Mussel Powered Living Shorelines for Salt Marsh Erosion Control

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Partnership for the Delaware Estuary

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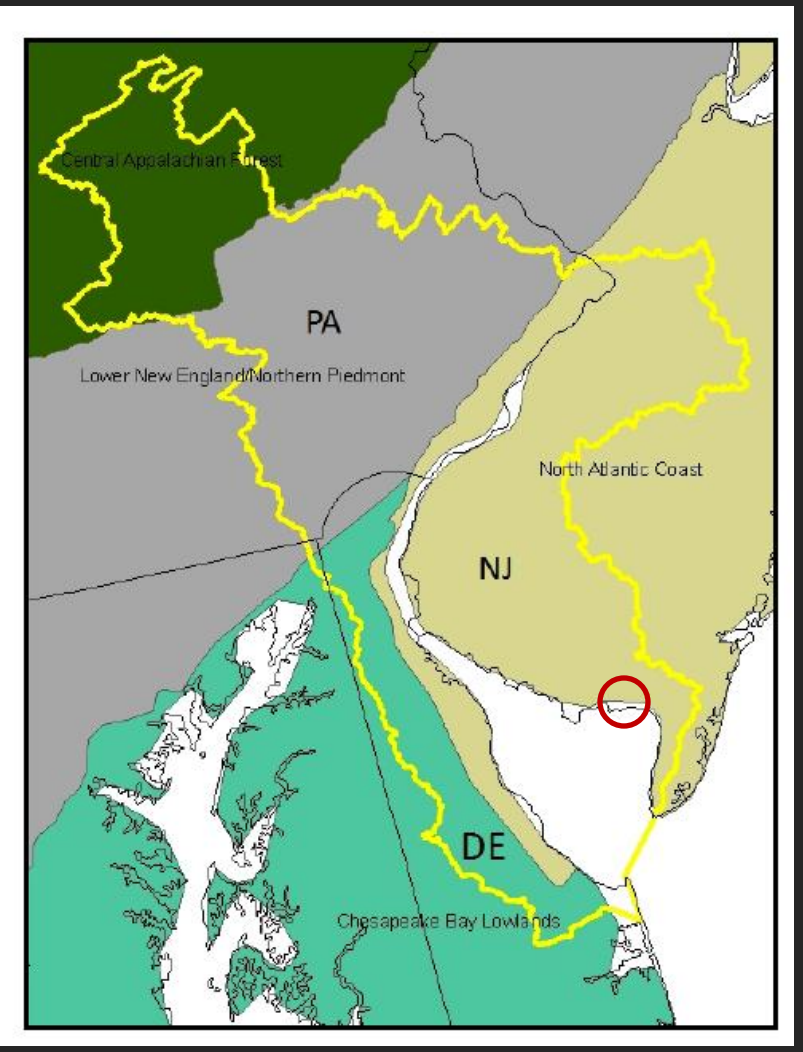
Problem: Marsh loss due to sea level rise and shoreline erosion



Shellfish as Natural Erosion Control

- Fringing oyster reefs absorb wave energy and trap sediments.
- Oyster reefs also provide other valuable ecological services such as habitat creation, water filtration and nutrient recycling.

