TLP: Ecological/Environmental Considerations and Select Case Studies

Rachel Innocenti, Ph.D.

Rusty Feagin, Ph.D.

Texas A&M University

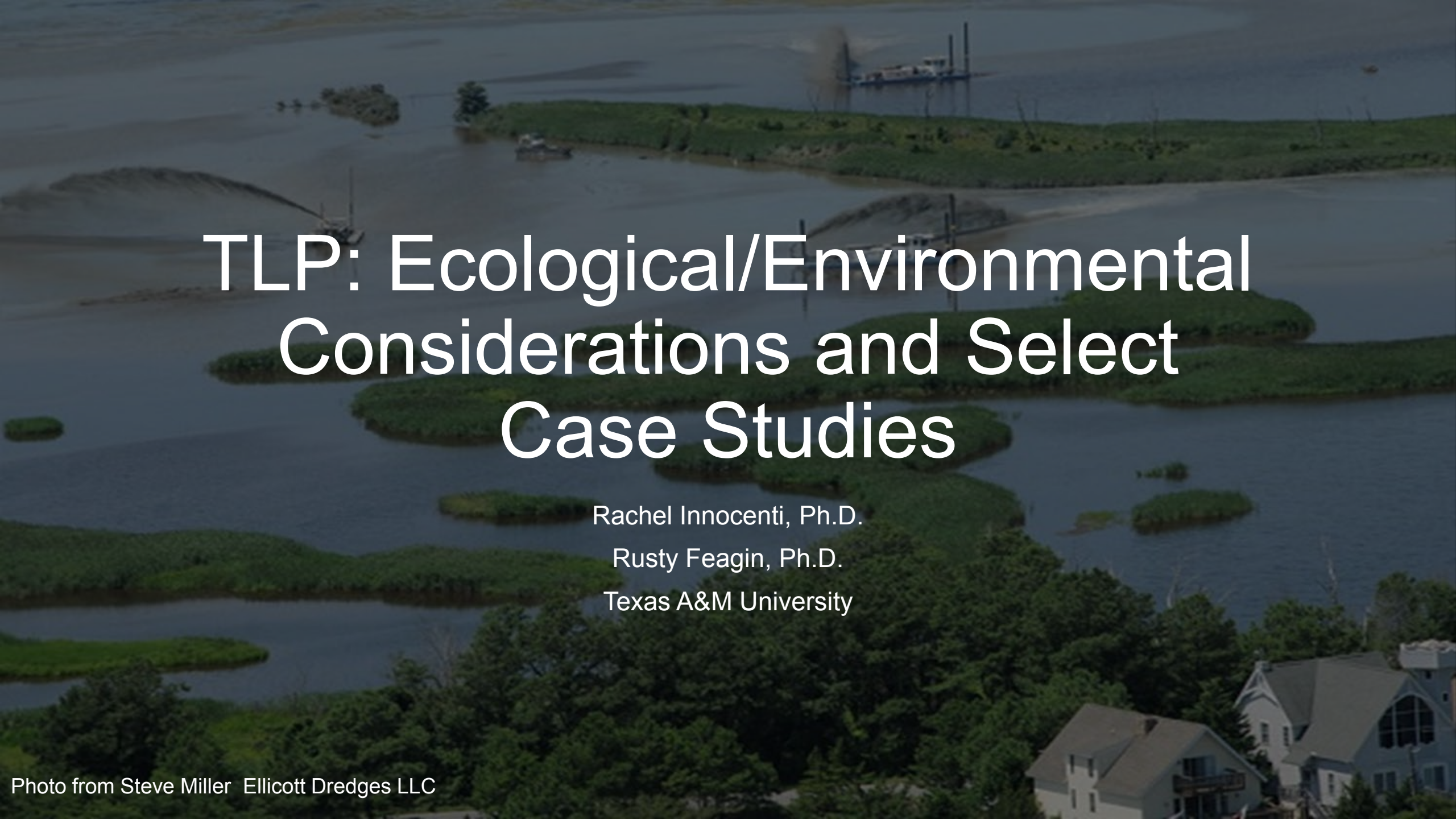
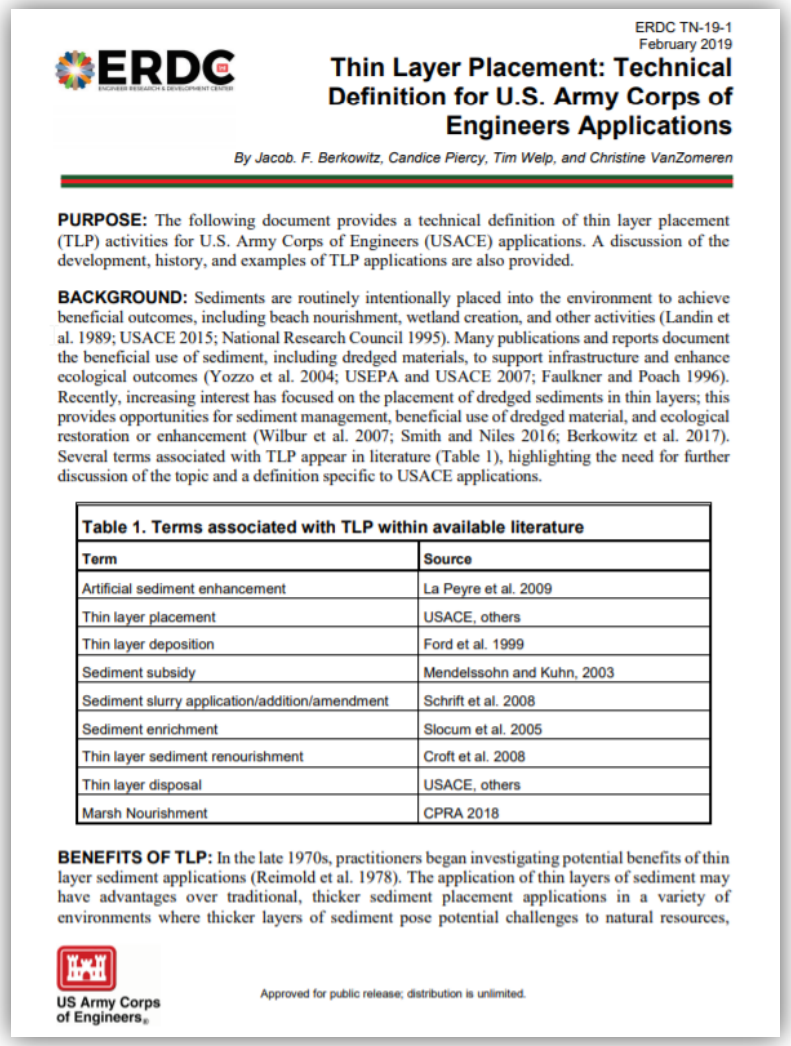


