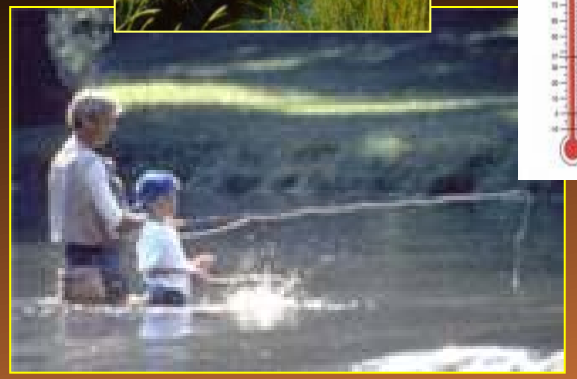
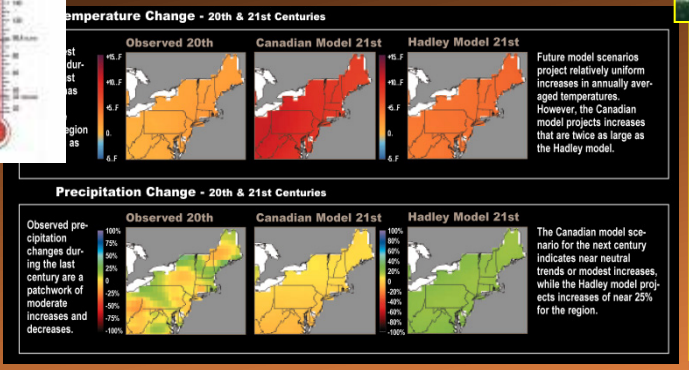
Enhancing and Harnessing Nature for Climate Resilience along the Delaware Bayshore

Danielle Kreeger
Partnership for the Delaware Estuary



USFWS
February 25, 2014



INFORMATION

INVENTORY

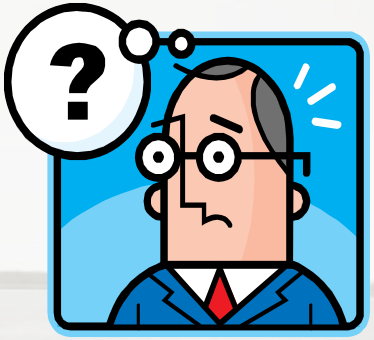
EXAMPLE

PLANNING

PROJECTS

POLICY

Why Are We Here?



Living Shoreline Tactics

Example: DELSI Mussel/Plant Tactic

Where and How to Invest?

Implementation Tips

Paradigm Barriers & Shifts

PARTNERSHIP FOR THE DELAWARE ESTUARY INC.

Why Are We Here?

INFORMATION

VOLUME 17 ✻ ISSUE 2 ✻ WINTER 2007

ESTUARY NEWS

NEWSLETTER OF THE PARTNERSHIP FOR THE DELAWARE ESTUARY: A NATIONAL ESTUARY PROGRAM

Climate Change Hits Home

By Kathy Klein, Executive Director, Partnership for the Delaware Estuary

As I was driving to work one recent morning, thinking about writing this article and listening to National Public Radio, I learned that the Bulletin of Atomic Scientists has concluded that the threat posed by climate change is second only to the threat posed by nuclear weapons. Although I am absolutely relieved that climate change is finally getting the attention it deserves, I am also keenly aware that time continues to tick away as world leaders and other policymakers explore ways to address global warming and its environmental impacts.

2007

Being the visual person that I am, I can't seem to forget the recent image in the media of a lone polar bear floating on a piece of ice that had broken off the Arctic icecap as a result of melting. What most people do not realize, however, is you do not have to go to the Arctic to see the results of global warming. For many years, scientists in the Delaware Estuary have noted the dieback of upland

tant to realize, however, that there are small steps each one of us can take in our daily lives that, when multiplied, can make a meaningful impact.

One of these small steps is the use of compact florescent light bulbs (CFLs). CFLs use up to 75 percent less energy than regular incandescent light bulbs while lasting approximately eight times longer, and this results in less production of greenhouse gas emissions, air pollution, and toxic waste. The average CFL will save its owner at least $55 in energy costs over its lifetime. If every U.S. household replaced one bulb with a CFL, it would have the same impact as removing 1.3 million cars from the road.

I love a challenge and I hope you do too. Therefore, I would like to challenge the readers of "Estuary News" to make the switch at home, in at least one light fixture, from an incandescent light bulb to a CFL. If you already use CFLs in your home, why not make the

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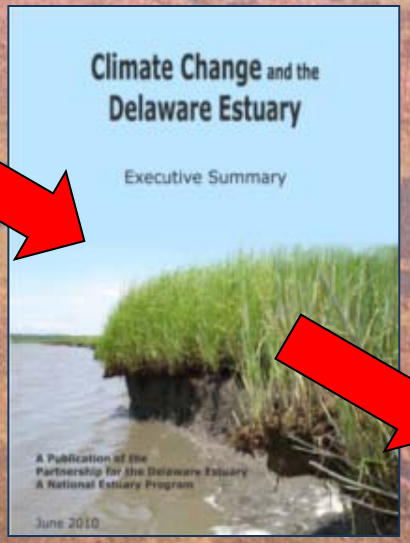
2007

Recognize Problem

2010

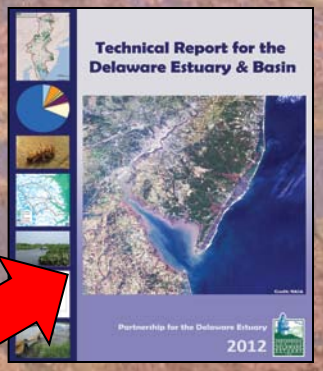


Assess Vulnerability & Prioritize Solutions

2011

Translate & Engage

2012-13



Track Change

Action Plans

Adaptation Projects

Future Needs?

Monitoring

Project R&D

Studies

Strategic BMPs

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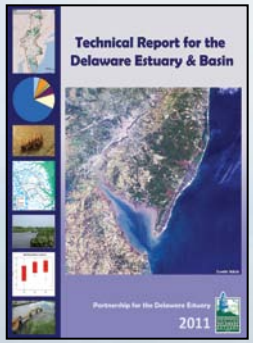
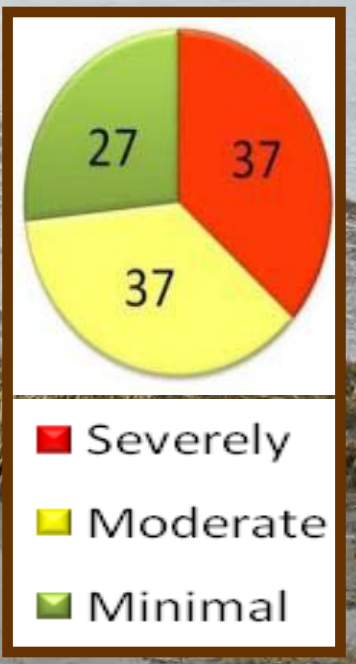


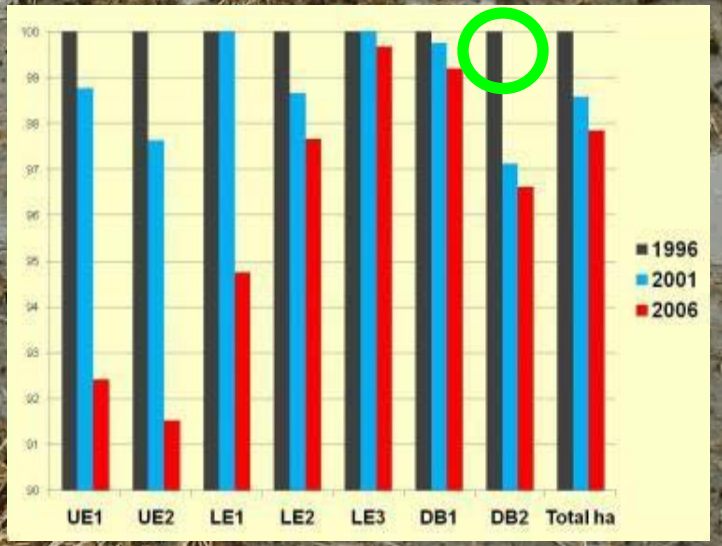
2012 State of the Estuary Report

Rapid loss of acreage and degraded wetland health

Losing an acre per day (1996-2006)

