserve for 2010, 2016, 2017, and 2018. Simultaneously, the team will use LIDAR data to produce Digital Elevation Models, which will be used to simulate and better predict patterns of water flow that may improve or harm the health of coastal vegetation.

Finally, the team will process the LIDAR and satellite data to create a 2010 baseline map and series of annual terrestrial and nearshore ocean bottom (benthic) habitat maps for the 2016 to 2018 period. Field surveys and expert knowledge of the habitats will be used to evaluate uncertainties in the maps. The team will compare maps from different years to measure change in these habitats over time and pinpoint the causes of change. The timing, extent, and location of changes will be recorded and shared with reserve partners and the public to identify opportunities for mitigation. Other reserves will be able to use the methods developed by the team, so the benefit can be transferred nationally.

Targeted End Users and Anticipated Products

The primary end users are Rookery Bay Reserve and Ten Thousand Islands National Wildlife Refuge, which overlaps with the reserve and is facing similar habitat degradation. Secondary end users include the United States Geological Survey, the U.S. Marine Biodiversity Observation Network, and other local, state, and federal partners. To inform coastal management, the team is developing the following mapping products:

- A baseline habitat map based on 2010 observations
- Annual habitat maps for the years 2016 to 2018
- Habitat-change maps indicating extent, location, and timing of habitat change
- Models of land surface elevations and hydrology
- Field observations used to validate maps

About the Science Collaborative

The National Estuarine Research Reserve System's Science Collaborative supports collaborative research that addresses coastal management problems important to the reserves. The Science Collaborative is managed by the University of Michigan's Water Center through a cooperative agreement with the National Oceanic and Atmospheric Administration (NOAA). Funding for the research reserves and this program comes from NOAA. Learn more at coast.noaa.gov/nerrs or graham.umich.edu/water/nerrs.