

# VALUING THE BENEFITS PROVIDED BY MARSHES AND LIVING SHORELINES TO COASTAL COMMUNITIES

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## Background

Coastal and estuarine marsh habitats provide important benefits to coastal communities. These benefits, such as carbon storage, nutrient removal, fish habitat provision, recreation opportunities, aesthetics, and reduction in storm damages, are often referred to as ecosystem services. Changing climate conditions and human stressors are threats to marsh habitats and their ability to provide valued services. The increasing rate of sea level rise is causing increased marsh migration and loss (Mitchell et al. 2017). Loss of marsh habitat is especially prevalent in areas where marsh migration pathways are limited.



Coastal development and hard shoreline modification for erosion control, such as the installation of bulkheads and revetments, lead to the reduction of natural resilience and adaptive capacity of coastal environments (Sutton-Grier et al. 2015). In order to prevent erosion while still protecting the resiliency of coastal environments, nature-based solutions may be utilized. Nature-based coastal protection approaches that restore or protect salt marsh as a means to reduce erosion and storm damage (*living shorelines* henceforth) can help mitigate some of the anticipated loss or degradation of marshes from climate and anthropogenic stressors, in particular sea level rise. For additional information about living shorelines, please visit: [https://www.vims.edu/ccrm/outreach/living\\_shorelines/](https://www.vims.edu/ccrm/outreach/living_shorelines/)

Understanding and communicating the value of coastal and estuarine marsh ecosystem services can help with shoreline management and restoration decisions because one can evaluate tradeoffs of different interventions, such as is there greater community benefit to restoring a marsh in one location or another. Restoration decisions often are made at more local scales, requiring interdisciplinary ecosystem service valuation approaches that can reflect local conditions and human perceptions and values. Spatial variation in ecosystem service values arises from both differences in site-dependent ecosystem function and processes, as well as differences in human use and preferences (De Valck and Rolfe 2017).

We combined economic valuation techniques with human use and preference surveys, local ecological function data, and physical and geospatial modeling to estimate the value and spatial variation in ecosystem service benefits for marsh and living shorelines within understudied rural coastal communities in Chesapeake Bay, Virginia, USA.

## This Study

1. Estimated the monetary value of ecosystem service benefits provided by marshes & living shorelines for local communities in the Middle Peninsula, Virginia.
2. Developed an interactive web-based tool, **SHORE-BET: MARSH RESTORATION COASTAL COMMUNITY BENEFIT TOOL**, that calculates gained ecosystem and community benefits for marsh restoration projects. This tool is intended to support planning, reporting, and restoration prioritization.

### Project Overview

This project estimated the monetary value of ecosystem service benefits provided by marshes & living shorelines for local communities in the Middle Peninsula, Virginia. Values were integrated into an interactive web-based tool, **SHORE-BET: MARSH RESTORATION COASTAL COMMUNITY BENEFIT TOOL**, that calculates gained ecosystem and community benefits for marsh restoration projects.

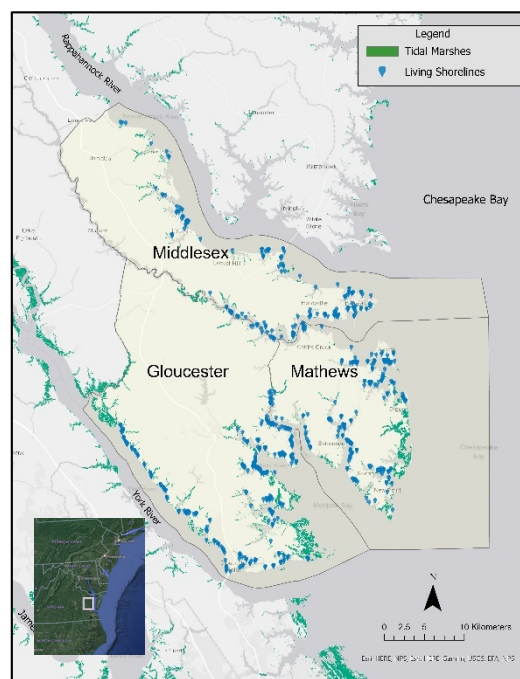
**SHORE-BET** calculates the economic value of select key coastal community benefits to be gained by using living shoreline techniques that restore marshes. This tool helps to account for these ecosystem services so that coastal communities can be better informed when making decisions impacting their environment, economy, and overall quality of life. The geographic focus of this is the counties along the Chesapeake Bay within the Middle Peninsula, Virginia (Gloucester, Mathews, Middlesex); however, the approaches behind the tool can be transferred to other regions.



