Is Marsh Surface Tracking Sea Level Change? Developing Tools and Visualizations for Sentinel Site Data

Project Location

Eight National Estuarine Research Reserve sites on the East, West and Gulf Coasts

Project Duration

September 1, 2018 to August 31, 2019

Project Lead

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Project Type

Catalyst – Targeted investment for advancing collaborative science

Project Partners

- Chesapeake Bay National Estuarine Research Reserve, Virginia
- Delaware National Estuarine Research Reserve
- Elkhorn Slough National Estuarine Research Reserve, California
- Grand Bay National Estuarine Research Reserve, Mississippi
- Mission-Aransas National Estuarine Research Reserve, Texas
- Padilla Bay National Estuarine Research Reserve, Washington
- South Slough National Estuarine Research Reserve, Oregon
- Waquoit Bay National Estuarine Research Reserve, Massachusetts

Overview

Coastal marshes provide a range of valuable ecosystem services, including buffering coastlines from storms, improving water quality, and providing habitat to a wide range of organisms. However, marshes are increasingly under threat from sea level rise, and coastal managers are struggling to understand if different marsh plant communities can keep pace, or are likely to drown with the rising seas.

To better understand the local impacts of climate change, the National Estuarine Research Reserve System expanded their long term monitoring efforts to include a Sentinel Site Application Module. A centerpiece of the Sentinel Site program is the use of highly specialized equipment—called Surface Elevation Tables, or SETs—to precisely measure and track changes to the marsh surface height over time. However, handling, analyzing, and interpreting Surface Elevation Table data is challenging and requires skills and statistical techniques that have not been standardized.

The reserve system has identified a need to increase its collective capacity to process and synthesize Surface Elevation Table data and to create visualizations and educational tools for scientists, managers, and the public. This project addresses these needs by developing standardized tools to quality-check Surface Elevation Table data, perform trend analyses, and generate informative visualizations for a variety of technical and non-technical audiences. The team's collaborative approach to developing statistical methods and outreach products will build both technical expertise and broader understanding of how the data can be used to better understand how sea level rise is impacting marshes.

Anticipated Benefits

- Increased ability of the reserves to use Sentinel Site data and inform local audiences about the impacts of sea level rise on coastal ecosystems.
- Enhanced technical capacity within the reserve system to analyze and synthesize Sentinel Site data in a standardized way.
- Improved ability of education and coastal training staff to interpret and communicate changes in marsh surface elevation to decision makers and non-technical audiences.

Project Approach

The project team, comprised of technical and outreach sub-teams, includes representatives from multiple reserves across the country and staff from all of the core reserve programs, including coastal training, education, research, and stewardship. To ensure the project meets current reserve needs, the project team will host a kickoff call to discuss the proposed project outputs and solicit feedback. The technical sub-team will begin by developing R software scripts, visualizations, and analyses of Surface Elevation Table data for a subset of reserves, using Grand Bay Reserve's existing R scripts as a starting point. They will regularly consult a statistician throughout the process. The technical sub-team will collaboratively test the developed R scripts and troubleshoot any issues at a workshop hosted at Grand Bay.

Midway through the project, the team will provide examples of their developed outputs and invite other reserves to submit their Surface Elevation Table data for analysis. Participating reserves will receive assistance with data reformatting, reserve-specific reports, and outreach tools, and the project team will compile these analyses into a national synthesis.

The project will culminate in a two-day workshop dedicated to sharing statistical methods with others involved in analyzing similar data from their monitoring programs. A half-day virtual training will be held to share outreach products and discuss their applications in coastal training and education programs.

Targeted End Users and Anticipated Products

Primary end users are staff at the 26 reserves that are currently conducting Sentinel Site work. Project outputs will also be useful for those in the broader coastal research and management community, including the U.S. Fish and Wildlife Service, National Park Service, and NOAA's Sentinel Site Cooperatives. The project team will produce a series of technical tools to help reserve staff analyze Surface Elevation Table measurements to understand how elevation of the vegetation plain compares to regional and local sea level rise over time. The tools include the following:

- Recommendations for quality control procedures and R software scripts to implement them;
- Surface Elevation Table data reformatted into a standardized format for participating reserves;
- Recommendations on appropriate statistical analyses for the data with accompanying R code;
- Data visualizations for reserves and non-technical audiences;
- Training on all produced tools; and
- A national synthesis report that integrates data from participating reserves on marsh surface elevation versus sea level rise trends.

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National Estuarine Research Reserve System