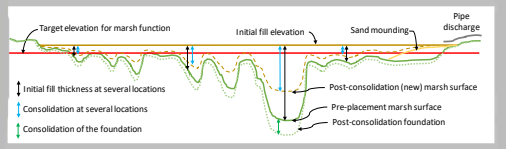
BIOGEOCHEMICAL RESPONSE OF COASTAL WETLAND SOIL TO THIN LAYER SEDIMENT APPLICATION



Prepared by Christine M. VanZomeren[1], Jacob F. Berkowitz[1], John R. White[2], Candice D. Piercy[1]

[1]Engineering Research and Development Center, Vicksburg, MS
[2]Louisiana State University, Baton Rouge, LA

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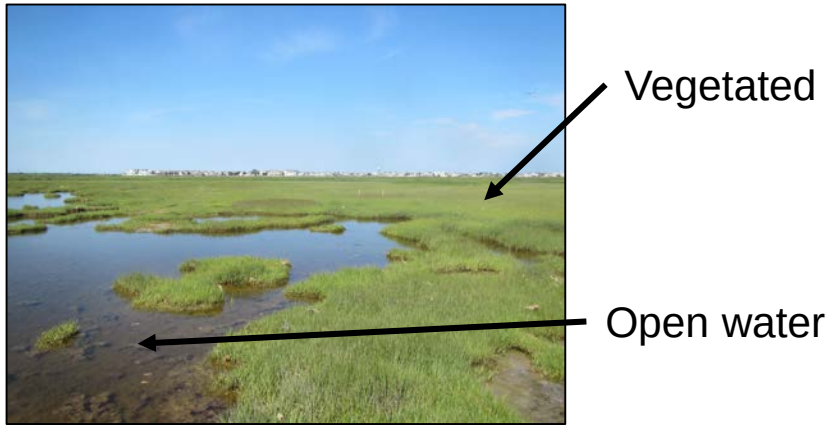
Salt marsh stress indicators…signs of waterlogging?

- Healthy, stable marsh contain mosaic of vegetated and stable open water areas
- Waterlogging negatively affects vegetation productivity
- Degraded salt marshes exhibiting excessive soil waterlogging, stunted unhealthy vegetations, and expansion of open water areas
- Observed in the Northeast

Project partners identified several degraded marsh areas near Avalon, NJ to be restored

Research Questions

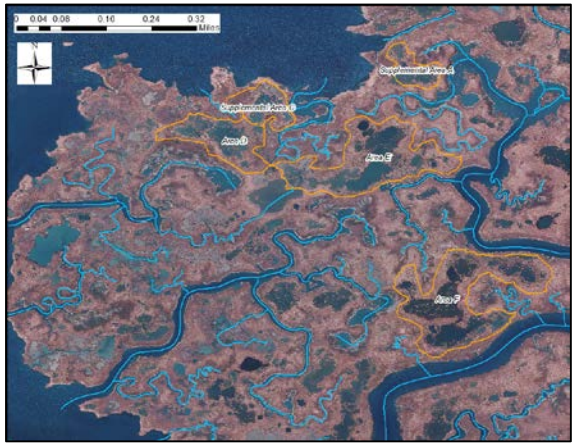
- **Do initial soil properties differ between vegetated and open water areas?**



- **What is the short term soil response of vegetated and open water areas to thin layer applications of dredged material?**