Photo from Steve Miller Ellicott Dredges LLC

Definition

- Purposeful placement of thin layers of sediment (e.g., dredged material) in an environmentally acceptable manner to achieve a target elevation or thickness (Berkowitz et al. 2019).
- Thin layer placement projects may include efforts to support infrastructure and/or create, maintain, enhance, or restore ecological function (Berkowitz et al. 2019).



ERDC TN-19-1
February 2019

ERDC

Thin Layer Placement: Technical Definition for U.S. Army Corps of Engineers Applications

By Jacob. F. Berkowitz, Candice Piercy, Tim Welp, and Christine VanZomeren

PURPOSE: The following document provides a technical definition of thin layer placement (TLP) activities for U.S. Army Corps of Engineers (USACE) applications. A discussion of the development, history, and examples of TLP applications are also provided.

BACKGROUND: Sediments are routinely intentionally placed into the environment to achieve beneficial outcomes, including beach nourishment, wetland creation, and other activities (Landin et al. 1989; USACE 2015; National Research Council 1995). Many publications and reports document the beneficial use of sediment, including dredged materials, to support infrastructure and enhance ecological outcomes (Yozzo et al. 2004; USEPA and USACE 2007; Faulkner and Poach 1996). Recently, increasing interest has focused on the placement of dredged sediments in thin layers; this provides opportunities for sediment management, beneficial use of dredged material, and ecological restoration or enhancement (Wilbur et al. 2007; Smith and Niles 2016; Berkowitz et al. 2017). Several terms associated with TLP appear in literature (Table 1), highlighting the need for further discussion of the topic and a definition specific to USACE applications.

Table 1. Terms associated with TLP within available literature

Term	Source
Artificial sediment enhancement	La Peyre et al. 2009
Thin layer placement	USACE, others
Thin layer deposition	Ford et al. 1999
Sediment subsidy	Mendelssohn and Kuhn, 2003
Sediment slurry application/addition/amendment	Schrift et al. 2008
Sediment enrichment	Slocum et al. 2005
Thin layer sediment renourishment	Croft et al. 2008
Thin layer disposal	USACE, others
Marsh Nourishment	CPRA 2018

BENEFITS OF TLP: In the late 1970s, practitioners began investigating potential benefits of thin layer sediment applications (Reimold et al. 1978). The application of thin layers of sediment may have advantages over traditional, thicker sediment placement applications in a variety of environments where thicker layers of sediment pose potential challenges to natural resources,

US Army Corps of Engineers

Approved for public release; distribution is unlimited.

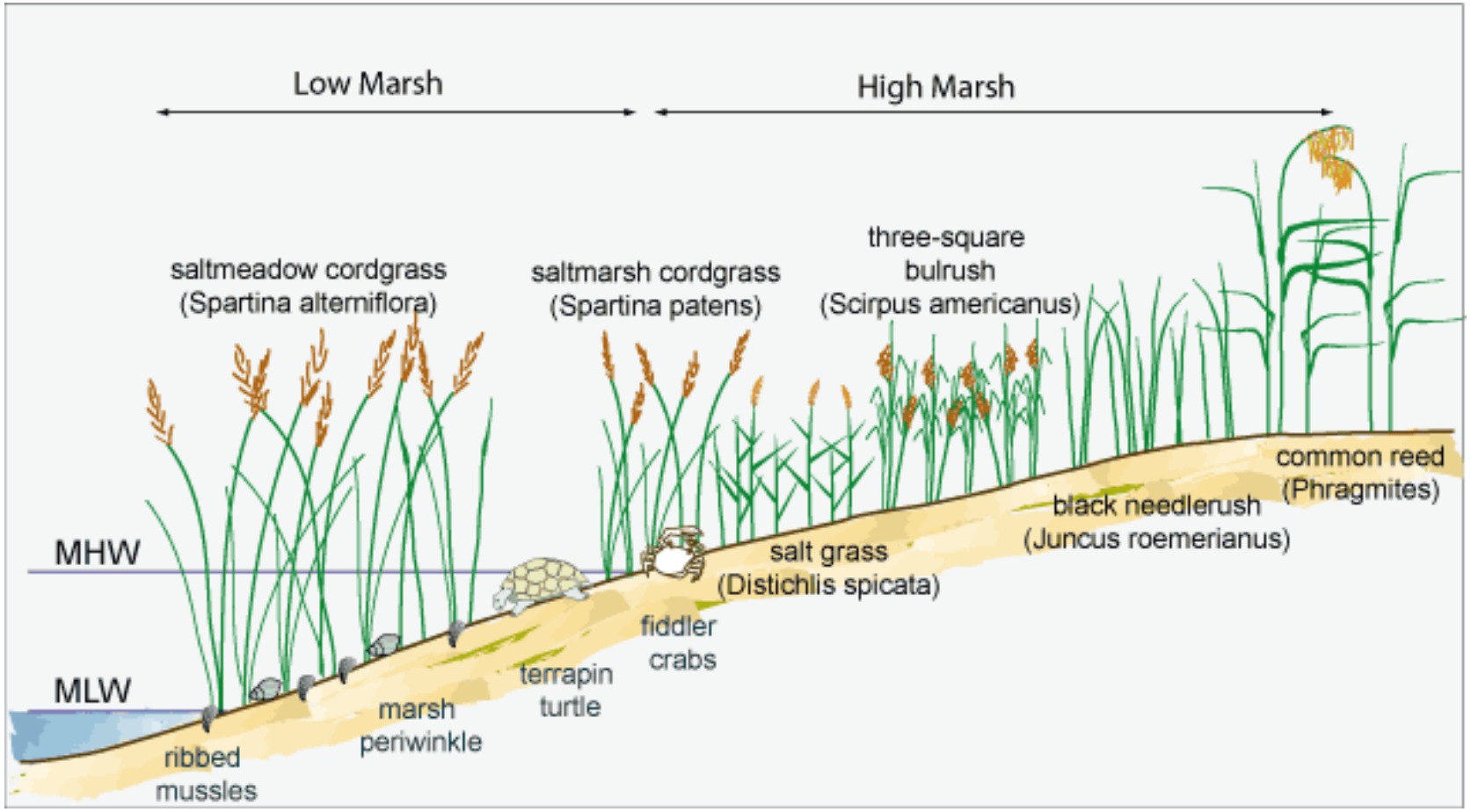
Slide provided by: Damarys Acevedo-Mackey, PE
Environmental Engineer, US Army Engineer Research and Development Center, Environmental Engineering Branch