Most tidal wetlands are moderately or severely stressed

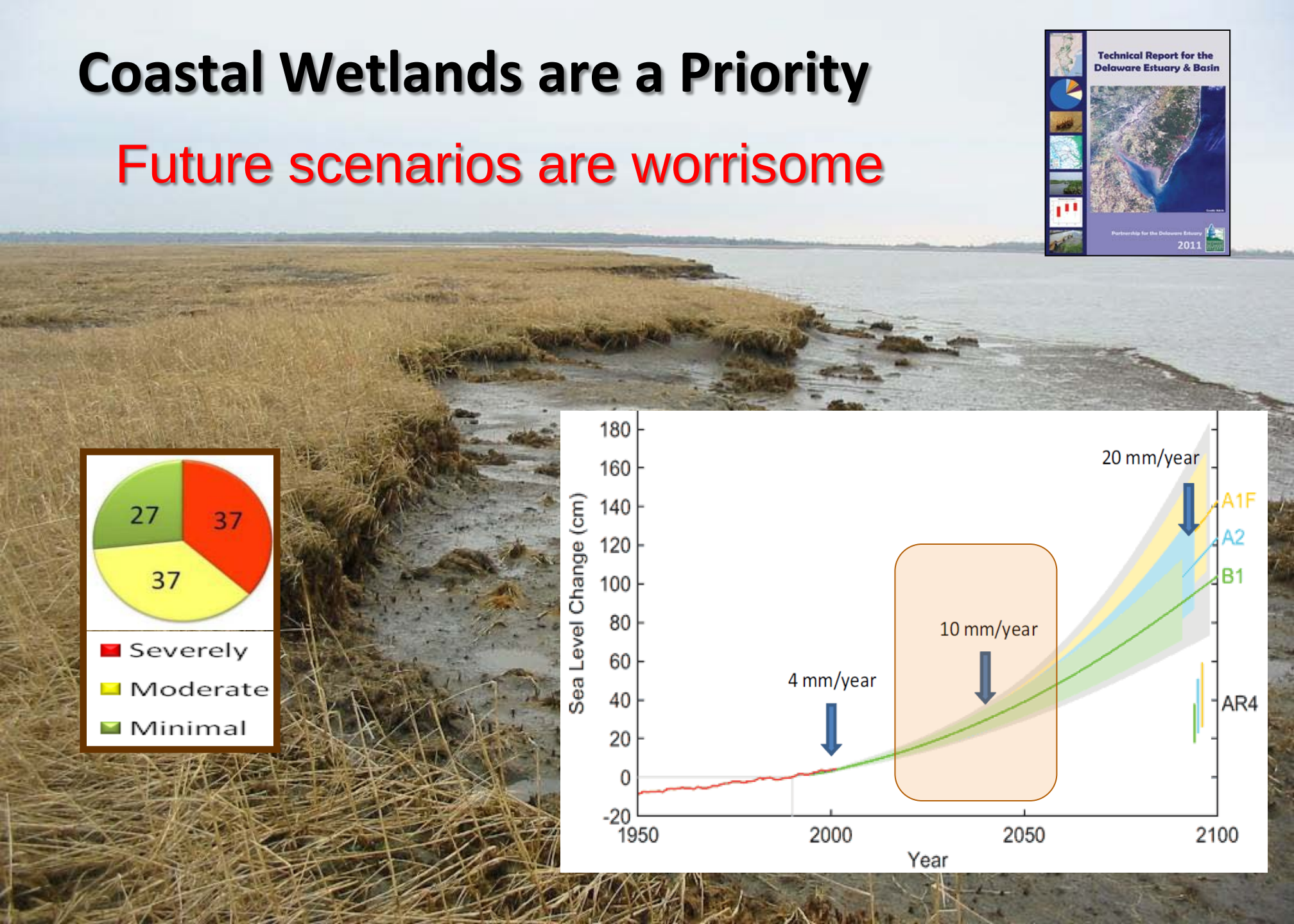




http://delawareestuary.org/technical-report-delaware-estuary-

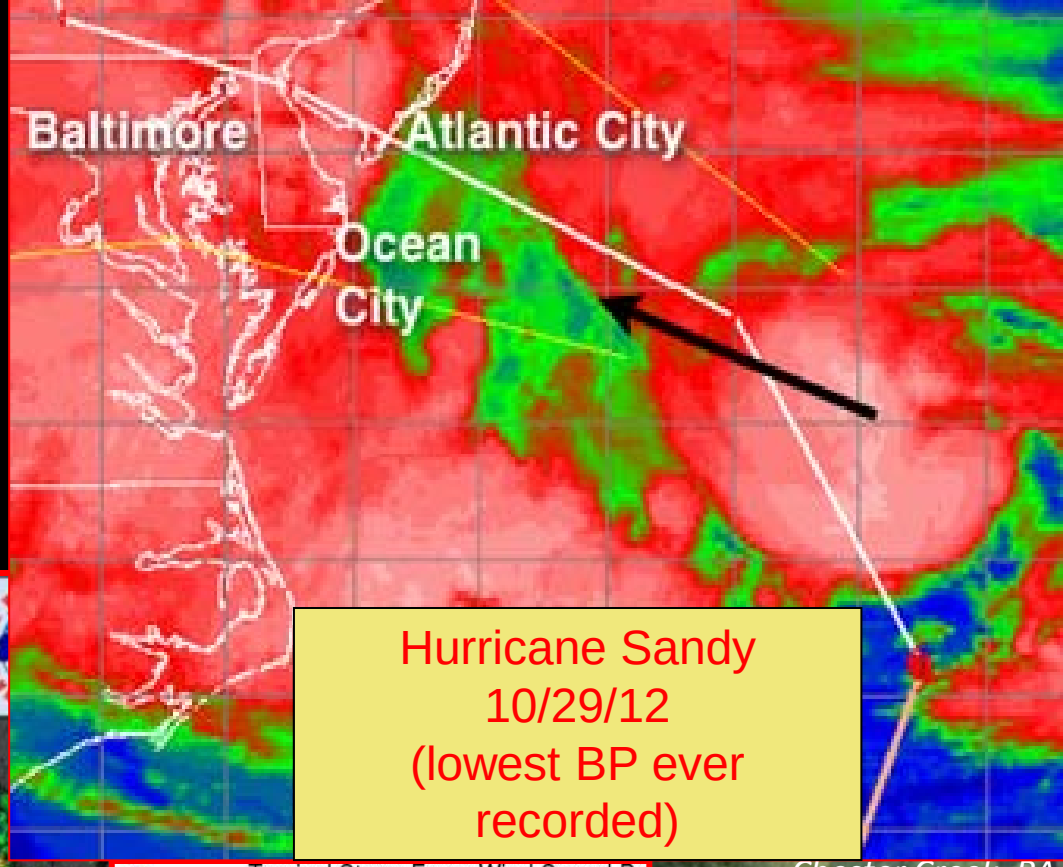
Coastal Wetlands are a Priority

Future scenarios are worrisome

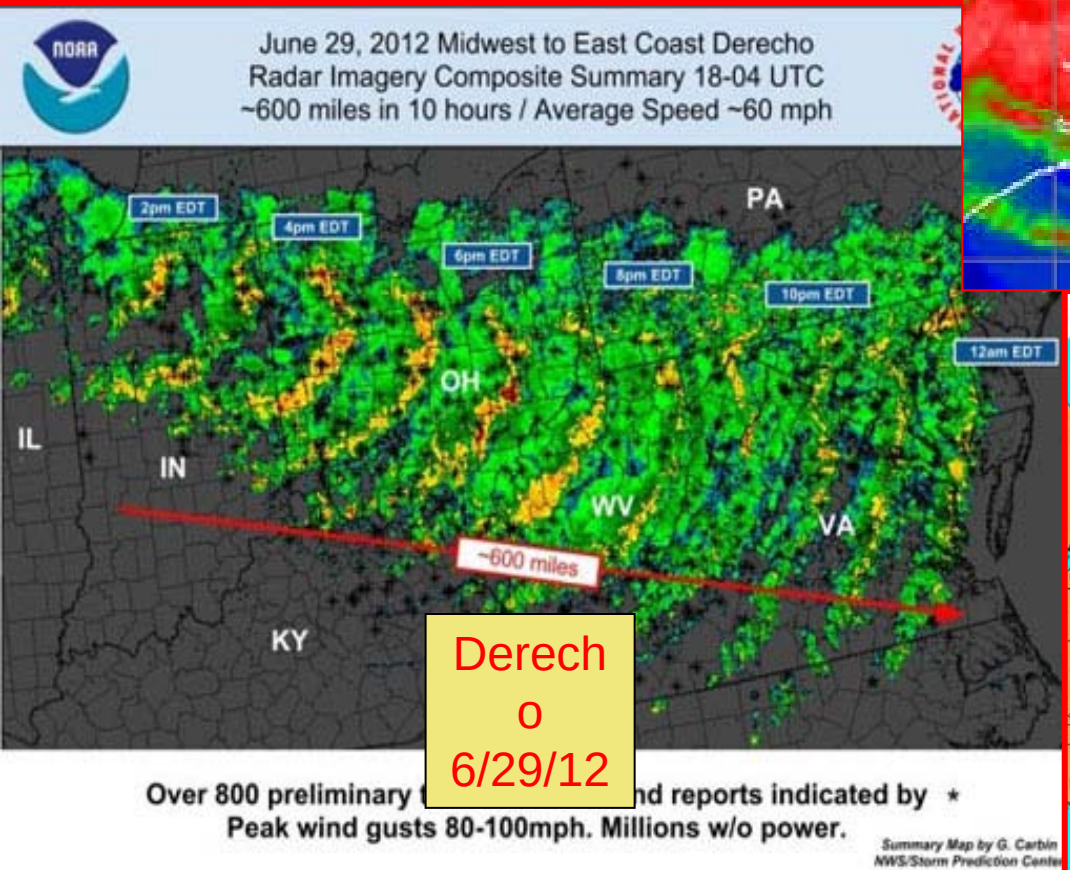


Emerging Threats

Frequent Bigger Storms
Heat Stress
Saltwater and Sea Level Rise
Flooding (amid Droughts)



Hurricane Sandy
10/29/12
(lowest BP ever recorded)

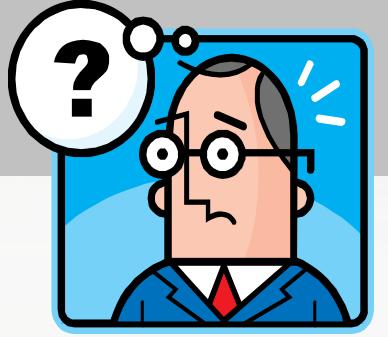


Derecho
6/29/12

Hurricane
8/30/11

Storm
10/1/10

Post-Sandy Questions



How resilient are coastal wetlands and shellfish?

