Monitoring

Angela Padeletti
Science Programs Manager

Partnership for the DELAWARE ESTUARY

How to Build for Success and to Address the Unexpected

Nature Based Solutions :

1. "Provide ecological uplift": Leaves room for many techniques
2. More than materials; ecology: What is "living component"
3. Measure of functionality over time: aim of a project over time

<u>Practitioner Tasks</u>

A. Create proper conditions for ecological success
B. Adaptively manage site-specific needs

<u>Practitioners Manage</u>

Materials: Persistent Energy

Not all materials are appropriate everywhere but in-tandem materials can be helpful





Materials: Biological Interactions

Can enhance or diminish material stability

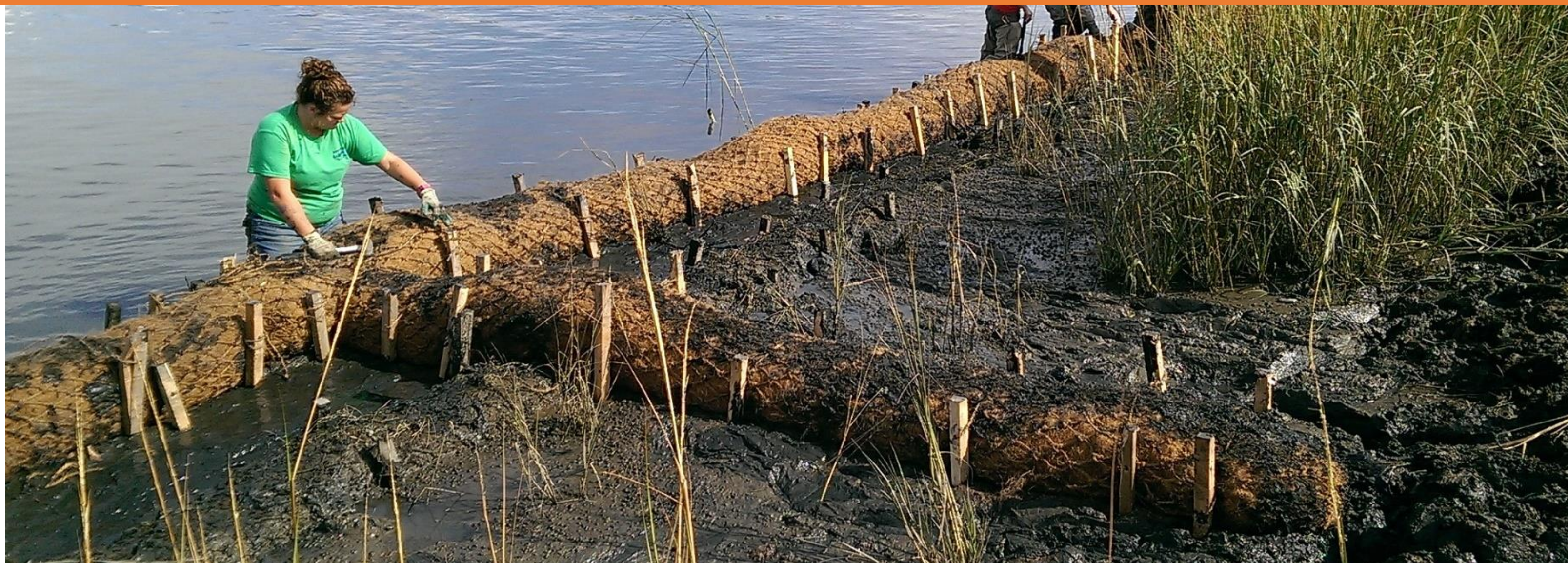
Physical Environment ⟷ Biological : "Living " Component

Basis of success:

1. Sedimentation
   - Facilitate vertical building
2. Elevation of vegetation community
   - Inundation time
   - Sustain elevation
3. Planting strategies
   - Positioning
   - Plant age
4. Proper drainage
   - Anoxia
   - Internal erosion
5. Faunal Community