Ribbed Mussels: An Alternative To Oysters

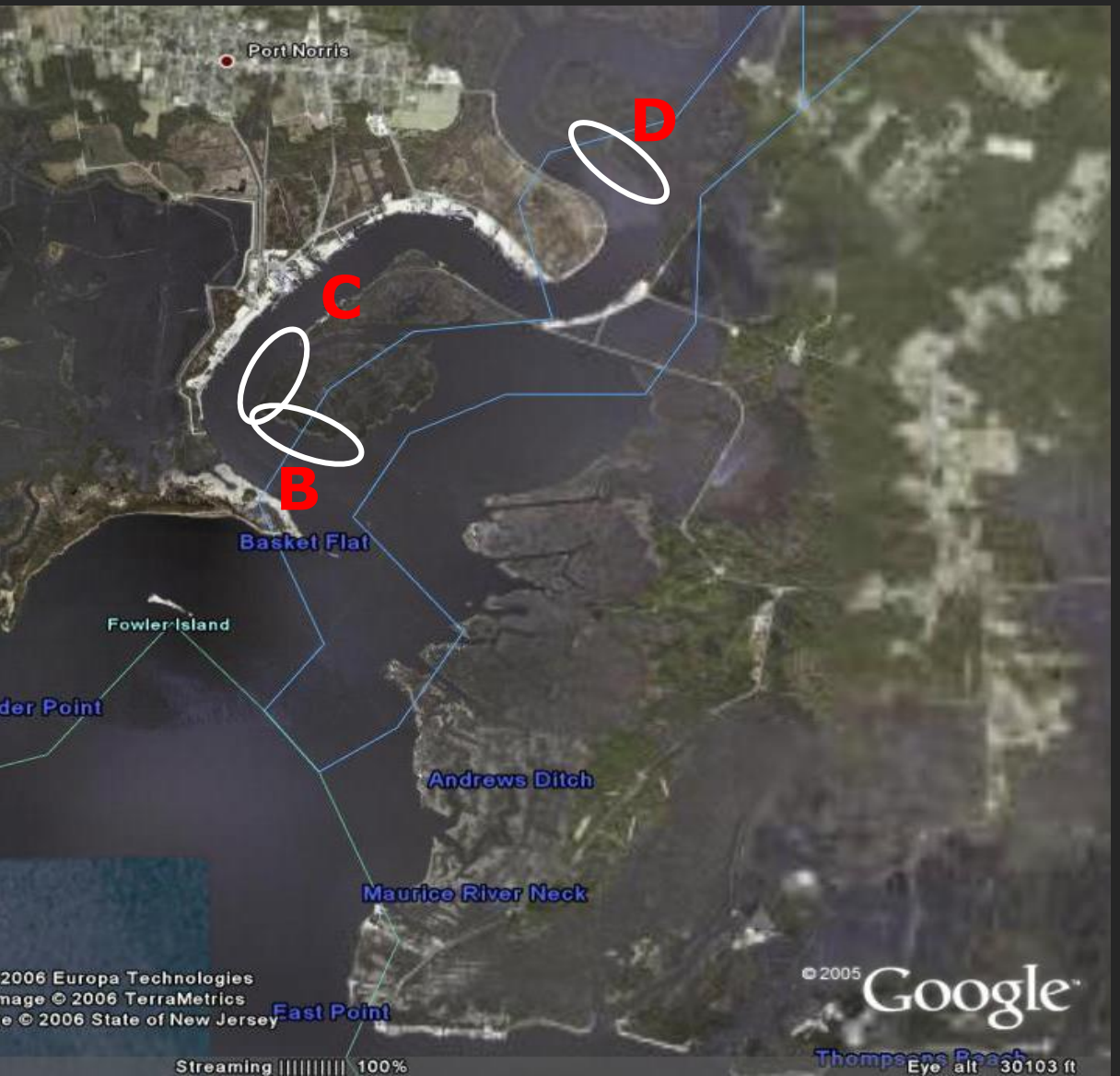
- Similar ecological services
- Not harvested
- Combine with oysters and marsh vegetation for greater impact
- Reduce wave energy
- Trap silt
- Reduce bank erosion
- Protect salt marsh
- Enrich habitat for other biota

Mussel – Marsh Grass Mutualism

Ecosystem Engineers

Delaware Estuary Living Shoreline Initiative

Pilot Study in the Maurice River



Objective: Develop strategies to combat shoreline erosion along marshes in the Delaware Estuary.

- This project examines the use of coir fiber products to arrest erosion while promoting recruitment of ribbed mussels for long-term stabilization to the marsh edge.

Question: How do biologs perform across erosion/energy gradients in salt marsh systems