Study Design

- Stratified random design
  - Vegetated vs.
  - Open water areas

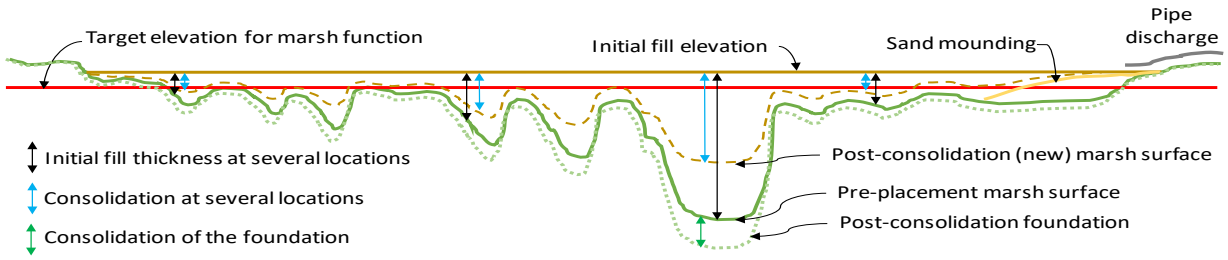


Vegetated and Open Water Areas are Different

Bulk Density	>	Bulk Density
Total Carbon	>	Total Carbon
Microbial Biomass	=	Microbial Biomass
Potentially Mineralizable N	>	Potentially Mineralizable N
Dissolved Organic Carbon	>	Dissolved Organic Carbon
Extractable NH_4-N	<	Extractable NH_4-N

Marsh Restoration: Thin Layer Placement

- **Restoration strategy:**
  - Introduce sediment to account for subsidence
  - Support stable platform for vegetation growth
  - Keep up with future rates of sea level rise
- **Thin layer placement of dredged material**
  - Introduce sediment to raise marsh elevation and allow vegetation growth
- **Focused on response of soil properties to thin layer placement**



Research Questions

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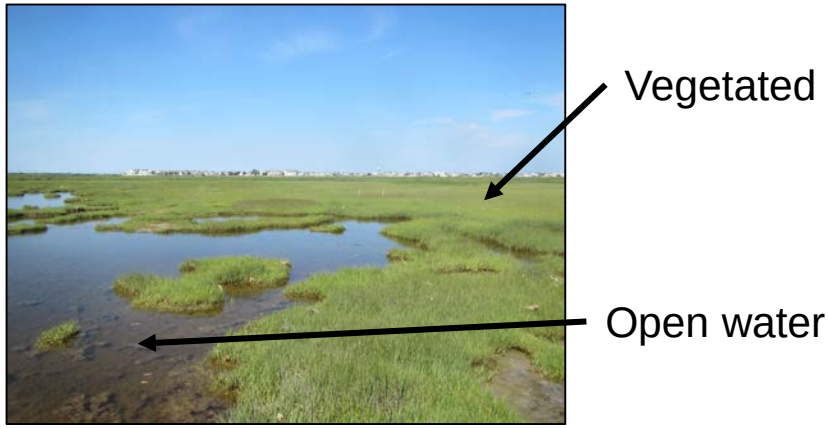


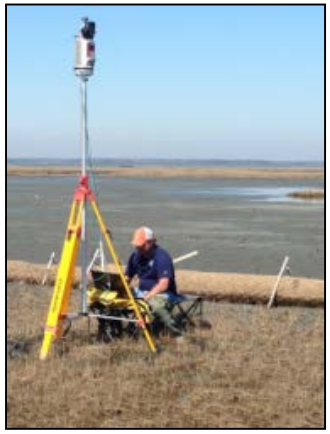
- **What is the short term soil response of vegetated and open water areas to thin layer applications of dredged material?**

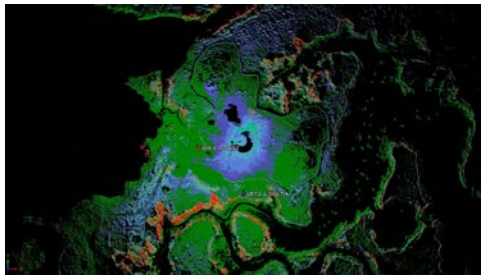
Project partners identified several degraded marsh areas near Avalon, NJ to be restored

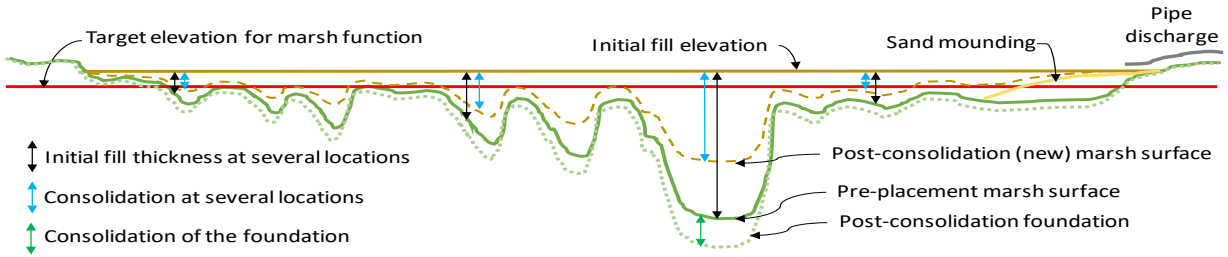
- Placed within hydrologically isolated areas on the marsh
- Defined biologically-derived target elevation based on vegetation community surveys
- ~ 35 acres of marsh received DM between November 2015 and February 2016
- Thicknesses ranged from just a few cm up to ~0.5 m in pools