Where will wetlands/reefs likely survive in the future?

How can declines in coastal wetland/reef acreage, condition and resilience be reversed?

What is the Return on Investment?

How can tactics and actions promote coastal resilience via healthy wetland and shellfish acreage?

Are there the resources, public will, and permit support to implement strategic projects on the ground?

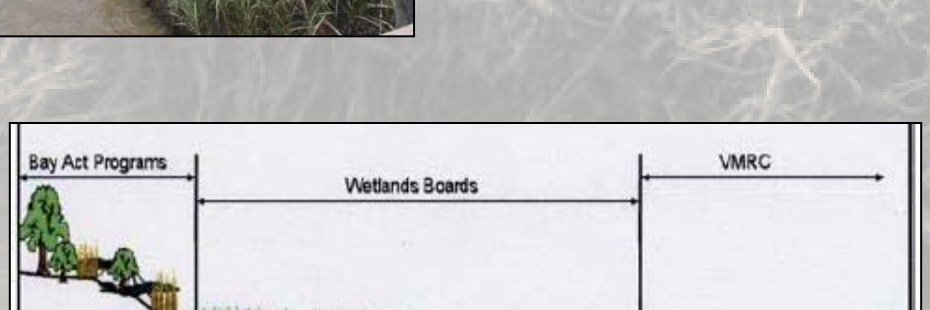
Living Shorelines

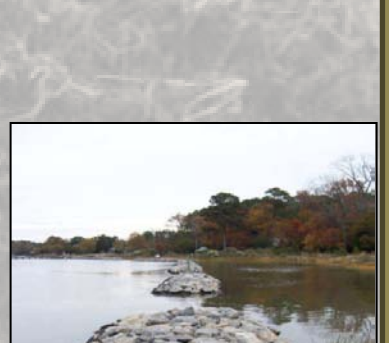
PDE Definition:

A living shoreline is a method of shoreline stabilization that protects the coast from erosion while also preserving or enhancing environmental conditions

INFORMATION

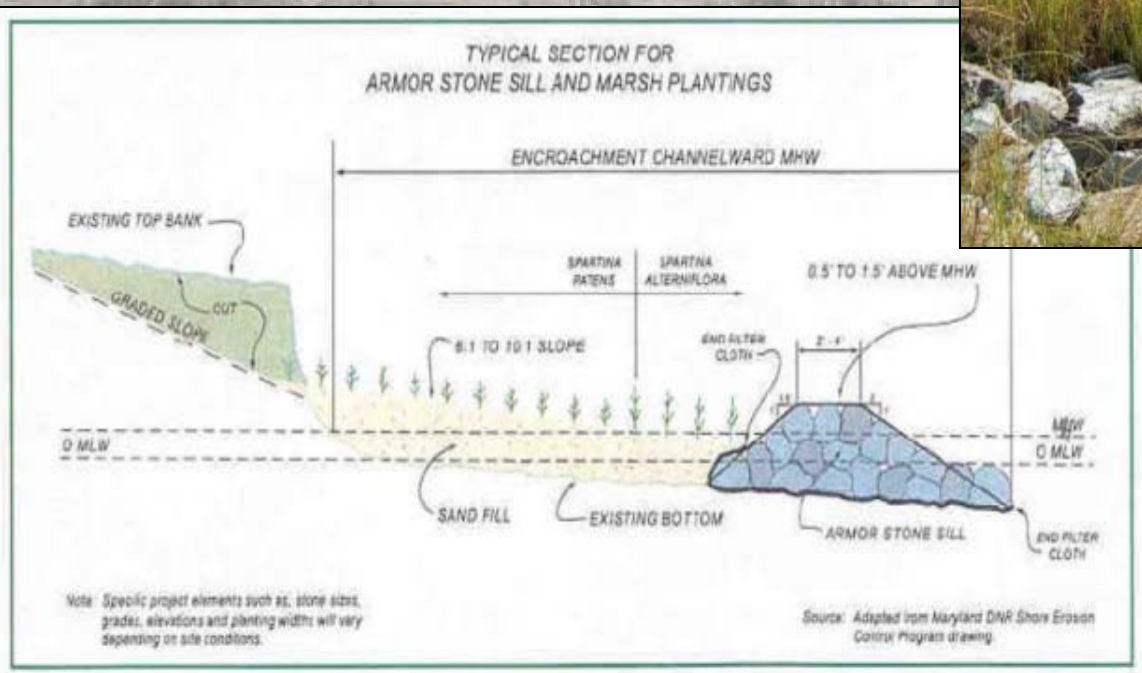
Living Shorelines – Many Options





“Hybrid” Designs

1. Sills with Marsh Planting



S. alterniflora is planted from mid-tide to mean high water

S. patens is planted above mean high water

INFORMATION

2. Groins with Marsh Planting

MHW - Mean High Water MLW - Mean Low Water

Profile of typical stone groin and cross section used to stabilize eroding banks.
Note: Plants are placed between groins on the sand fill.

INFORMATION

3. Nearshore or Offshore Breakwaters

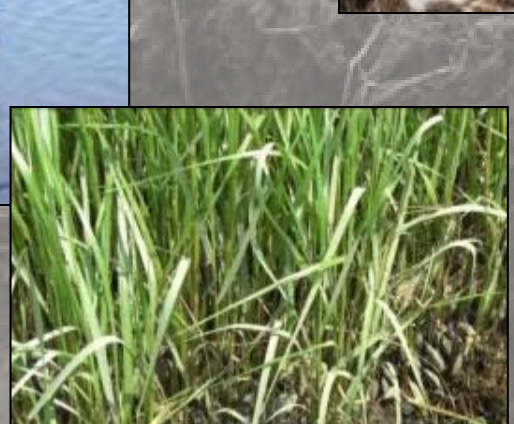
Oyster dome breakwater

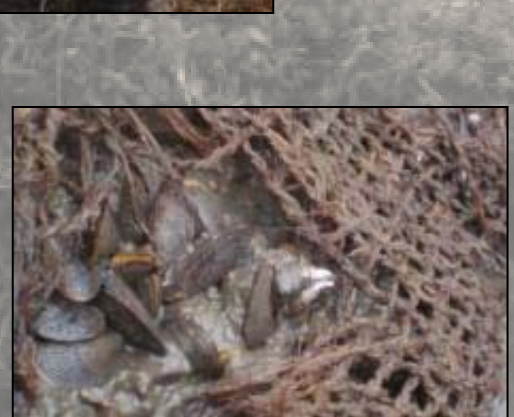
Perforated or segmented to create habitat mosaic, enrich complexity

INFORMATION

4. Biological with Natural Materials

Ribbed Mussels

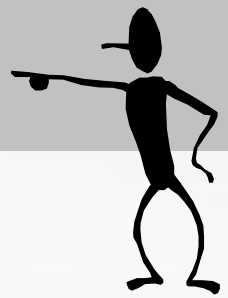




Shellfish-based Intertidal Shorelines – Danielle Kreeger & Dave Bushek

INFORMATION

Considerations



Living shorelines, beneficial use, and shell reef augmentation are not habitat restoration to natural, historic conditions

- **Under changing conditions and more rapid rates of sea level rise, many natural areas will not survive**
- **Natural infrastructure projects designed to achieve flood protection or other ecosystem benefits are still engineered actions to achieve specific goals**

Living Shoreline R&D

Mussel Powered Living Shorelines for Salt Marsh Erosion Control

Danielle Kreeger, David Bushek, Joshua Moody,
Angela Padeletti, Laura Whalen

Shellfish as Natural Erosion Control

- Fringing oyster reefs absorb wave energy and trap sediments.
- Oyster reefs also create habitat, filter water, and recycle nutrients.