Physical Environment: Sediment

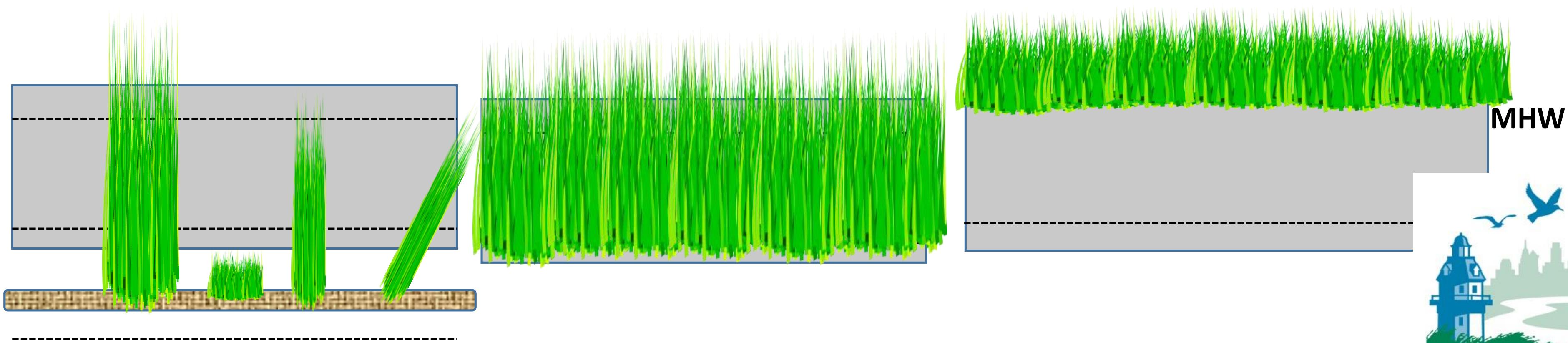
It may be available, but tough to trap



Physical Environment: Elevation

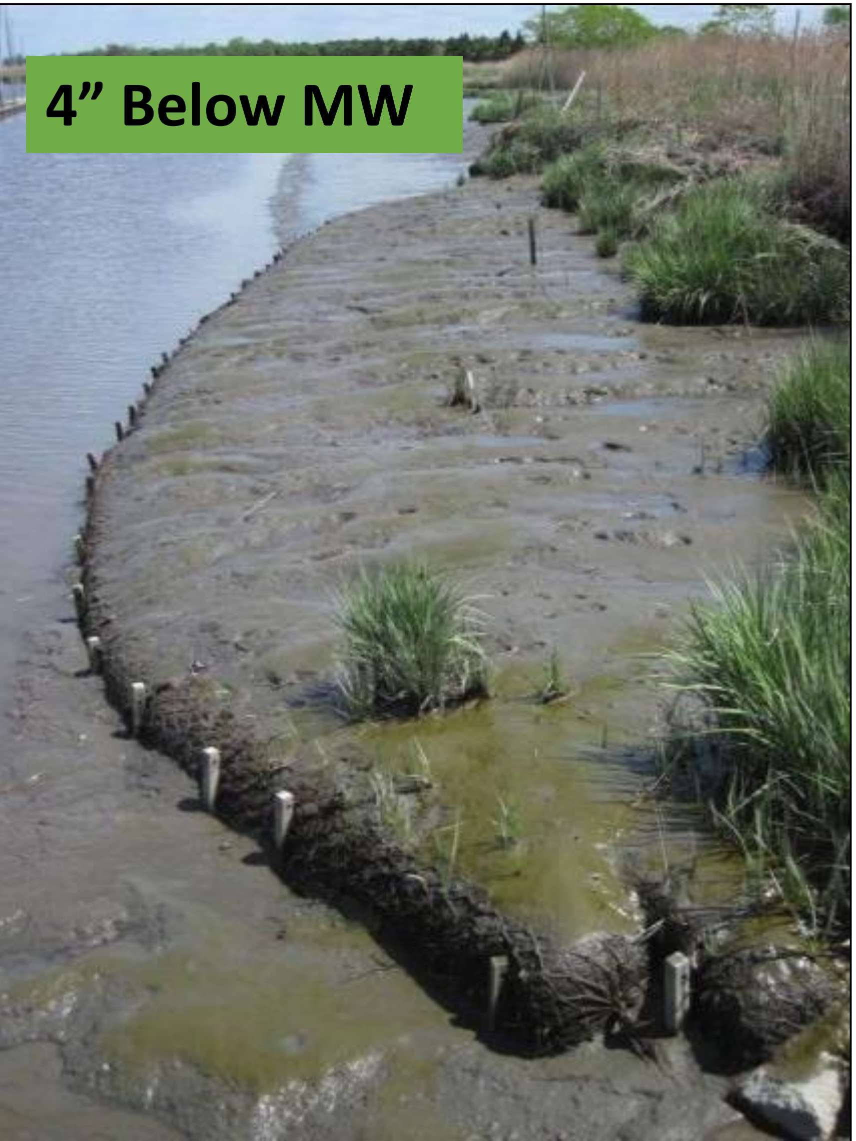
Plants can sustain elevation

