



Evaluating the Impact of Hydrologic Alterations on Salt Marsh Sustainability in a Changing Climate

Overview

Coastal managers are faced with the challenge of managing marsh hydrology in a way that meets human health needs, optimizes ecosystem services, and supports sustainability. In New England this includes accounting for the effects of ditches that were dug decades ago in 90% of the region's salt marshes.

Ditches increase marsh drainage and reduce the spatial extent of shallow pools that may represent physical loss of buried soil carbon. However, efficient drainage may reduce the long-term sustainability of marshes by altering below ground biogeochemical and physical processes in a way that results in subsidence and lowered marsh elevation. Managers, restoration practitioners, and scientists at the Waquoit Bay National Estuarine Research Reserve, Woods Hole Oceanographic Institution, U.S. Geological Survey, U.S. Fish and Wildlife Service, National Park Service, and the Cape Cod Mosquito Control Project have expressed a need to understand the tradeoffs of hydrologic management strategies (i.e., ditch remediation, density, maintenance) and identify actions that will achieve user-specified outcomes— such as drainage, maintaining elevation, and carbon burial.

This project is a collaboration between scientists and end users to develop decision-support tools for marsh hydrological management strategies that promote sustainability and delivery of valuable ecosystem services under future sea level scenarios.

Project Location

Waquoit Bay National Estuarine Research Reserve

Great Barnstable Marsh

Project Duration

November 2017 to October 2019

Project Lead

Amanda Spivak
Woods Hole Oceanographic Institution
(508) 289-4847
aspivak@whoi.edu

Project Type

Collaborative Research – generating science that informs decisions

Project Partners

- Cape Cod Mosquito Control Project
- Louisiana State University
- National Park Service
- United States Fish and Wildlife Service, Rachel Carson National Wildlife Refuge
- United States Geologic Survey
- Waquoit Bay National Estuarine Research Reserve
- Woods Hole Oceanographic Institution



Anticipated Benefits

- Informed decision-making process whereby end users can test out various management options before implementation by evaluating outputs from the decision-support tool. This has the potential to give end users greater confidence and certainty in applying management strategies.
- Enhanced communication and understanding among managers, end users, and the science team. Regular communication between the science team and managers will help build relationships and trust, which will facilitate future collaboration.
- Support more effective management of salt marsh hydrology through sustained engagement with end users, development of tailored communication materials, and a decision support tool.

Project Approach

End users will be integrated into every step of the project through a collaborative learning process. Throughout, end users will bring their knowledge and expertise as part of a multidisciplinary problem solving approach to addressing complex environmental problems. The core research questions of the project are

1. How are metrics of marsh ecosystem services (plant productivity, carbon storage) and sustainability (elevation, pooled area, accretion rates) affected by ditch density and tidal range?; and
2. How do hydrologic management approaches—ditch infilling, naturalization, maintenance, remediation; runnels; and thin layer deposition—interact with sea level and tide range to affect marsh sustainability?

To address question one, the team will characterize plant communities and measure soil carbon storage and accretion rates, marsh elevation, and pool dimensions in the macrotidal Great Barnstable Marsh and the microtidal Waquoit Bay Sage Lot Pond Marsh, both in Massachusetts. Spatial, vegetation, soil, and water table data will be integrated into a Marsh2D model to address question two. Results from field, lab, and modeling research will be synthesized to create decision-support tools that allow end users to assess the tradeoffs of hydrologic management decisions.

Targeted End Users and Anticipated Products

End users include the Waquoit Bay Research Reserve, Cape Cod Mosquito Control Project, U.S. Fish and Wildlife Service, and the National Park Service. Outputs include activities and products that are informed by and responsive to end user needs, answer the research questions, and communicate findings to a broad community. They include

- An evaluation and synthesis of end user knowledge gaps and decision making needs;
- Scientific data sets and results;
- Communication materials (graphics, web, and print publications);
- A freely-accessible, web-based decision-support tool; and
- A case study documenting the use of the decision-support tool in assessing ecosystem services tradeoffs of management decisions.

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.