Ribbed Mussels: An Alternative To Oysters

Similar ecological services
- Stabilize sediments
- Water filtration
- Nutrient cycling
- Sediment deposition

Not harvested
- No poaching concerns
- No human health risk

Synergism with grass forms levees

Can combine with other tactics

PDE/Rutgers Example: Greening of Rip Rap

Coir mat to provide support for coir logs

Coir logs secured using wooden stakes. Coir twine is threaded through stakes and logs

A second tier of logs mimics natural marsh terracing

Shellbags are placed to “soft armor” logs

Allow time for sediment to fill; specific to each site and dependent on TSS. This site took two weeks.

May 2010

Salvage available *Spartina*/ribbed mussel clumps

Spartina/ribbed mussel clumps planted

Spartina alterniflora plugs also planted into coir logs

PDE/Rutgers Example: Greening of Rip Rap

April 2010


May 2010
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June 2010
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June 2011
PARTNERSHIP FOR THE
DELAWARE ESTUARY, INC


September 2011 (after Hurricane Irene)
PARTNERSHIP FOR THE
DELAWARE ESTUARY, INC

November 2012 (after Hurricane Sandy)

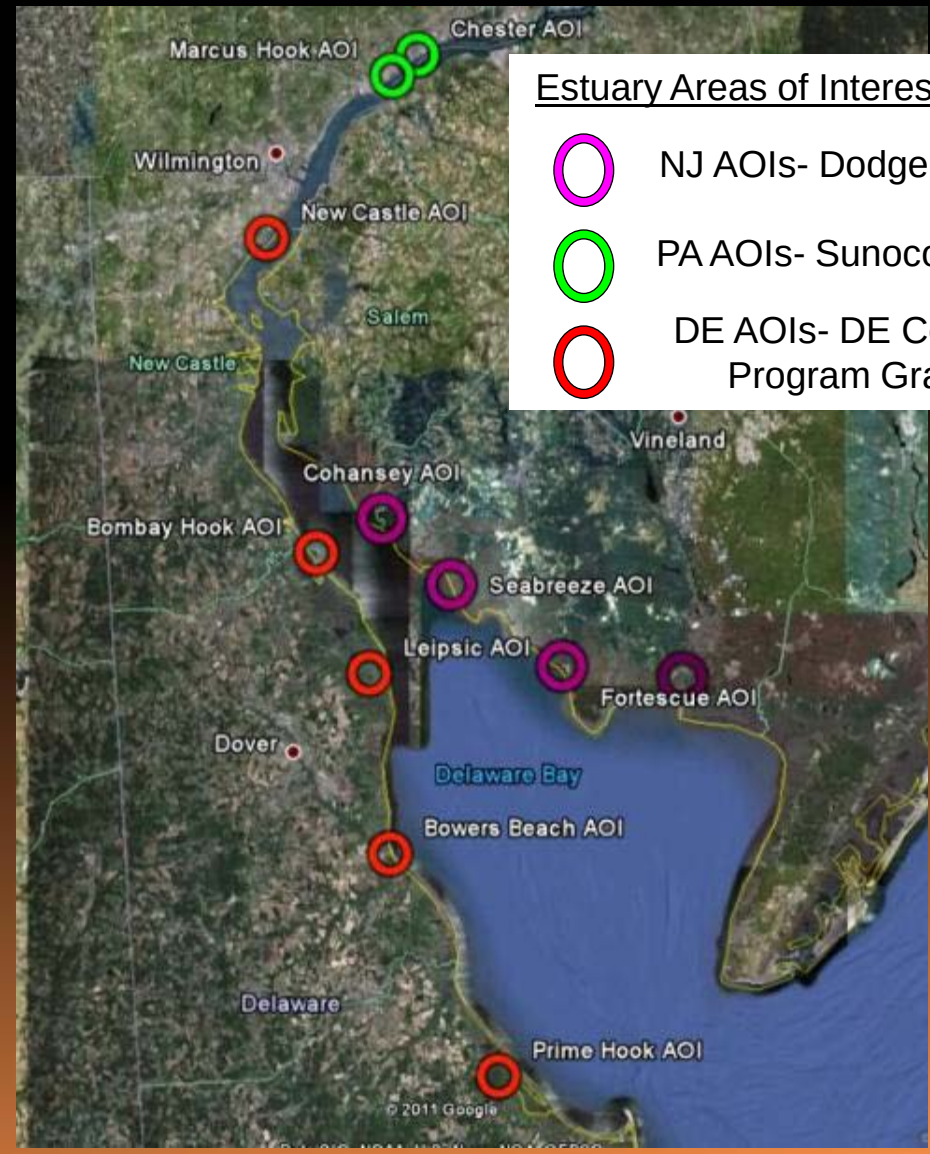
DelawareEstuary.org

- Practitioners Guide
- Outreach Products
- Potential Project Inventory (DE, NJ)

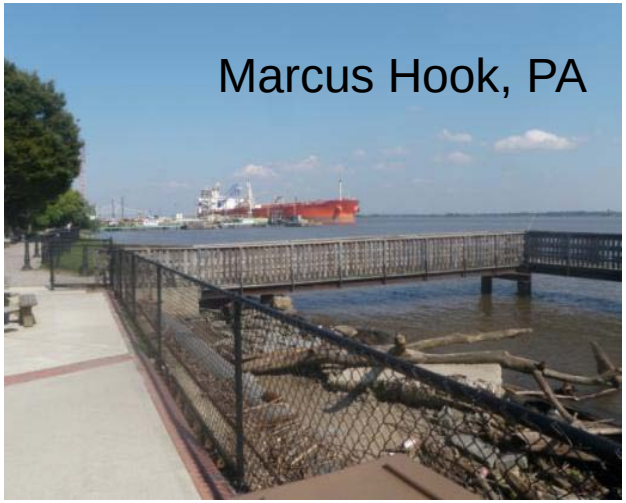
Living Shorelines Planning Project

DK

- Inventory of Types
- GIS Analysis in Areas of Interest
- Selection of Potential Project Sites
- Workshops
- Proposals for Pilots