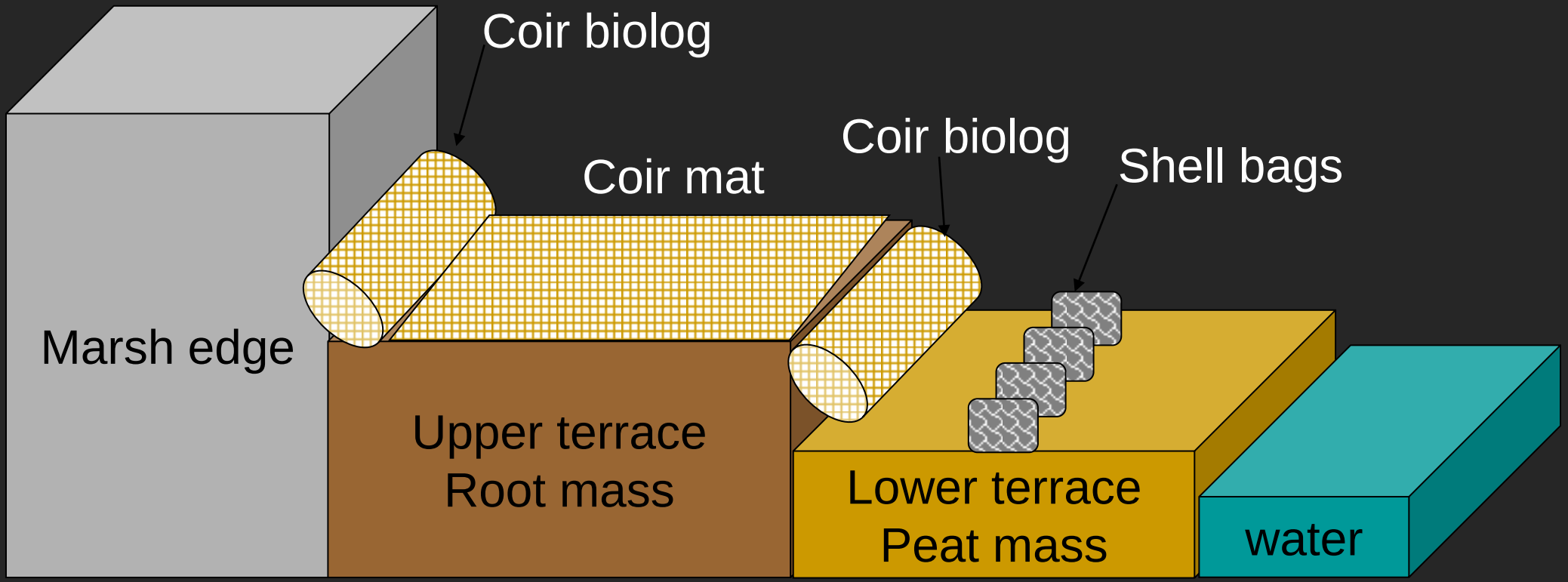
Coir Biologs and Mats: Reduce erosion and encourage mussel recruitment

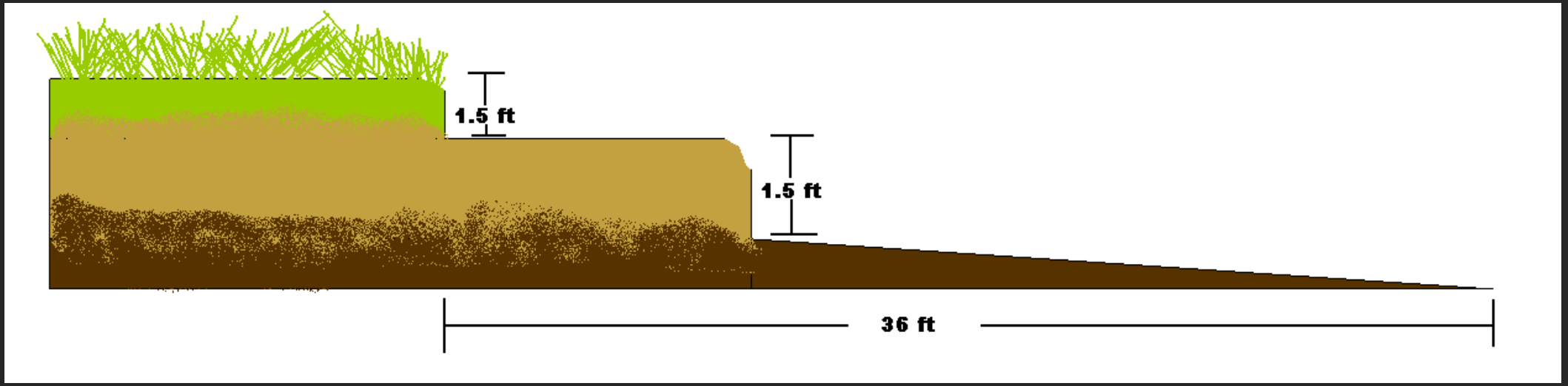
Coconut fibers (coir) are spun or woven to create mats or bound into logs

Designed to stabilize sediments to allow colonization by plants.