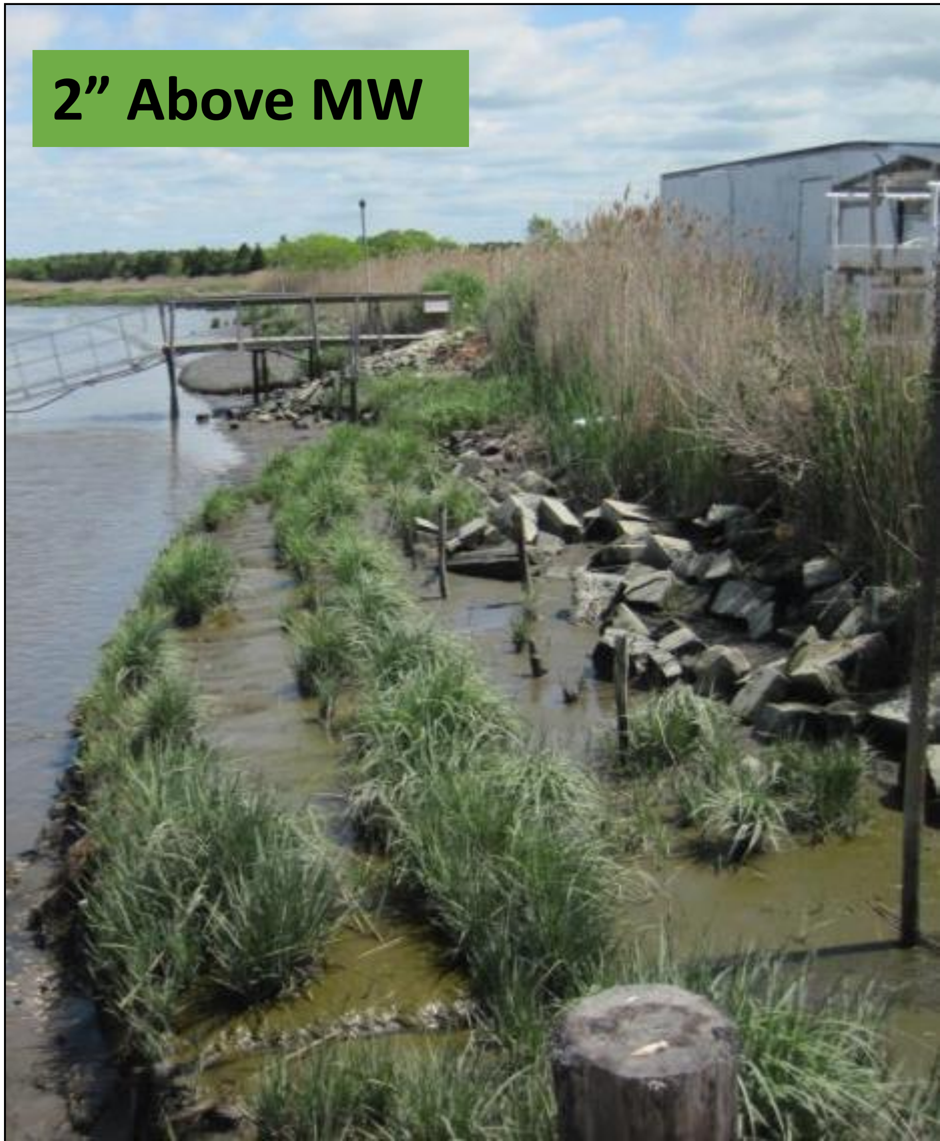
- Plants become dense at mid-upper positions (MW-MHW)
- Dense plants trap more sediment
- Trapping sediment helps marsh grow vertically
- Plants at proper position help marsh build