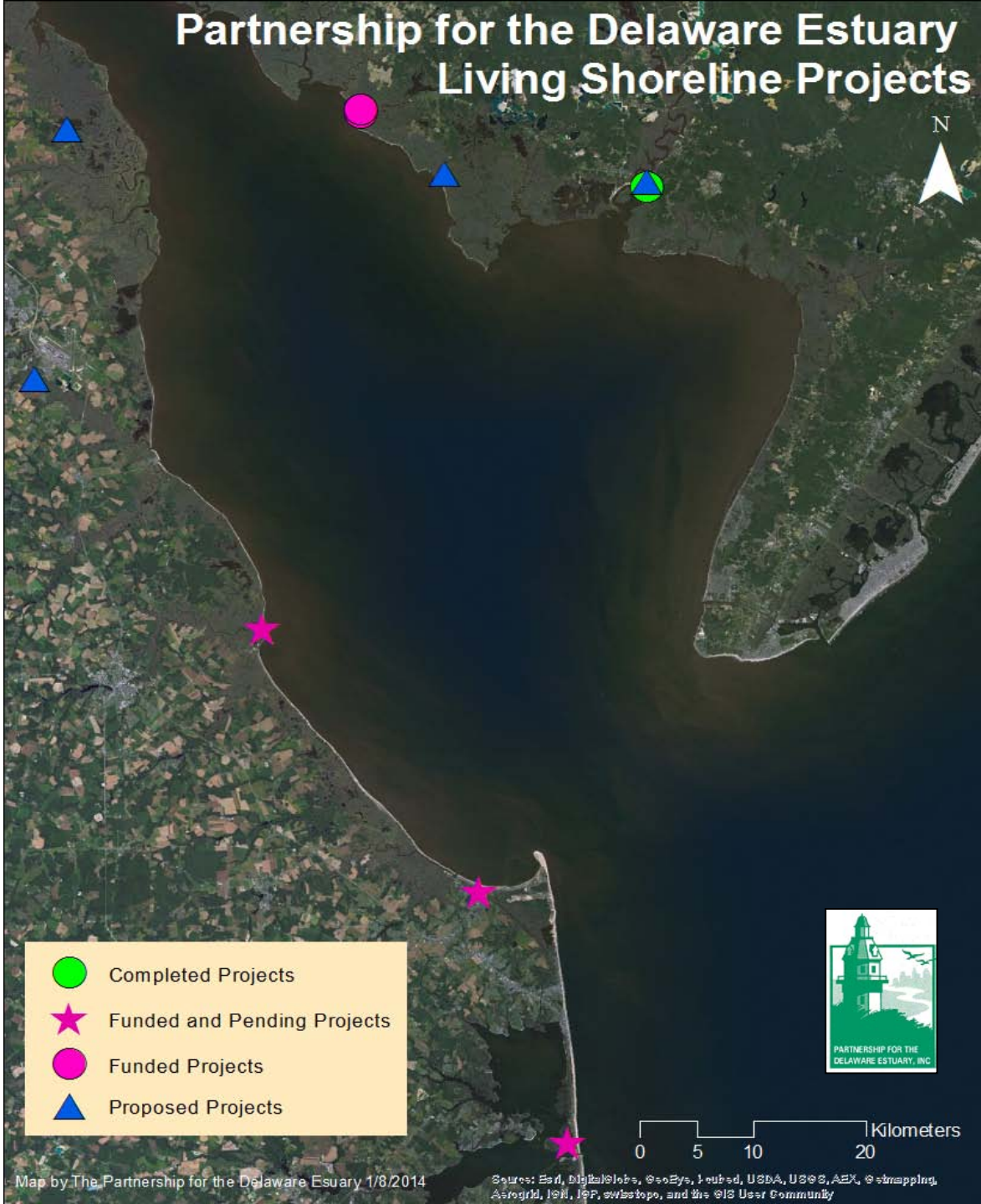


Potential Project Sites



- <u>Completed</u>
  - Maurice River, NJ
  - Matt's Landing, NJ

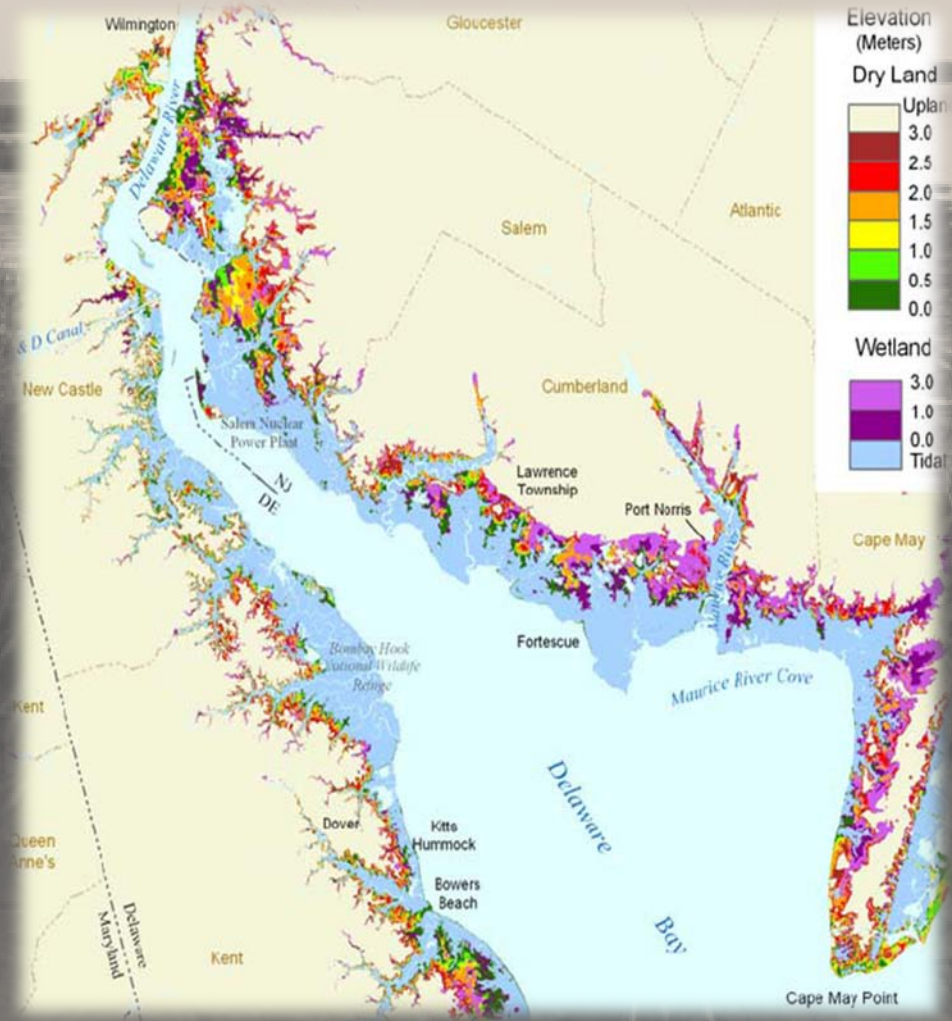
- <u>Funded and Pending 2014</u>
  - Inland Bays, DE
  - Lewes Canal, DE
  - Mispillion, DE
  - Money Island, NJ



Where and How to Invest?

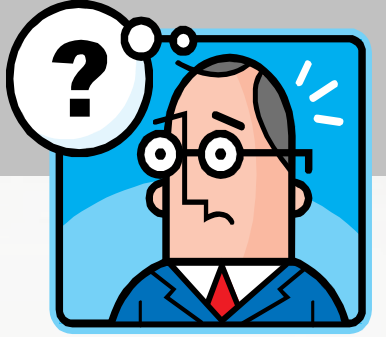
Complex Landscape & Challenges

Is a Living Shoreline What you Need?



PLANNING

Natural Infrastructure Tactics



Examples:

Oyster/Rock Breakwaters

Living Shorelines (bio, hybrid)

Sediment Placement

What Are Your Goals?

- Restore Acreage ?
- Control Erosion?
- Stabilize Contaminants ?
- Enhance Fish & Wildlife ?
- Enhance Water Quality ?
- All of Above ?

INFORMATION

Nature's Benefits

Bivalve Shellfish are "Ecosystem Engineers"