Current Status of TLP Projects

- Relatively new method of beneficial use of dredge material
- Little formal guidance (new guidance in development)

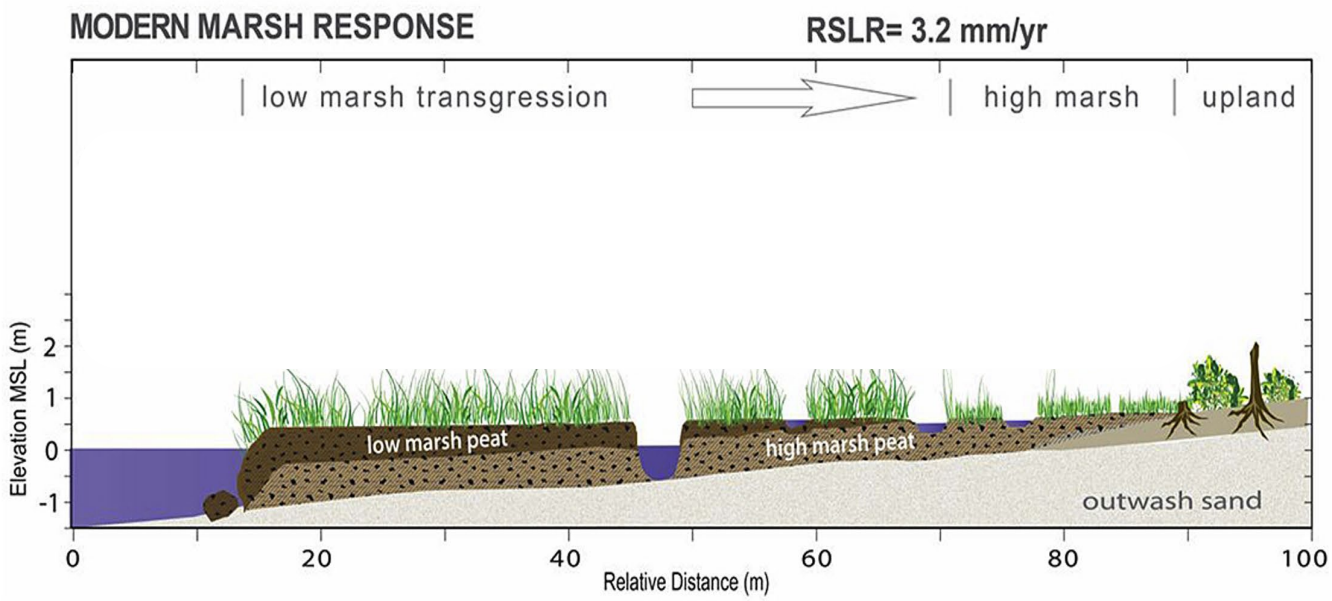
Photo credit: Robert Randall, Ph.D.
Professor Emeritus, Ocean Engineering, Texas A&M University

