

FY21 RSM IPR



Marsh Equilibrium Model Trail Guide Abigail Eilar, Brandon Boyd, & Candice Piercy; ERDC

Goal:

Create a Marsh Equilibrium Model trail guide to serve as a tool for practitioners in the planning process of restoration projects.

Objectives

- Promote beneficial use dredge material
- Create a tool for the planning process of restoration efforts
- Explore different thin layer placement (TLP) scenarios
- Produce interactive and informative form of trail guide that serves as data storage

Approach

- Marsh Equilibrium Model to run simulations for GUI
- Use R Shiny to produce accessible web GUI





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Leveraging/Collaborative Opportunities

DOER BU in SFB

FY20 RSM BU Planning (SAM)

Stakeholders/Partners

USACE Dredging Community

University of South Carolina

Trail Guide for Practitioners: A Virtual, Interactive, and Informative Tool for the Marsh Equilibrium Model (MEM)
 Abigail Eilar ^{1,2}, Brandon Boyd ¹, Candice Piercy ¹, & Jim Morris ³

Introduction

- Success of a marsh depends on numerous factors: rate of subsidence, climate, sediment supply, and elevation.
- Marshes provide environmental services that help create resilient and diverse coastlines which promote utilization by a wide array of species.
- Marshes are currently facing numerous ecological and anthropogenic factors: rising sea levels, increasing strength and frequency of storms, and a decrease in sediment availability.
- Marshes are at risk of loss of marsh function, degradation, and possible drowning.
- As risks to marsh survival increase, knowledge and tools to protect and maintain marshes for the future are detrimental.
- As part of the USACE mission and vision, it is our goal to collaborate with partners to achieve a common goal of finding engineering solutions to some of our biggest challenges and reduce the risk for the future.

Marsh Equilibrium Model (MEM)

The Marsh Equilibrium Model (MEM) is a tool that helps predict salt marsh sustainability by using variables that drive salt marsh function (e.g. sea-level rise, biomass productivity, and accretion rates) to understand how anticipated environmental and anthropogenic changes will impact salt marsh elevation. Due to its complexity, the MEM Trail Guide was created to provide a simplified version that can be used by more individuals without the need of an individual familiar with MEM. The MEM Trail Guide provides in-depth summaries about the parameters used in the MEM, why they are important to marsh dynamics, and how we can use them to inform action.

Thin Layer Placement

Thin layer placement (TLP) is a method of utilizing the beneficial state of dredged material (SLUDG) to restore eroding and deteriorating marshes through increasing elevations. The most common method of TLP hydraulically sprays sediment at high pressures on the marsh area which helps to mimic natural sediment influences of sediment from events such as storms. The optimal thickness of the sediment layer is site-specific and will vary with elevation goals, type of habitat, and characteristics of the site.

Marsh Equilibrium Model Summary

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Simulation Site Description: Grand Bay Estuary

Situated in the Northern Gulf of Mexico, of the MSAL border, lies Grand Bay National Estuarine Research Reserve one of the most diverse and productive habitats. The 20th century brought landscape changes to Grand Bay due to the diversion of its sediment source, the Escatawpa River, and the erosion of Grand Batture which serves as a protective barrier island. Erosion has occurred due to natural tidal and wave action in addition to damage by hurricanes like other areas in the Mississippi Sound.

Screenshots from Trail Guide GUI

MEM Scenarios: Grand Bay Marsh Response

Plot Information: This plot shows how marsh variables responded to changes in sea-level rise, elevation, and channelized water discharge over time. Channel flow, development of a protective barrier, and changing the size of variables, different marsh responses can be compared.

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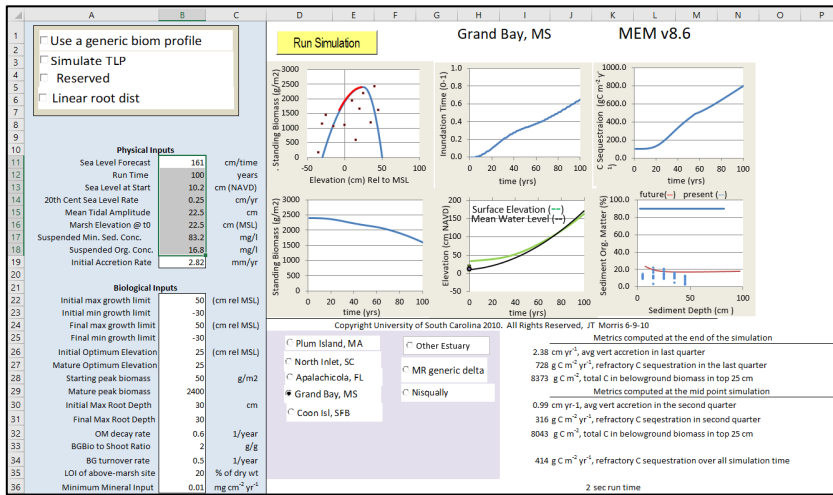
Future Studies

- Continue to implement trail guide and GUI in restoration efforts
- Have GUI reflect multiple locations for the simulation page
- Create a Python version



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Marsh Equilibrium Model Trail Guide



Menu

Introduction

MEM Variables

Optimal Elevation

Overview and Importance

Optimal elevation for growth describes the elevation conditions that will promote the most growth by plants. The magic number of the optimal elevation varies within and between marshes and therefore understanding site-specific conditions is crucial in determining the optimal elevation.

Role in MEM

Vegetation

Optimal Elevation

Accretion

Root to Shoot Ratio

Organic Matter (OM) Decay

Suspended Organic Concentration (SOC)

Suspended Sediment Concentration (SSC)

Sea Level

Inundation

Marsh Surface Elevation

Thin Layer Placement

Simulations

Relevant Literature

About

Accomplishments

- Completion of draft trail guide with in-depth explanation of MEM variables with references
- Completion of GUI with simulations for Grand Bay Estuary
- Completion of poster for ASBPA National Coastal Conference
- **Publication: Beneficial Use Decision Support for Wetlands: Case Study for Mobile Bay, Alabama in Journal of WW, Port, Coastal, and Ocean Engineering Sep 2021

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What challenges did you face to get your project to implementation and how did you move past them? If not yet implemented, what is your path forward to construction? What were your lessons learned that you think might benefit other Districts?

- Finding location specific data on sea-level rise, elevation, and accretion to show low, intermediate, and high scenarios of each variable
- Time constraints on providing more than one location in GUI; this is a long-term goal
- Learning R Shiny package simultaneously with MEM and how to best approach the GUI

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**How is this project benefiting the USACE and Nation?
(efficiency, monetary, technical, relationship building, outreach, etc.)
(Volume of sediment to be managed, Acres created, etc)**

- Enable and promote beneficial use dredge material
- Supplementary tool that can be utilized by practitioners not familiar using MEM
- Tool informs on how to best utilize BUDM (how much sediment should be used and how often) and understand how locations may differ