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Mussel Beds

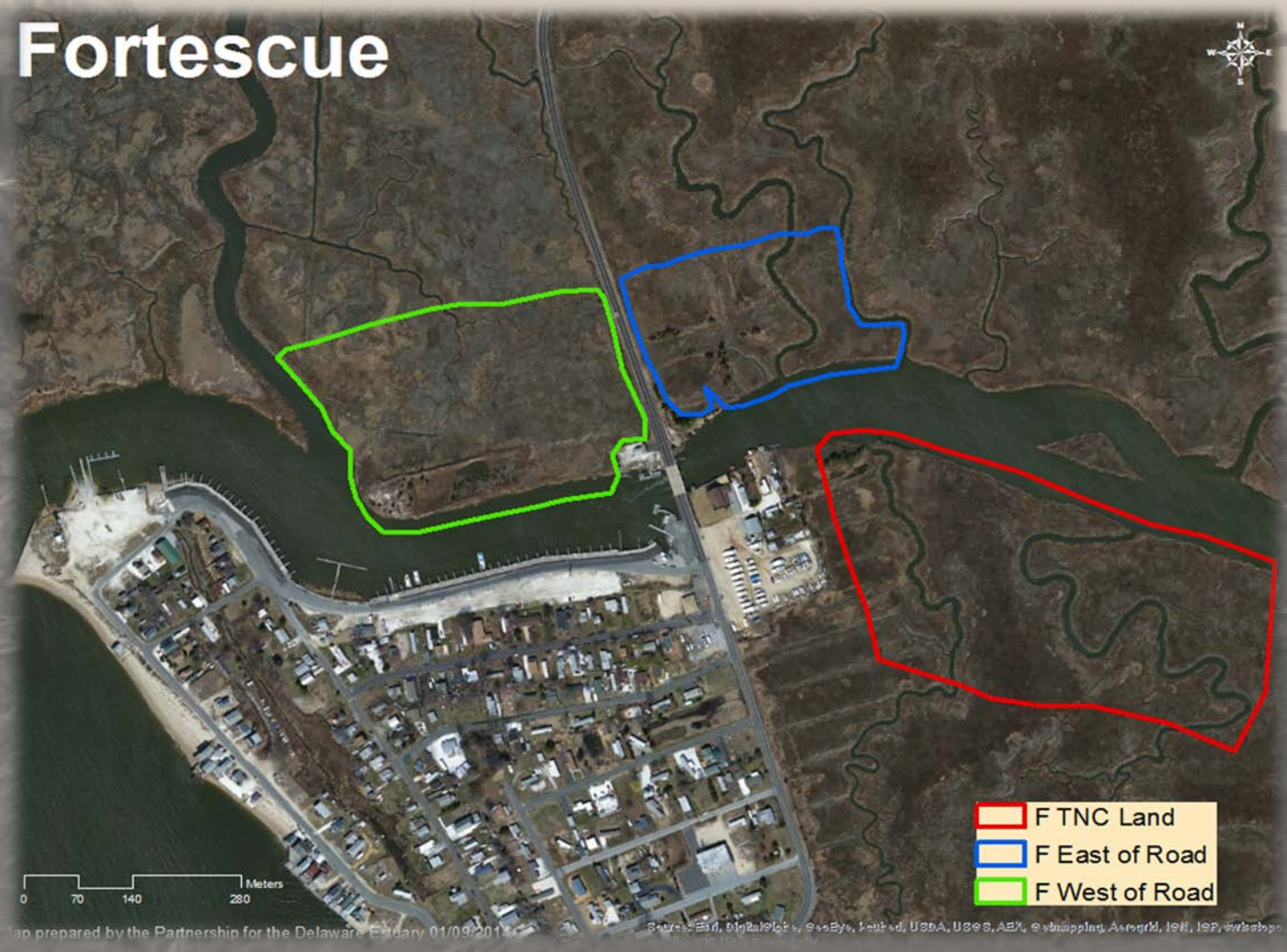
reshwater Mussel Projec

Oyster Reefs

Kreeger

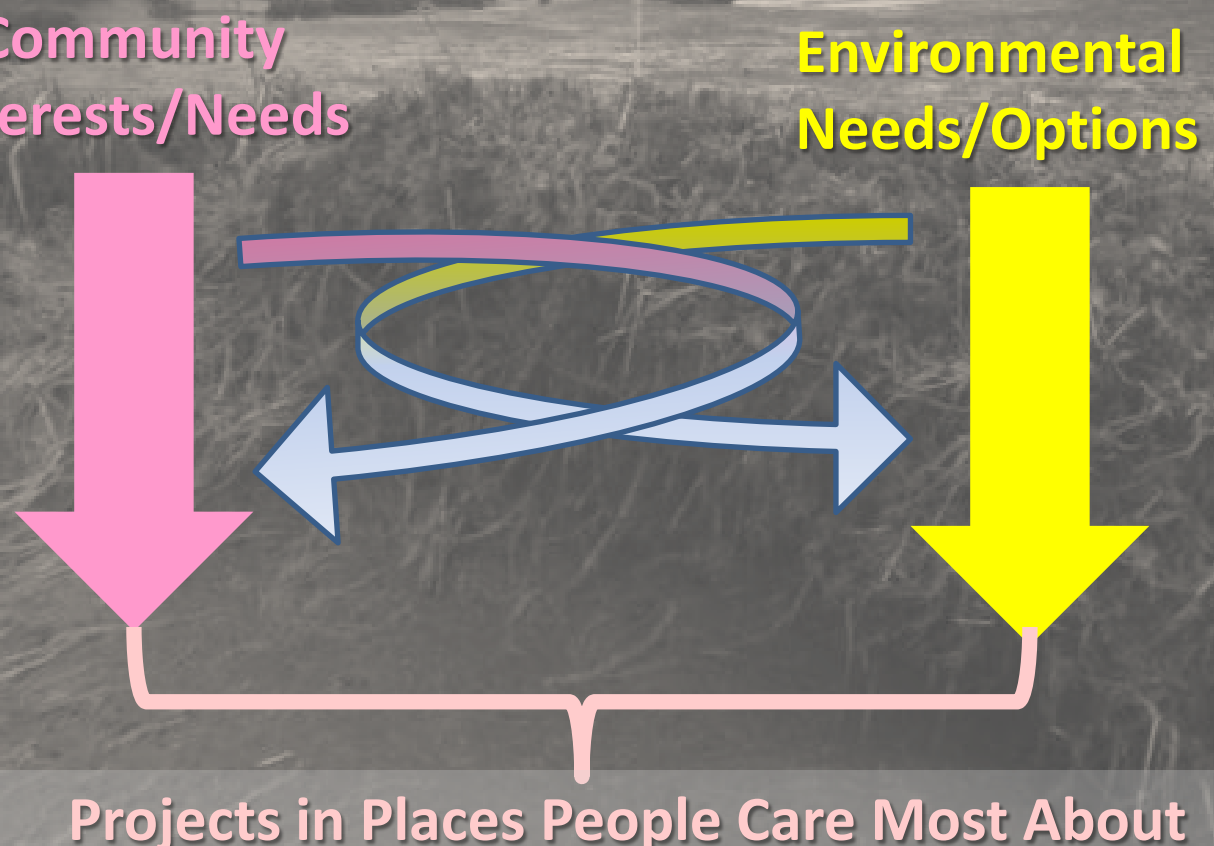
Where and How to Invest?

Often based on where people care



Where and How to Invest?

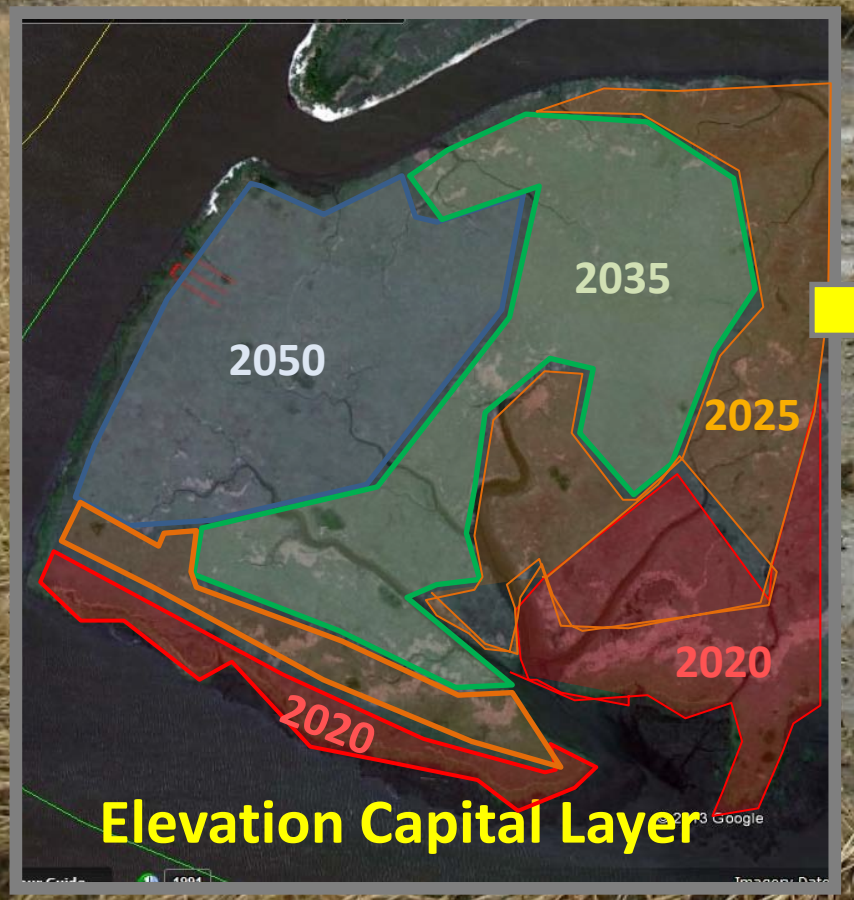
But science can also guide decisions about tactics and likely effectiveness

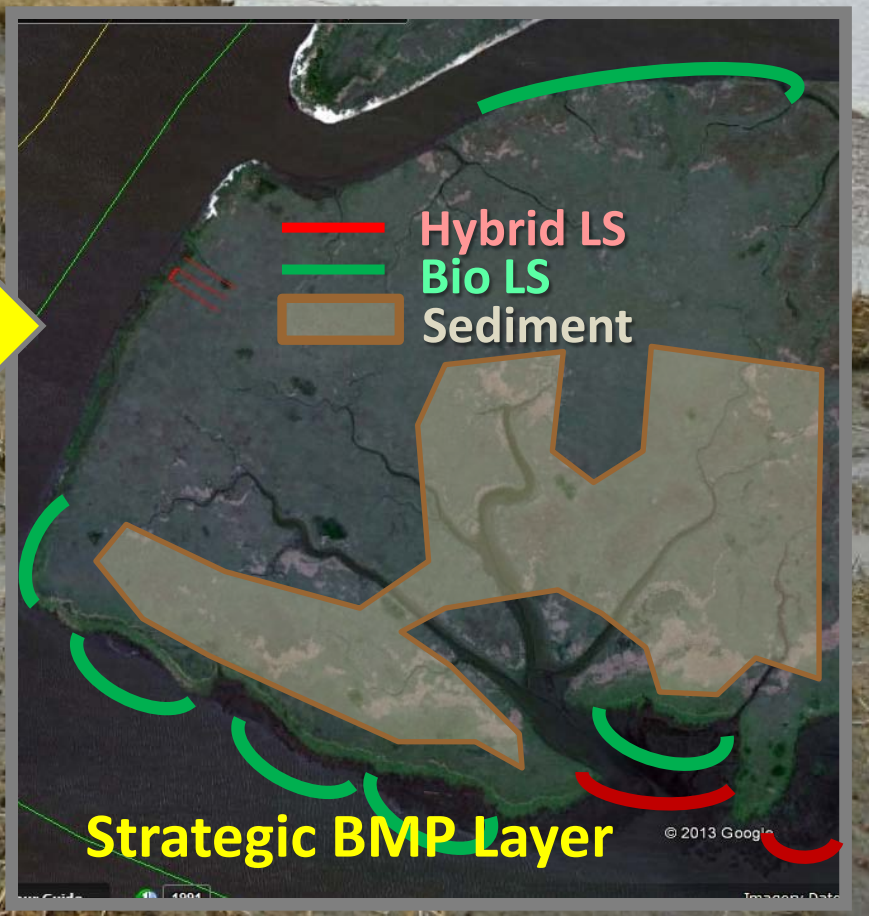
- 

Planning

Marsh Futures

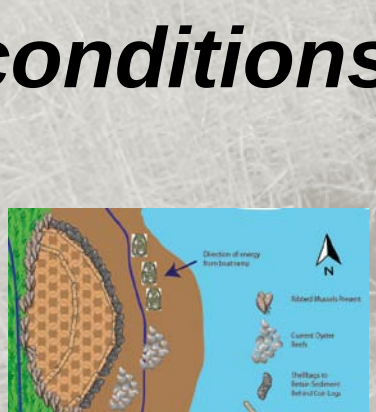
Strategic, Science-Based Prioritization of Places and Tactics (BMPs, Resilience Proj.)