Salt Marsh Structure and Function

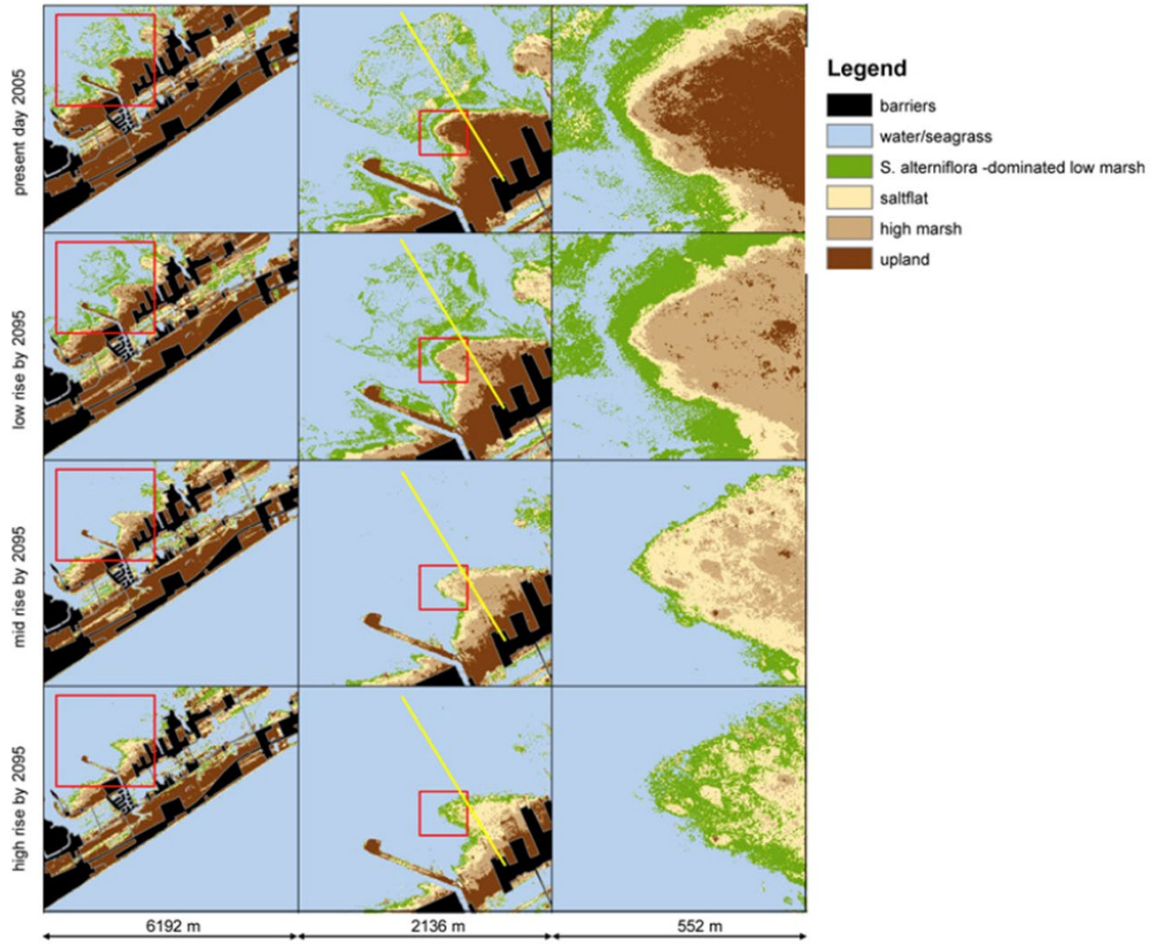


Salt-marsh zonation depends on the tidal elevation gradient, with species that are adapted to the inundation frequency, including extreme flooding and storm events. Picture: Larsen et al., USGS Open-file Report 04-1302.

SLR and Salt Marsh Structure and Function



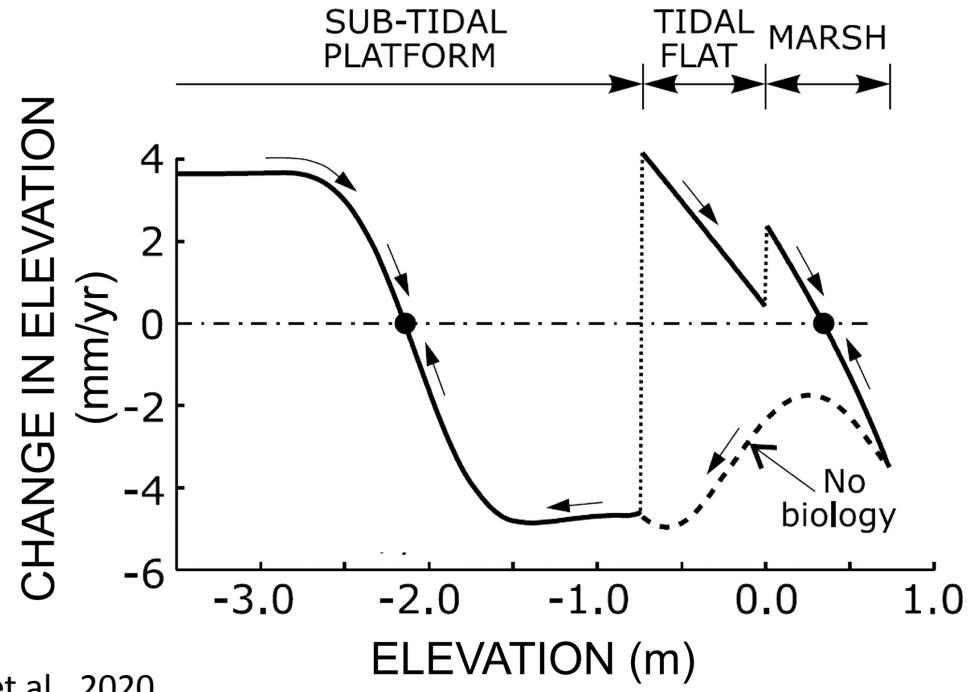
Gonneea et al., 2019. *Salt marsh ecosystem restructuring enhances elevation resilience and carbon storage during accelerating relative sea-level rise*. Estuarine, Coastal and Shelf Science, 217, 56-68.



Feagin et al., 2010. *Salt Marsh Zonal Migration and Ecosystem Service Change in Response to Global Sea Level Rise: A Case Study from an Urban Region*. Ecology and Society, 15(4), 14.

TLP and Salt Marsh Restoration

- Placement depth not restrictively defined
- Wetlands nourishment ~ 6 inches thick
- Mobile Bay thin layer – 6 to 12 inches thick
- Wetlands and island creation > 12 inches



Fagherazzi et al., 2020.