Partnership for the DELAWARE ESTUARY

Biological: Vegetation/Elevation
Generally MW-MHW





Biological: Faunal Movement
Safe passage

Partnership for the DELAWARE ESTUARY

BUILDING ECOLOGICAL SOLUTIONS TO COASTAL COMMUNITY HAZARDS (BESCCH)

Areas of Interest for projects:

- Overall changes to shoreline appearance
- Changes in elevation of shoreline
- Changes in shellfish communities
- Changes in vegetation communities

Professional and Citizen Monitoring

Professional Monitoring

- High accuracy

Citizen Monitoring

- Engage community
- Build relationships with community, local and state govt
- Sustain Monitoring after grants

Professional and Citizen Monitoring

Goal	Objective	Metric	Methods
Erosion control	Living shoreline appears visually similar to a natural shoreline	Appearance	1. Photo-doc at fixed points
Erosion control	Erosion control structure maintains its established position	Position of erosion control structures	1. Photo-doc 2. RTK-GPS survey
Erosion control	Vegetated edge moves waterward from baseline position	Position of contiguous vegetated shoreline and community boundaries	1. Measured distance of boundaries along transects 2. RTK-GPS survey
Erosion control	Vegetation community develops to be robust	Vegetation robustness	1. Integrate: vegetation height and vertical/ horizontal obstruction
Erosion control/ water quality uplift	Shellfish establish residence in the living shoreline	Shellfish population density	1. Observation across site

Blue=Citizen Science Methods
Red=Professional Methods

Professional Monitoring

Pre and Post Construction Monitoring Consists of:

- RTK monitoring for changes in shoreline movement and elevation
- Vegetated plots along three transects
  - Dominant Species Identification
  - Percent cover
  - Light Attenuation
  - Horizontal Vegetation obstruction
- Observational Data
  - Shellfish presence/absence
  - Fixed Photo Points
  - Debris presence/absence
  - Notes on other impacts
    (ice, blockage of drains and/or other structures)

Citizen Science Monitoring

Pre and Post Construction Monitoring Consists of:

- Measure distance of vegetated communities
  from the shoreline edge
- Vegetated plots along three transects
  - Dominant Species Identification
  - Percent cover
  - Vegetation Height
- Observational Data
  - Shellfish presence/absence
  - Fixed Photo Points
  - Debris presence/absence
  - Notes on other impacts
    (ice, blockage of drains and/or other structures)

Citizen Science Monitoring

Pre and Post Construction Monitoring Consists of:

- Measure distance of vegetated communities
  from the shoreline edge
- Vegetated plots along three transects
  - Dominant Species Identification
  - Percent cover
  - Vegetation Height
- Observational Data
  - Shellfish presence/absence
  - Fixed Photo Points
  - Debris presence/absence
  - Notes on other impacts
    (ice, blockage of drains and/or other structures)

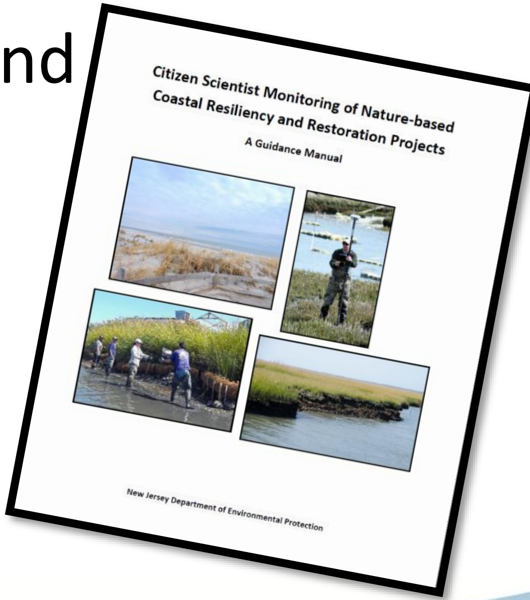
Citizen Science Monitoring

Pre and Post Construction Monitoring Consists of:

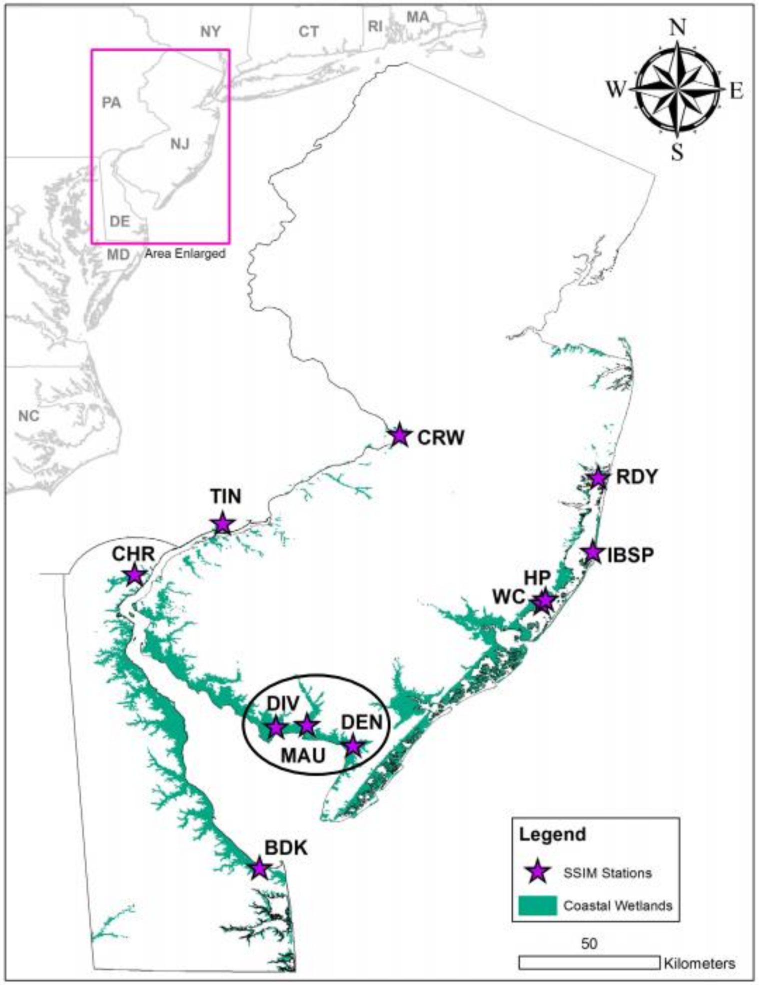
- Measure distance of vegetated communities
  from the shoreline edge
- Vegetated plots along three transects
  - Dominant Species Identification
  - Percent cover
  - Vegetation Height
- Observational Data
  - Shellfish presence/absence
  - Fixed Photo Points
  - Debris presence/absence
  - Notes on other impacts
    (ice, blockage of drains and/or other structures)

Citizen Science Monitoring

- Citizen Science training was held in June 2017
- A manual was developed to guide the citizen scientists
- Easy to read maps and datasheets were developed
- In late fall 2017 professional scientists and citizen scientists conducted monitoring