Fibrous structure also enables mussel colonization.

Mussels can recruit naturally or be seeded directly from wild populations, hatcheries or shellfish gardeners.


Coir biolog
Coir mat
Coir biolog
Shell bags
Marsh edge
Upper terrace
Root mass
Lower terrace
Peat mass
water


1.5 ft
1.5 ft
36 ft

DELSI Log Deployment Methods

Aerial photo of quadrant at on transect line

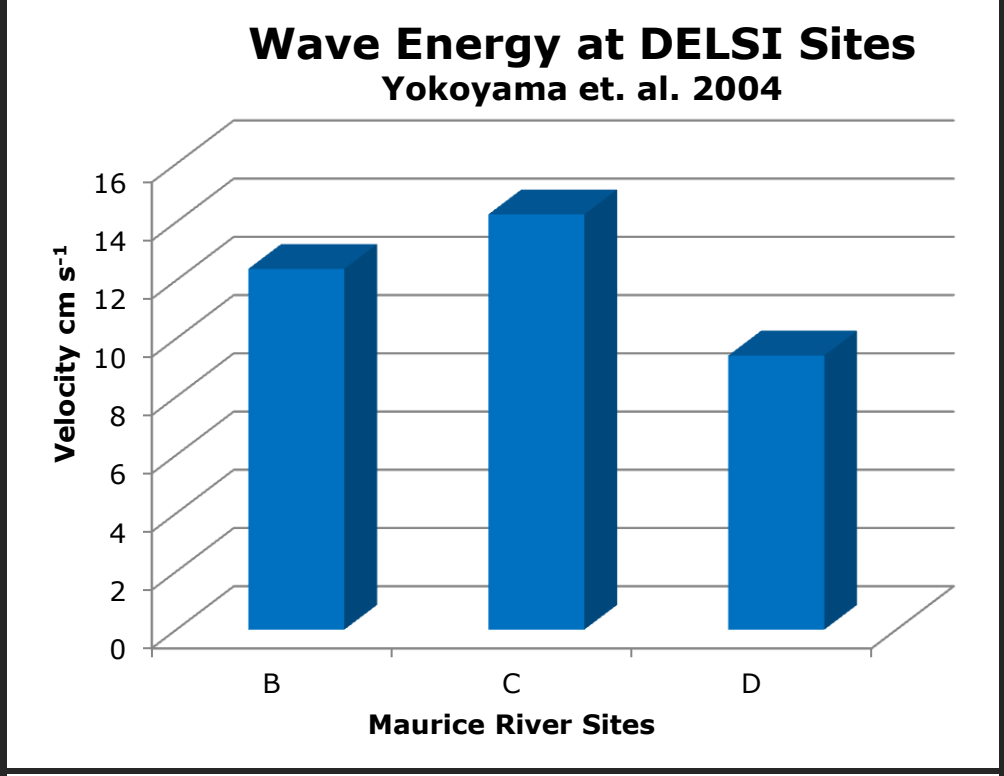
Monitoring:

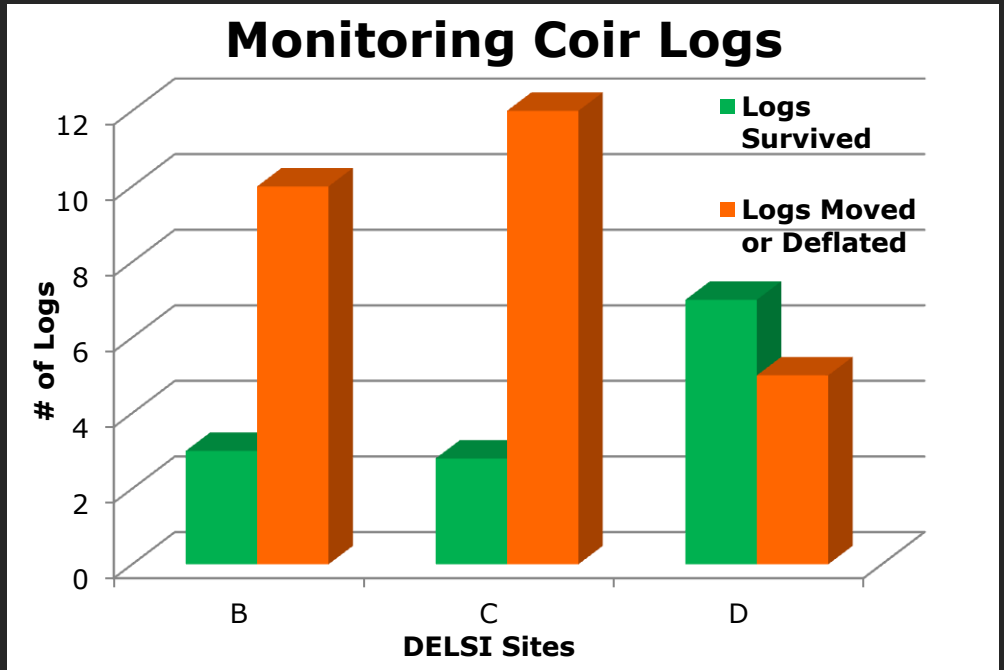
- Sediments are trapped quickly and generate rich microphytobenthic mats.
- Mussels and grass seeded into logs are surviving and growing well.
- Evidence of good mussel and oyster recruitment to coir and cultch.