TLP and Salt Marsh Restoration

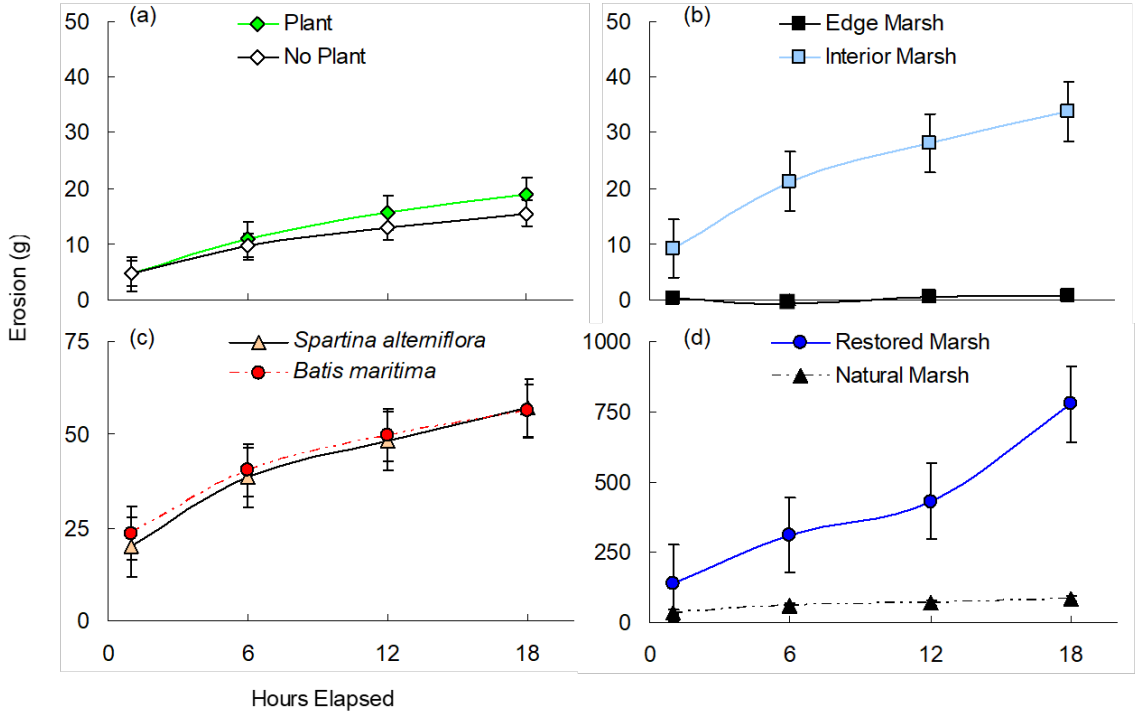
Before Sedimentation

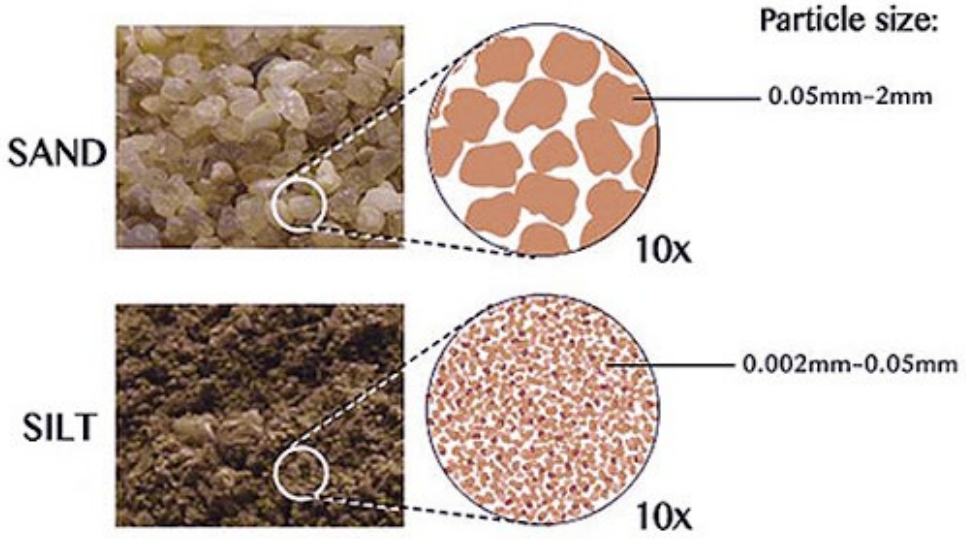
After Sedimentation

TLP and Salt Marsh Restoration

Other considerations:

- Sediment grain size



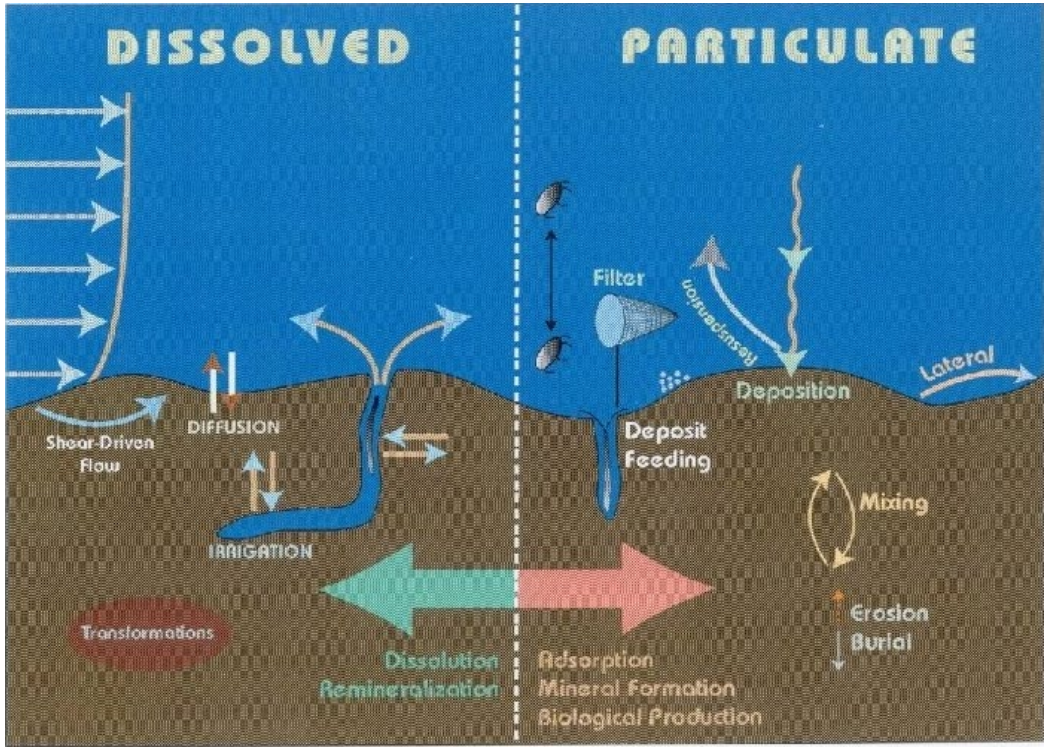


Right: Irregularities caused by the discharge from the dredge pipe, Jumbilee Cove, 2001. Photo credit: Cherie O'Brian