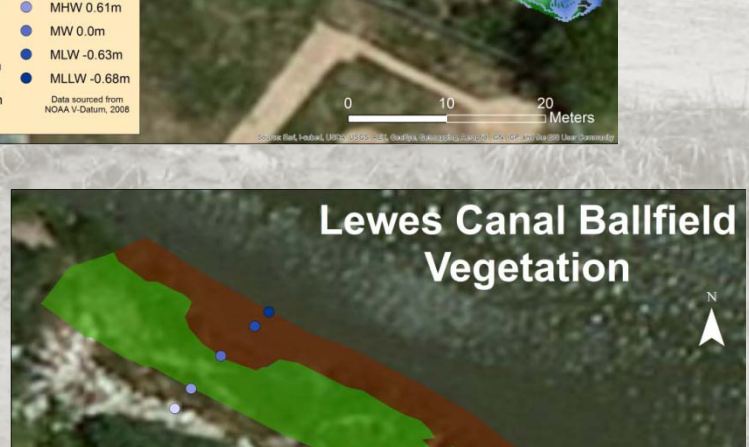




Considerations

Tactics and project designs need to be tailored to local site conditions





Considerations

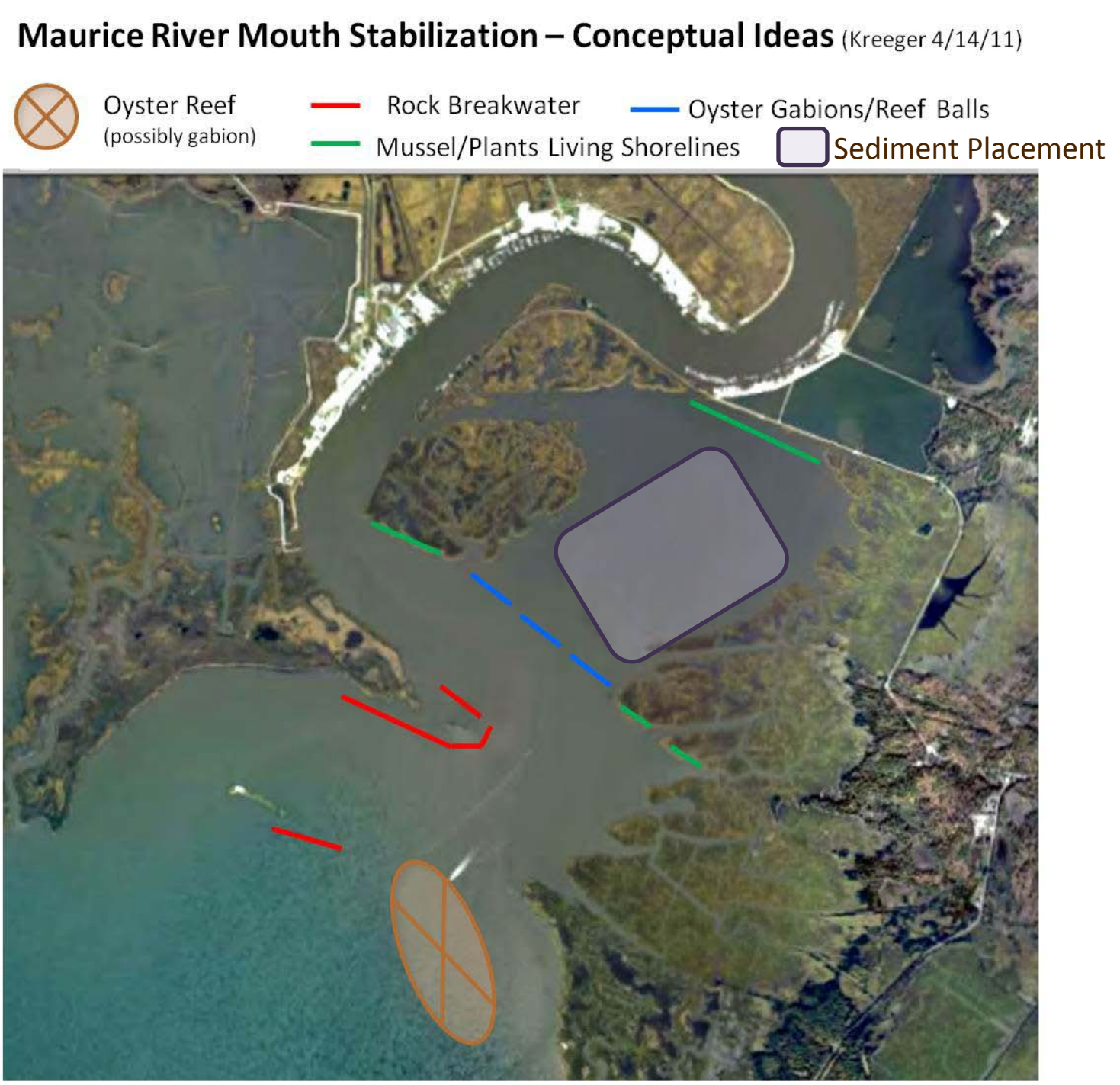
Think About the Sequence – Which First?

Oyster/Rock Breakwaters

Living Shorelines

Sediment Placement

The order of projects and tactics can be important



Considerations

Permitting

- **differs among states**
- **new rule in NJ** (e.g. need engineering)
- **new SAA in DE**
- **TOYR**
- **Habitat Tradeoffs**
- **Navigation**

Considerations

Logistical - Examples

Living Shorelines

- new

Sediment Placement

- Source of material
- Least costly option for dredgers?
- Clean?

Timeline: Based on Considerations

Initial RTK, flora and faunal use surveys; Installation of intertidal coir log treatment

Allow time for back-fill and plant by mid April **to avoid migratory shorebirds and HSC**

Mid June: Re-survey treatment, augment intertidal if necessary; install subtidal by 7/10 (oyster WADs)

Re-survey plant and animal metrics if permitted

Re-survey treatment and augment if necessary

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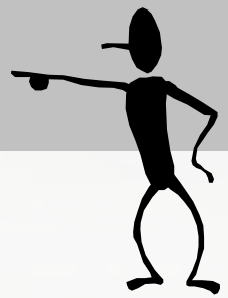
Considerations

Policies - Example

Oyster Restoration in NJ?

- not if in closed waters
- not if would limit harvest in open waters

Considerations



Monitoring will strengthen success

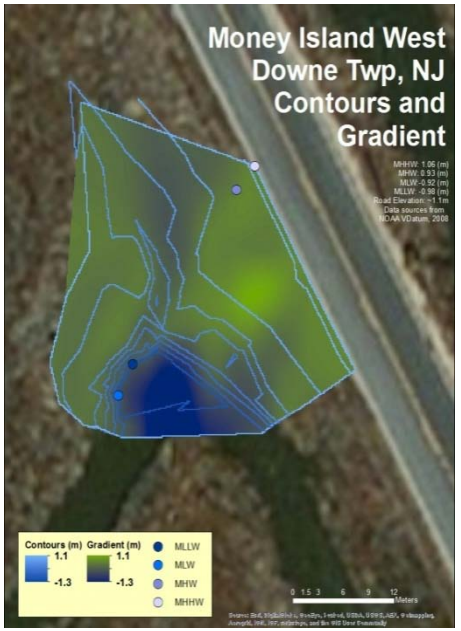
Natural infrastructure approaches are less tested and typically accept some "bending" with natural processes