Site monitoring was conducted across project partners

- Thickness of placement – spatial variation
- Elevation over time – measuring settling, consolidation, and subsidence
- Soil properties – Physical, chemical, nutrients, and microbial biomass
- Vegetation – species, biomass, stem height, cover
- Epifaunal macroinvertebrates – species, abundance, etc.
- Nekton – species, abundance, etc.
- Avian surveys – species, abundance

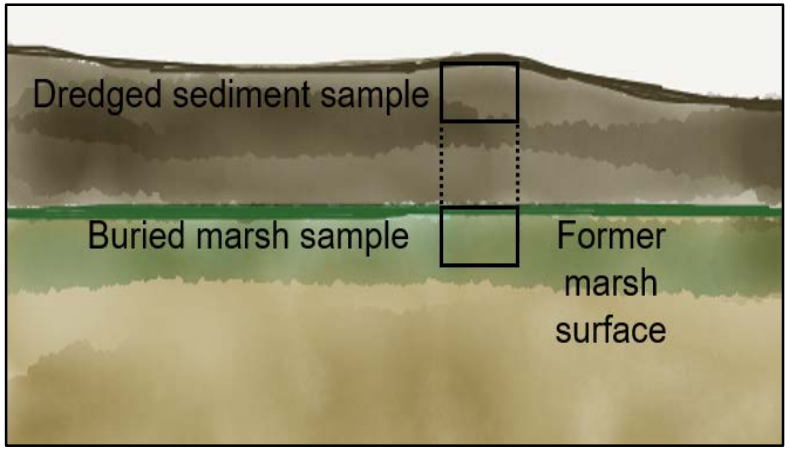






Study Design

- Stratified random design: (vegetated vs. open water areas)
- Before-After/Control-Impact
  - Before placement
  - 6 months after placement
  - 18 months after placement