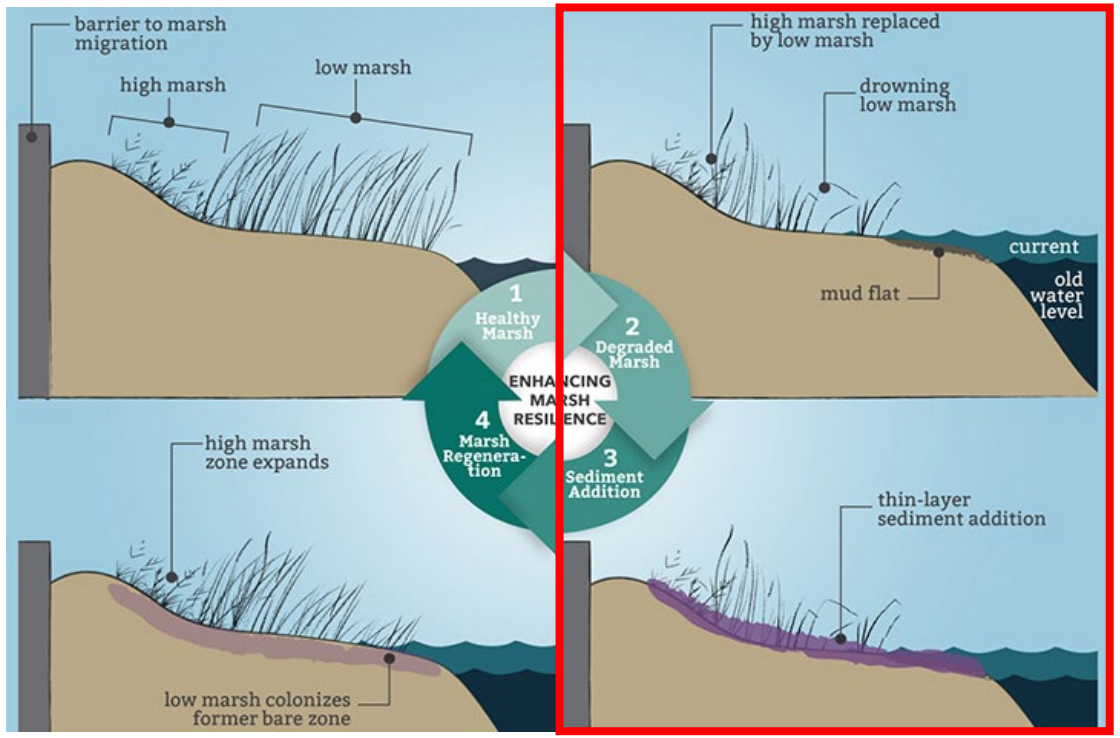
TLP and Salt Marsh Restoration

Other considerations:

- Toxic chemicals in dredge material
- Complete/partial organism burial from placement



The Sea Floor as a Sediment Trap, Richard A. Jahnke

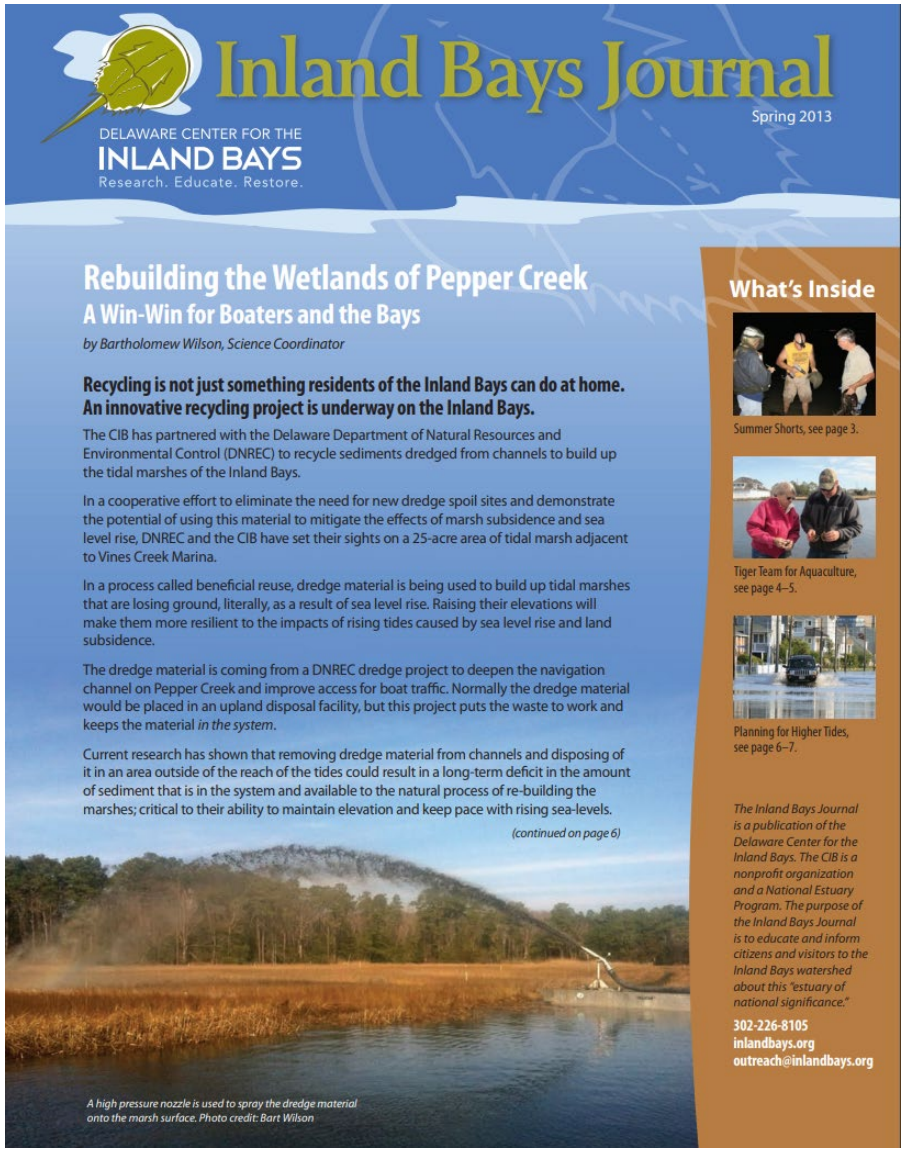


Guidance for thin-layer sediment placement as a strategy to enhance tidal marsh resilience to sea-level rise, NERRs

Case Study – Pepper Creek

- Location: Sussex County, Dagsboro, DE, US
- Year: 2013
- Project Type(s): Marsh restoration
- The main purpose of the project was to mitigate the effects of marsh subsidence and sea level rise.

Photo provided by Damarys Acevedo-Mackey



Inland Bays Journal

Spring 2013

DELAWARE CENTER FOR THE INLAND BAYS
Research. Educate. Restore.

Rebuilding the Wetlands of Pepper Creek

A Win-Win for Boaters and the Bays

by Bartholomew Wilson, Science Coordinator

Recycling is not just something residents of the Inland Bays can do at home. An innovative recycling project is underway on the Inland Bays.