Planted grass plugs on log

Aerial view of quadrant on log

Juvenile mussel recruit to coir log





Preliminary Observations

- Coconut fiber logs and mats survived best at Site D where wave energy is lower
- Logs at Sites B and C did not work if tucked against marsh; likely wave slap zone
- Logs survived best if oyster shell bags were placed as a barrier in front of logs

Site B – High Energy

Only stakes remain where a mat and log were installed only months before. Marsh retreat is evident here on a day-to-day basis

Logs that survived at B contained juvenile mussel recruits. This log had >50

Site C
High Energy

Deflated Log

Sediment Trapping Behind Log and Shell Bags

Site C has considerable boat wake erosion. Sediment accretion was evident landward of treatments that survived.

Site D - Lower Energy

Sediment accreted behind and around most treatments of logs and/or shell bags

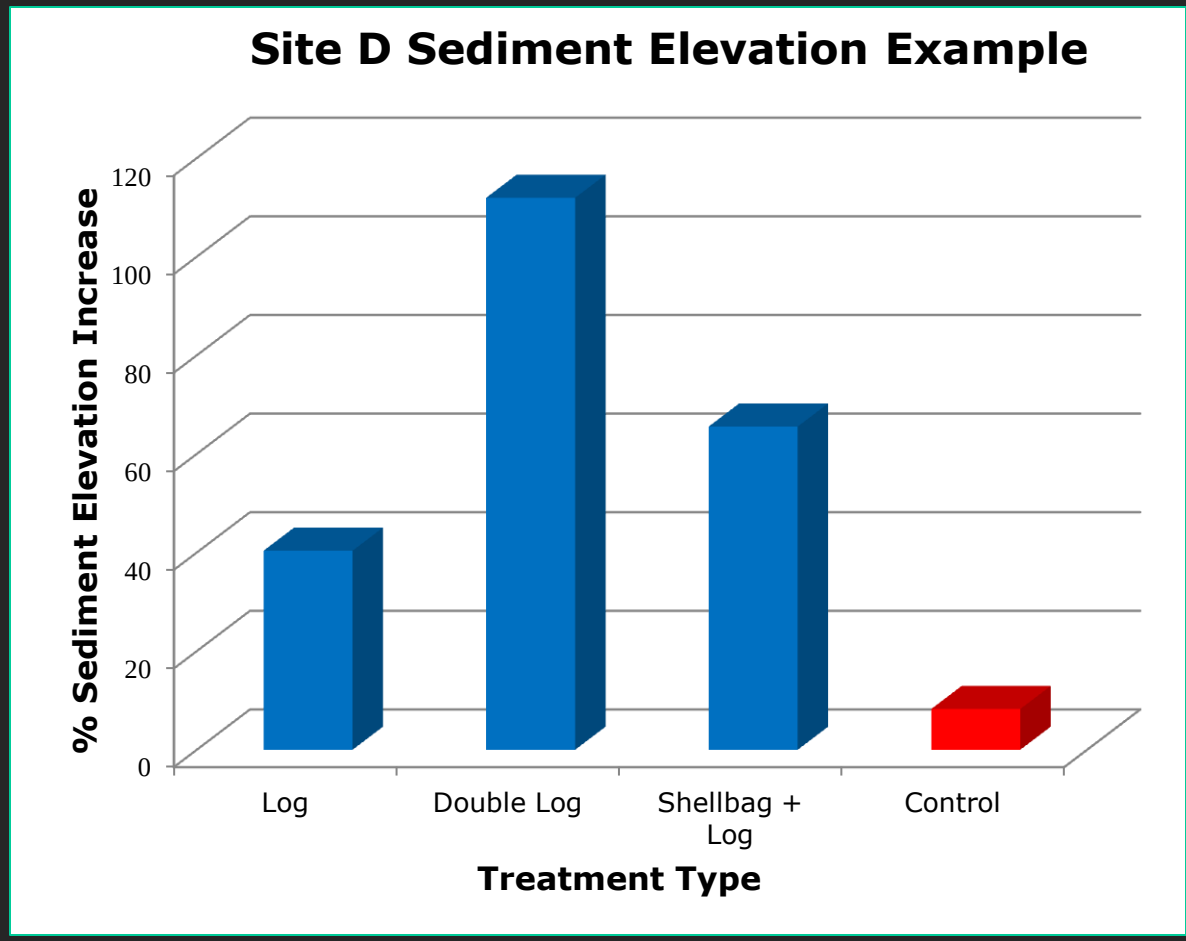
Sediment trapping behind log

Mat + Log

Most effective deployments were in locations where ebb runoff was reduced such as by this closed off scallop of eroding marsh edge

Site D – Most Suitable Conditions