Long-term Monitoring

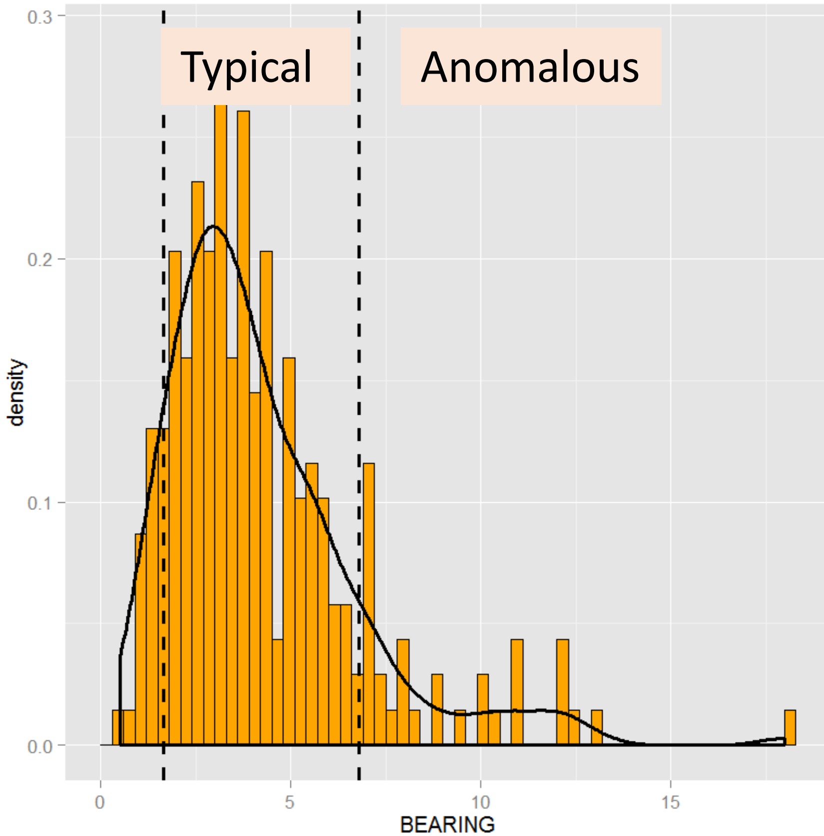


	Metric	Methodology	Citation
Surface Dynamics	Surface Elevation Change	Deep rod surface elevation tables	Lynch et al. (2015)
	Surface Accretion	Feldspar Marker Horizons	Lynch et al. (2015)
	Surface Elevation	Real Time Kinematic (RTK) GPS transect (vegetation-based) or grid (platform/feature-based) surveys	USGS (2012); Raposa et al. (2016)
Vegetation Dynamics	Vegetation Height	Plot specific height measurements	Mendelsshon and Seneca (1979)
	Plant Community Structure	Species richness, estimated cover	Donnelly and Bertness (2001)
	Vegetative Productivity	Above and below ground biomass (hand sorting)	Cahoon et al. (2002); Morris et al. (2002); Cahoon (2015);
Soil Quality	Soil Nutrients	Nitrogen, Phosphorus (laboratory analyses, by depth)	Quirk et al. (2015a/b); Raper et al. (2016)
	Soil Carbon	Carbon, bulk density (laboratory analyses, by depth)	Quirk et al. (2015a/b); Raper et al. (2016)
Water Quality	Water Nutrients	NOx, NHx, SRP, Alkalinity (laboratory analyses); Turbidity	Nitogen: Deegan et al. (2012); Turbidity: Raposa et al. (2016)
	Water Quality	Temperature, Conductance (salinity), Dissolved Oxygen, Total Dissolved Solids, pH (*in situ* YSI readings)	Quirk et al. (2015a/b); Raper et al. (2016)
	Suspended Sediments	Total Suspended Solids (laboratory analysis)	Morris et al. (2002); Fagherazzi et al. (2012); Kirwan et al. (2015)

Partnership for the DELAWARE ESTUARY

Connecting Long-term to projects

Are we seeing what we should?



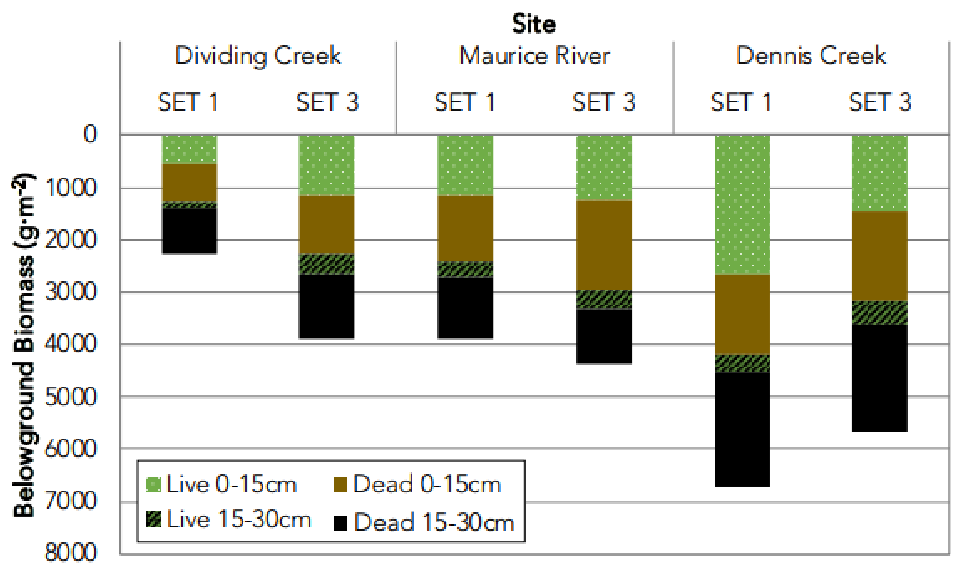
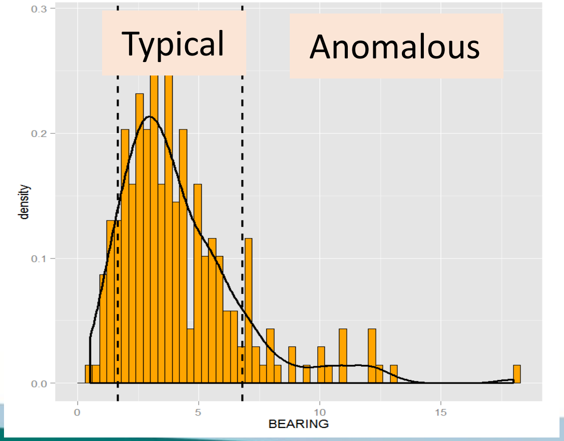