The CIB has partnered with the Delaware Department of Natural Resources and Environmental Control (DNREC) to recycle sediments dredged from channels to build up the tidal marshes of the Inland Bays.

In a cooperative effort to eliminate the need for new dredge spoil sites and demonstrate the potential of using this material to mitigate the effects of marsh subsidence and sea level rise, DNREC and the CIB have set their sights on a 25-acre area of tidal marsh adjacent to Vines Creek Marina.

In a process called beneficial reuse, dredge material is being used to build up tidal marshes that are losing ground, literally, as a result of sea level rise. Raising their elevations will make them more resilient to the impacts of rising tides caused by sea level rise and land subsidence.

The dredge material is coming from a DNREC dredge project to deepen the navigation channel on Pepper Creek and improve access for boat traffic. Normally the dredge material would be placed in an upland disposal facility, but this project puts the waste to work and keeps the material *in the system*.

Current research has shown that removing dredge material from channels and disposing of it in an area outside of the reach of the tides could result in a long-term deficit in the amount of sediment that is in the system and available to the natural process of re-building the marshes; critical to their ability to maintain elevation and keep pace with rising sea-levels.

(continued on page 6)

A high pressure nozzle is used to spray the dredge material onto the marsh surface. Photo credit: Bart Wilson

What's Inside

The Inland Bays Journal is a publication of the Delaware Center for the Inland Bays. The CIB is a nonprofit organization and a National Estuary Program. The purpose of the Inland Bays Journal is to educate and inform citizens and visitors to the Inland Bays watershed about this "estuary of national significance."

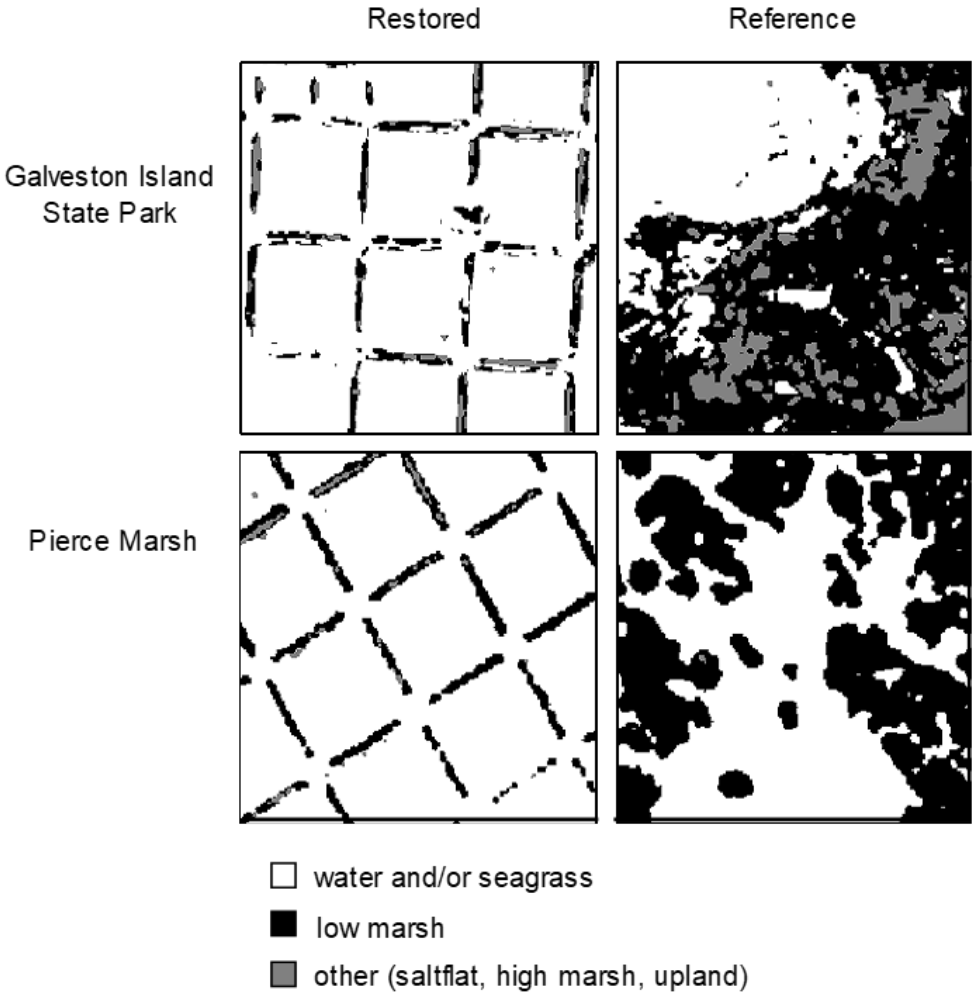
302-226-8105
inlandbays.org
outreach@inlandbays.org