Sediment Elevation Changes

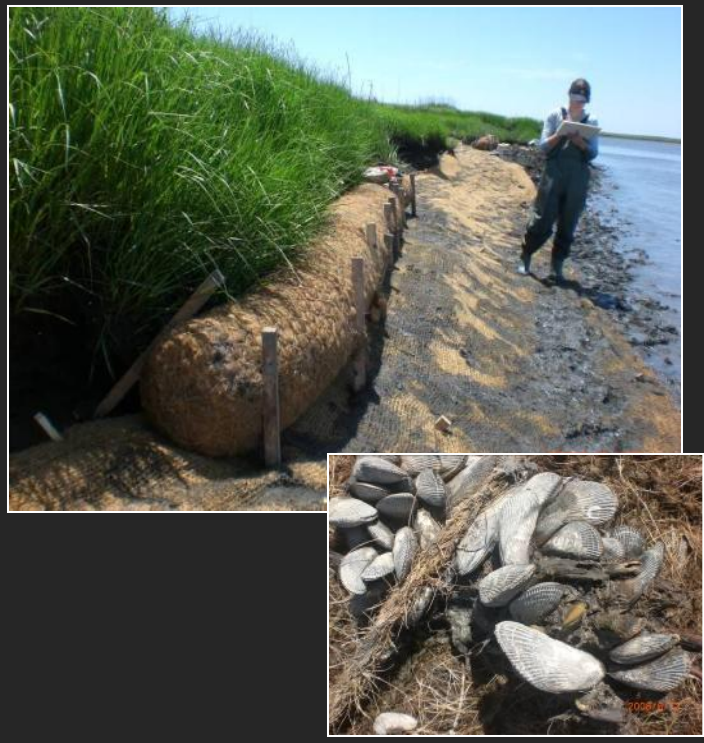


Conclusions

- **Shellfish-based living shorelines trapped sediment and appeared to decrease erosion at low-moderate energy sites, compared with untreated controls.**

- **Ribbed mussels (and oysters) successfully recruited onto natural substrates deployed in the intertidal zone along eroding salt marshes; long-term outcomes have yet to be assessed.**

- **DELSI uses a new approach for stemming salt marsh loss in some areas of Delaware Estuary; more substantial tactics will be needed in high energy locations.**



Supermussels

DELSI Next Steps

- **Continue monitoring to quantify sedimentation, shellfish and *Spartina* recruitment, as well as changes in shoreline relative to control sites.**
- **Validate/quantify relationship between erosion and marsh mussels**
- **Explore habitat use by other fauna**
- **Expand to additional sites and more specialized applications**
  - **Adjacent to marinas**
  - **Explore as alternative to bulkheads on private property**
- **Create an educational outreach demonstration project**

Thank you

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