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## Study Area

The Middle Peninsula is a large peninsula in Virginia on the western shore of the Chesapeake Bay. Lying between the York and Rappahannock Rivers, the region includes six counties: Essex, Gloucester, King and Queen, King William, Mathews, and Middlesex. The Middle Peninsula is largely rural, home to just over 90,000 individuals (U.S. Census Bureau 2023) and with an economy that is reliant on natural resources. Key industries include agriculture, forestry, commercial fisheries, aquaculture, and tourism. In 2022, the National Oceanic and Atmospheric Administration (NOAA) selected the Middle Peninsula of Virginia as one of ten “Habitat Focus Areas” (HFAs) across the country. HFAs are locations where habitat restoration activities and resources are targeted to have the greatest impact, increase coastal community resiliency, and advance habitat science and conservation efforts. This study focused on the counties directly adjacent to the Chesapeake Bay (Gloucester, Mathews, Middlesex).



Middle Peninsula, Virginia with a population of ~90,000 people has over 12,000 acres Tidal Marsh and more than 500 living shorelines

## Approach

This project estimated the economic value of community benefits derived by tidal marshes and restored living shoreline marshes from the following ecosystem services: storm/flood risk reduction, fish habitat provision, nutrient removal, carbon storage, and recreational fishing. While this list is not exhaustive, it captures many of the key services providing marsh ecosystem service value in the study region.

We conducted a literature review to determine the mean dollar value per acre per year for each ecosystem service. Ecosystem service values were applied to the study region with location-specific adjustments when sufficient local information was available (e.g., values were adjusted on the basis of marsh sizes and shapes or proximity to public access). Recreational benefits were determined from a survey of recreational fishers in the Middle Peninsula that quantified habitat use and willingness to pay. Detailed methods for each ecosystem service value estimation can be downloaded from the SHORE-BET Tool (*Calculation Info*).

Ecosystem service values for marshes were integrated into a web-based tool, SHORE-BET. This tool allows a user to input basic information on the size and location of a proposed or existing salt marsh restoration project (often living shorelines) and it outputs the annual and projected 30-year benefits derived from the restoration. The projected 30-year value for each benefit is determined by multiplying the annual value by a discount factor that adjusts future values to today's dollars. The weight factor applied was 22.39646, which is the 30-year weight factor with a 2% discount rate, *source: Circular No. A-4, The White House, Nov 2023*.



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## SHORE-BET Tool Outputs and Uses

The SHORE-BET tool provides the following outputs for each project:

- annual and projected 30-year benefits for each ecosystem service
- the total projected 30-year value for the bundle of services
- total shoreline length protected
- marsh area protected/restored
- relative rankings for public access, storm exposure, fish habitat quality, social vulnerability, and population per square mile for the project location
- Amount of pollutant load reduction (nitrogen, phosphorus, and suspended sediment)



Included is an option to generate a report that contains all the above information and a map of the project location. The project location map includes options to display existing living shoreline projects in the vicinity, public water access locations, and parcel boundaries. The information can then be easily transferred for use in project reports, proposals, or other communication outlets.

The SHORE-BET tool may be beneficial for groups involved in fisheries management, shoreline restoration, coastal planning, and technical guidance. The SHORE-BET tool serves as a method to plan and prioritize restoration projects, acquire grant funding, and raise awareness of living shoreline and marsh ecosystem benefits for the broader community.

## Findings

Within the Middle Peninsula,

- Total ecosystem service benefits provided by marshes and living shorelines amounted to **~\$87.6M per year**
- The **highest value is attributed to storm risk reduction benefits** provided by marshes and community partners ranked this service to be most important
- Marsh and living shoreline habitats are the most used shoreline habitats by recreational fishers and generate more than **3X the value** when compared to armored shores
- Marshes and living shorelines in the Middle Peninsula were estimated to yield **\$19,785.09/hectare/yr** in community benefits

## Publications

Scheld et al. 2024. Valuing shoreline habitats for recreational fishing. Ocean & Coastal Management.

<https://doi.org/10.1016/j.ocecoaman.2024.107150>



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### Citations

Mitchell, M., Herman, J., Bilkovic, D.M. and Hershner, C., 2017. Marsh persistence under sea-level rise is controlled by multiple, geologically variable stressors. *Ecosystem Health and Sustainability*, 3(10), p.1379888. <https://doi.org/10.1080/20964129.2017.1396009>

Sutton-Grier, A. E., Wowk, K., & Bamford, H. A. (2015). Future of our coasts: The potential for natural and hybrid infrastructure to enhance the resilience of our coastal communities, economies and ecosystems. *Environmental Science & Policy*, 51, 137–148. <https://doi.org/10.1016/j.envsci.2015.04.006>

U.S. Census Bureau. (2023). *Census Bureau tables*. <https://data.census.gov/table?g=050XX00US51057,51073,51097,51101,51115>

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### For More Information

**Project:** [https://www.vims.edu/ccrm/research/climate\\_change/adaptation/eco-services/index.php](https://www.vims.edu/ccrm/research/climate_change/adaptation/eco-services/index.php)

**SHORE-BET Tool:** <https://cmap22.vims.edu/ShoreBet/>



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