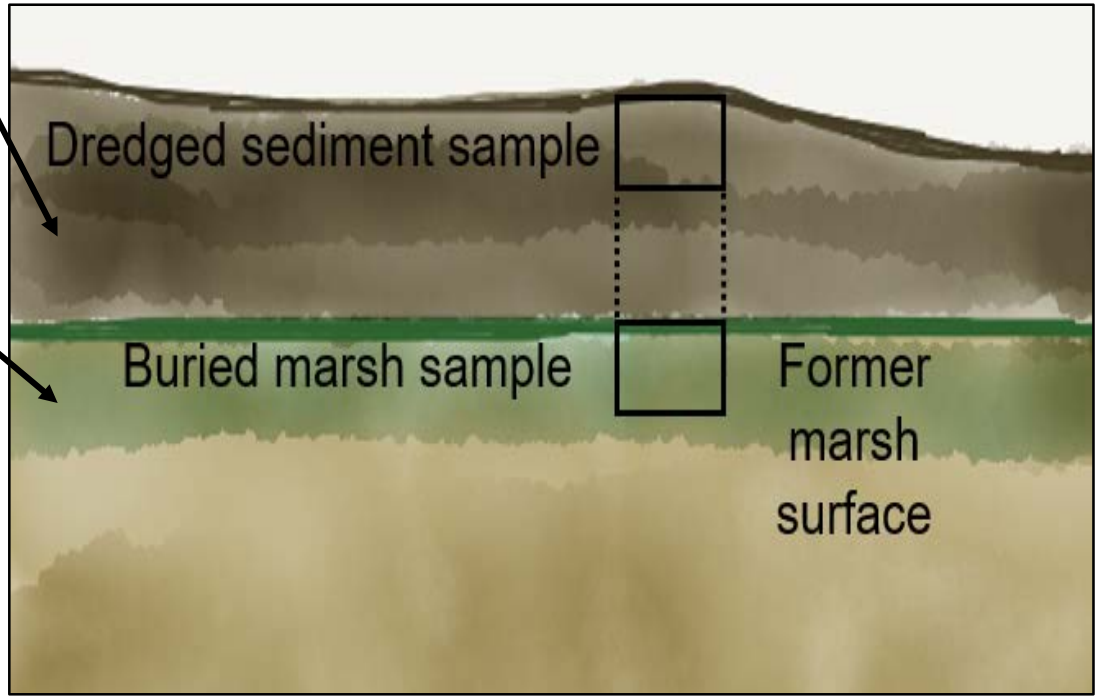


Six Months Following Placement

Increase in bulk density to support vegetation growth

Buried native marsh remained biologically active

Different response of buried vegetated and open water soil

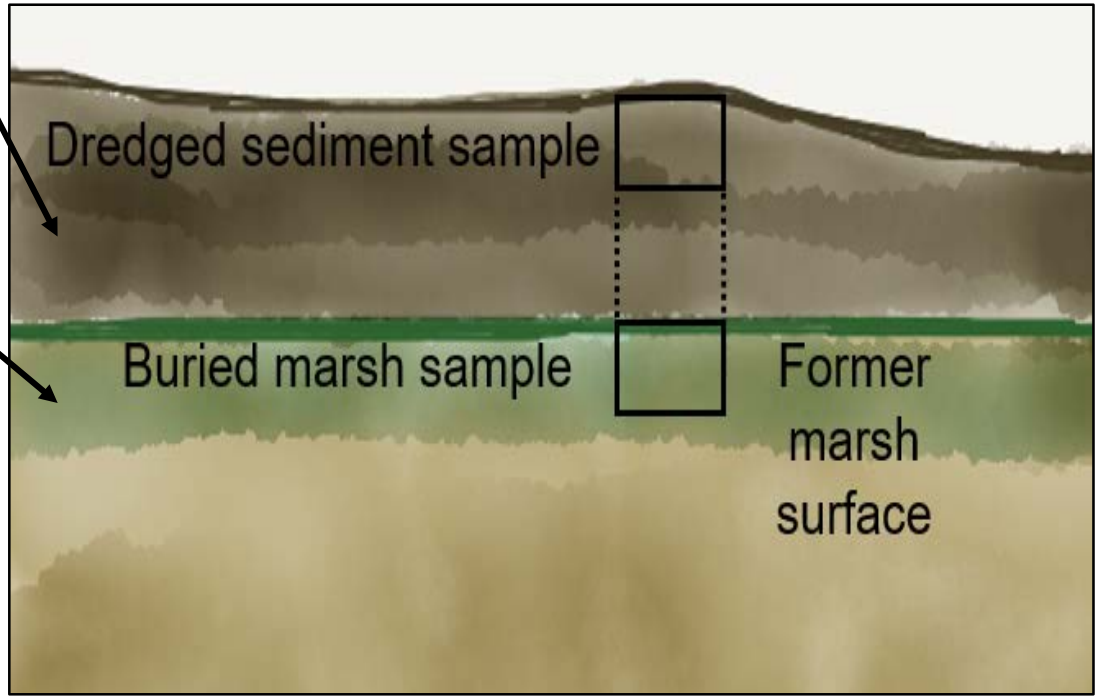


Eighteen Months Following Placement

Microbial biomass carbon equal or higher than control

Available nitrogen for vegetation growth

Different response of buried vegetated and open water soil



Conclusions

- **Documented differences in vegetated and open water soil physicochemical and biogeochemical properties**
  - **Implication of marsh geomorphic components to restoration**
- **Difference in buried native marsh and dredged material**
  - **Buried material remained biologically active**
  - **Source of available nitrogen**
- **Thin layer applications maintain native vegetation seed sources, rhizomes, and microbial communities in the near surface**
- **Highlights importance of identifying degrading marshes prior to large scale open water expansion**

Questions?

Jason Pietroski, Kevin Philley, and Darrell Evans assisted with field data collection and sample preparation

VanZomeren, C.M., J.F. Berkowitz, C. Piercy, J.R. White. *In Review*. Short term effects of thin layer placement of dredged sediment to a degrading marsh. Ecol. Eng.

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Contact:
Christine.m.vanzomeren@usace.army.mil