Figure 23. Bar plot of mean total belowground biomass (live and dead fractions) for SETs 1 and 3 at each SSIM station. See Table 5 (page 30) for means and standard errors.

Partnership for the DELAWARE ESTUARY

Project Monitoring

Structural Materials → Physical Environment ↔ Biological Community



Let’s Collaborate

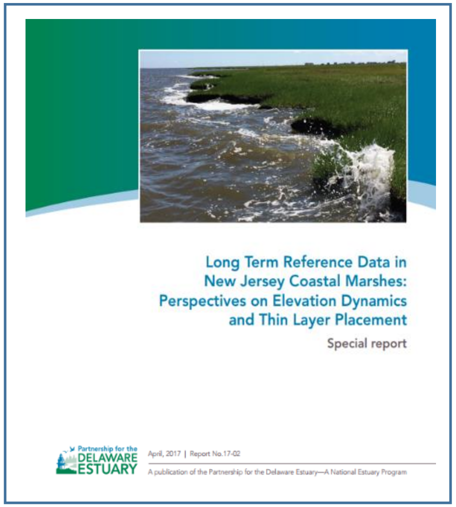
Partnership for the DELAWARE ESTUARY

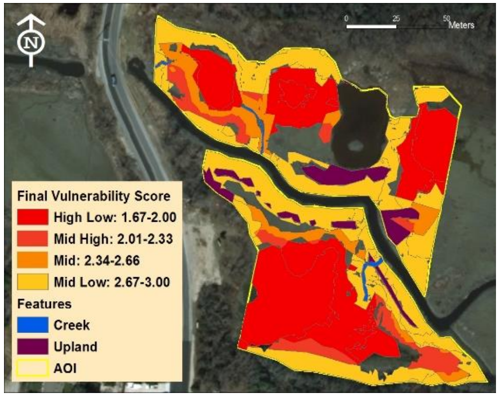
Angela Padeletti
Science Programs Manager
(302) 655-4990, x103
apadeletti@DelawareEstuary.org

Connecting people, science, and nature for a healthy Delaware River and Bay

Task 4. Monitoring

- Quality Assurance Project Plan
- Resource library on Monitoring and Assessment methods
- White paper on wetland issues
- Delaware Estuary Living Shoreline Manuscript
- Marsh Futures - report on assessments in Lower and Upper Townships
- Citizen science training, presentations and field work
- Monitoring of MACWA sites –data and reporting on trends over 3+ years
- Monitoring plans for 10 projects
- Monitored 4 projects over 9 months





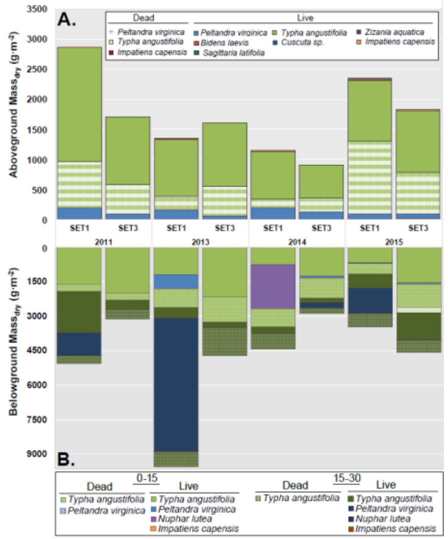


Figure 20. Average above (A) and below (B) ground biomass for Christina across sampling years.