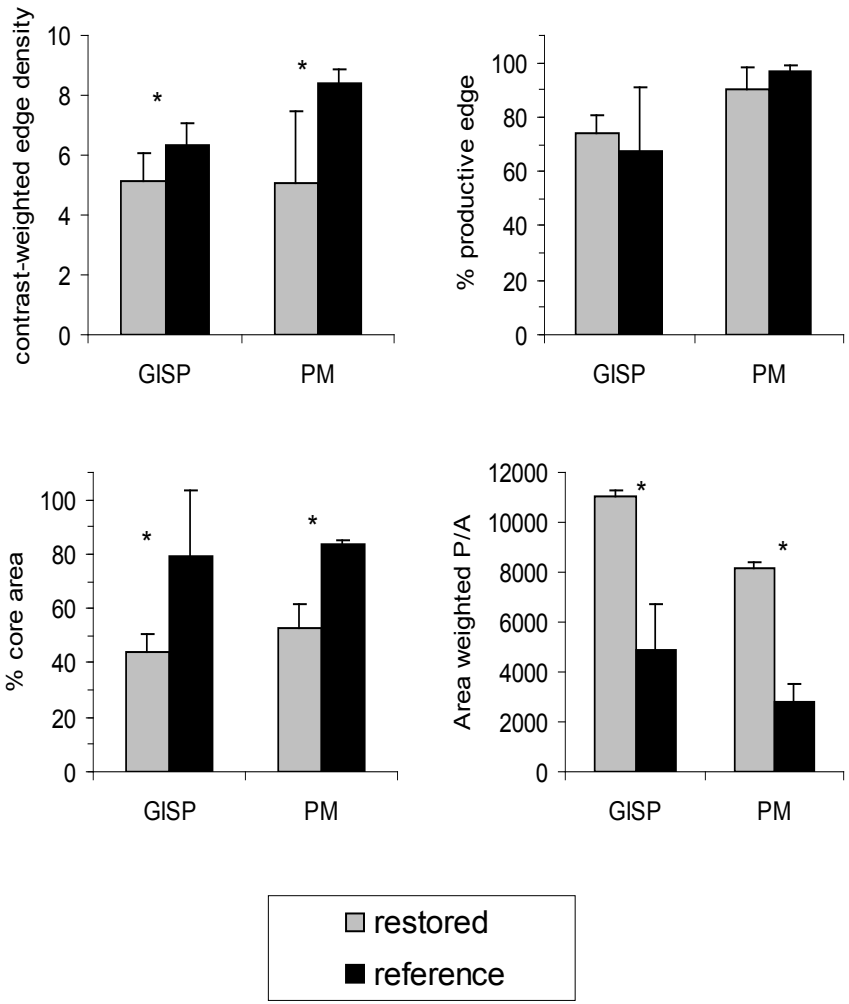
Case Study – Jumbile Cove

Case Study – Jumbile Cove

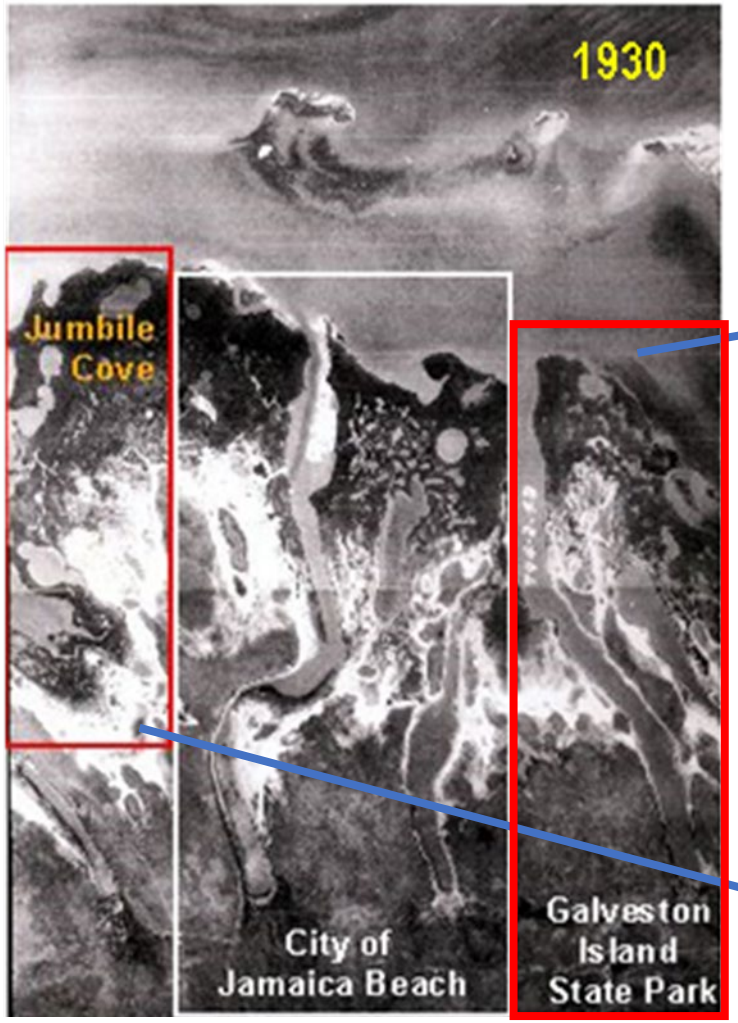
Top: 2,800 linear ft of geotube installed for restored marsh protection. Left: marsh mounds before and after being vegetated with *S. alterniflora*. Photo credit: Cherie O'Brian

TLP and Salt Marsh Creation



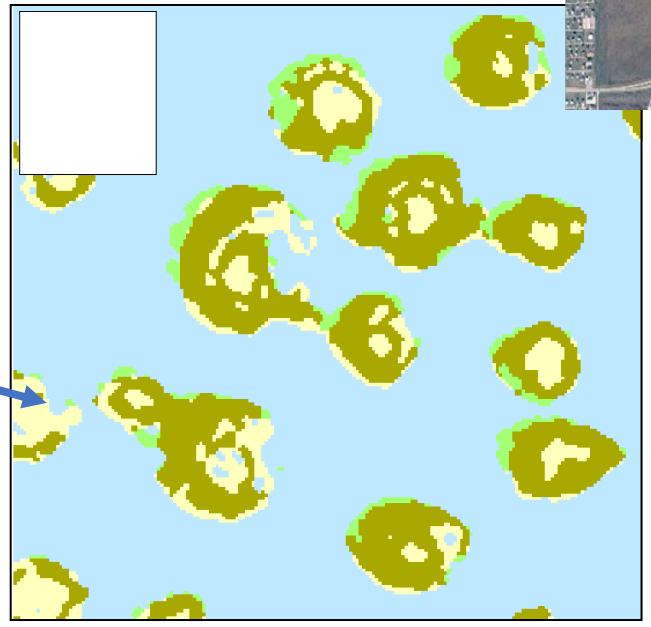


Case Study – GISP



Galveston Island State Park

Jumbilee Cove



Terracing maximizes marsh edge

TLP Ecological Considerations Overview

- Elevation change
- Physical and chemical make-up of the dredge material
- Organism burial
- Existing/planted vegetation
- Surface hydrology
- Naturally favored ecosystem/future ecosystem change

Left Picture: Jumbile revegetation, Cherie O'Brian.
Above Picture: Pepper Creek TLP, Bart Wilson.

TLP Emerging Research and Resources

- **NOAA – NERRS Reserves**

https://www.nerra.org/reserves/science-tools/tlp/

- **USACE – Environmental Lab, ERDC**

https://tlp.el.erdc.dren.mil/