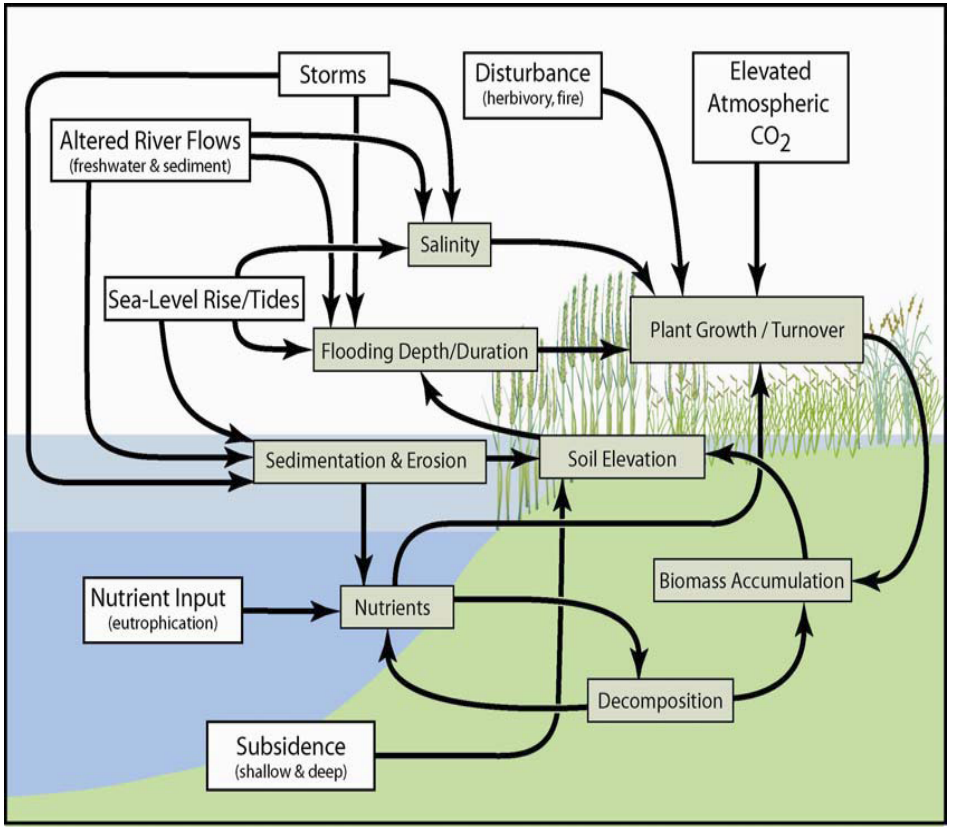
Monitoring will allow weak spots to be promptly addressed and scientific guidance will boost outcomes from and maintenance and adaptive management

Monitoring

1. Physical Conditions

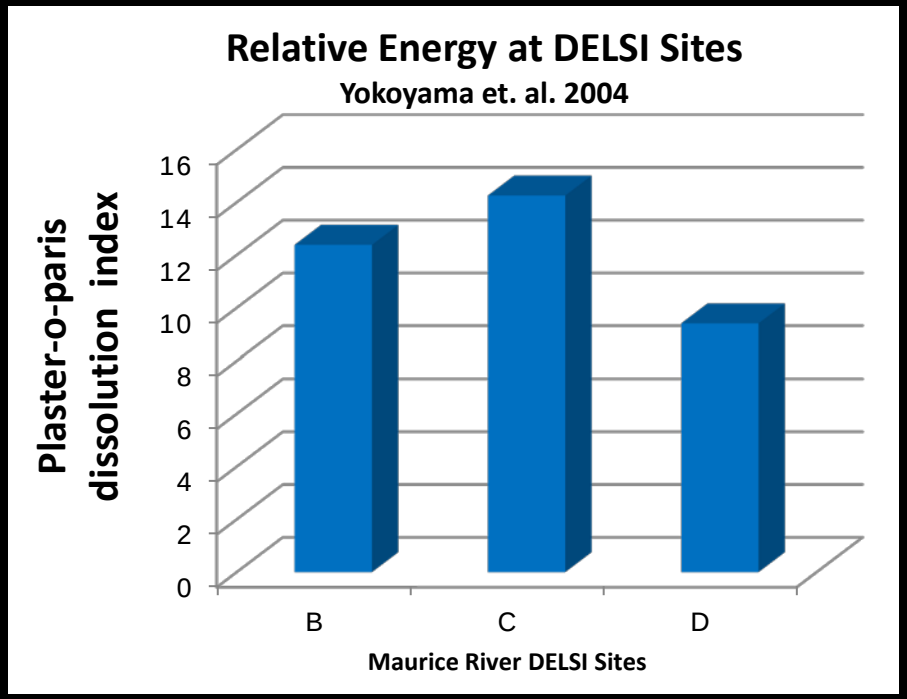
- Elevation
- Erosion
- Hydroperiod
- Log Survival

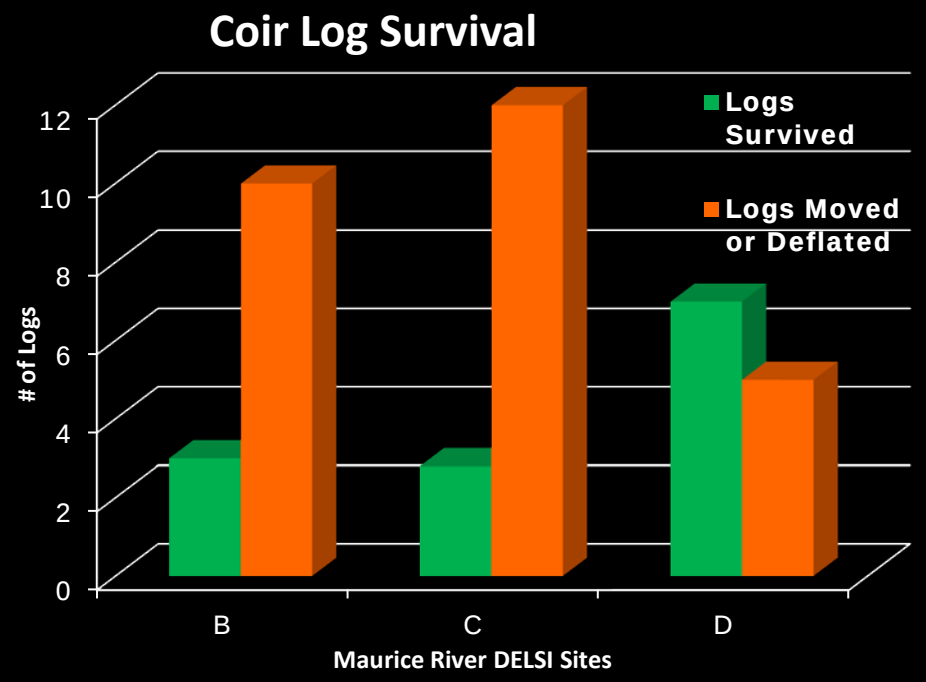




Lateral and vertical positions monitored using RTK GPS: accurate to 3cm vertical and 1cm horizontal

Energy and biolog survival



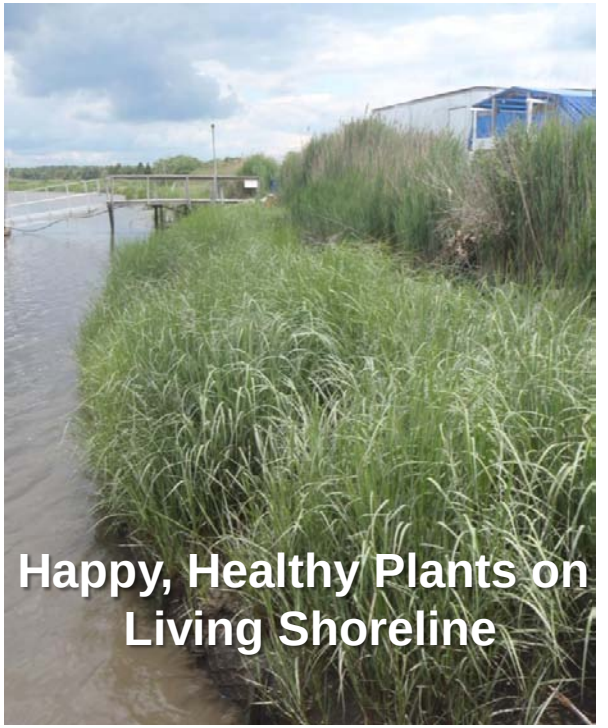


- Logs and mats survived best at low energy site
  - Logs did not work if tucked against marsh
  - Logs survived best when lined with oyster shell bags

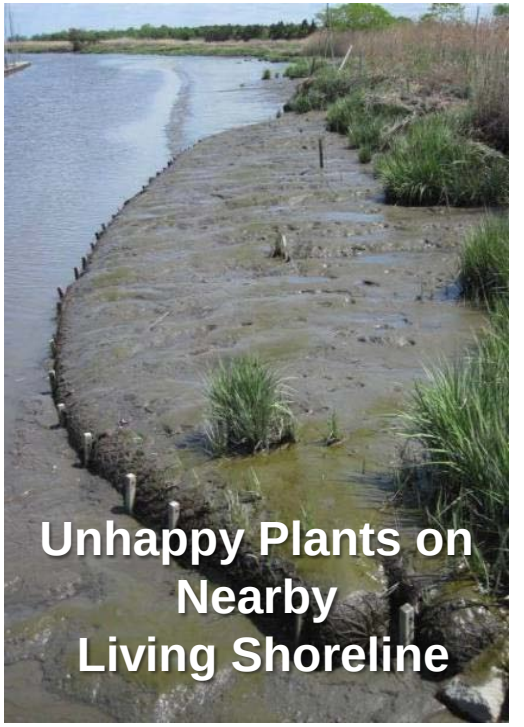
Monitoring

2. Biological Conditions

- **Plant Growth/Robustness**
- **Sessile Fauna**
- **Motile Fauna**
- **Wildlife**



Happy, Healthy Plants on Living Shoreline

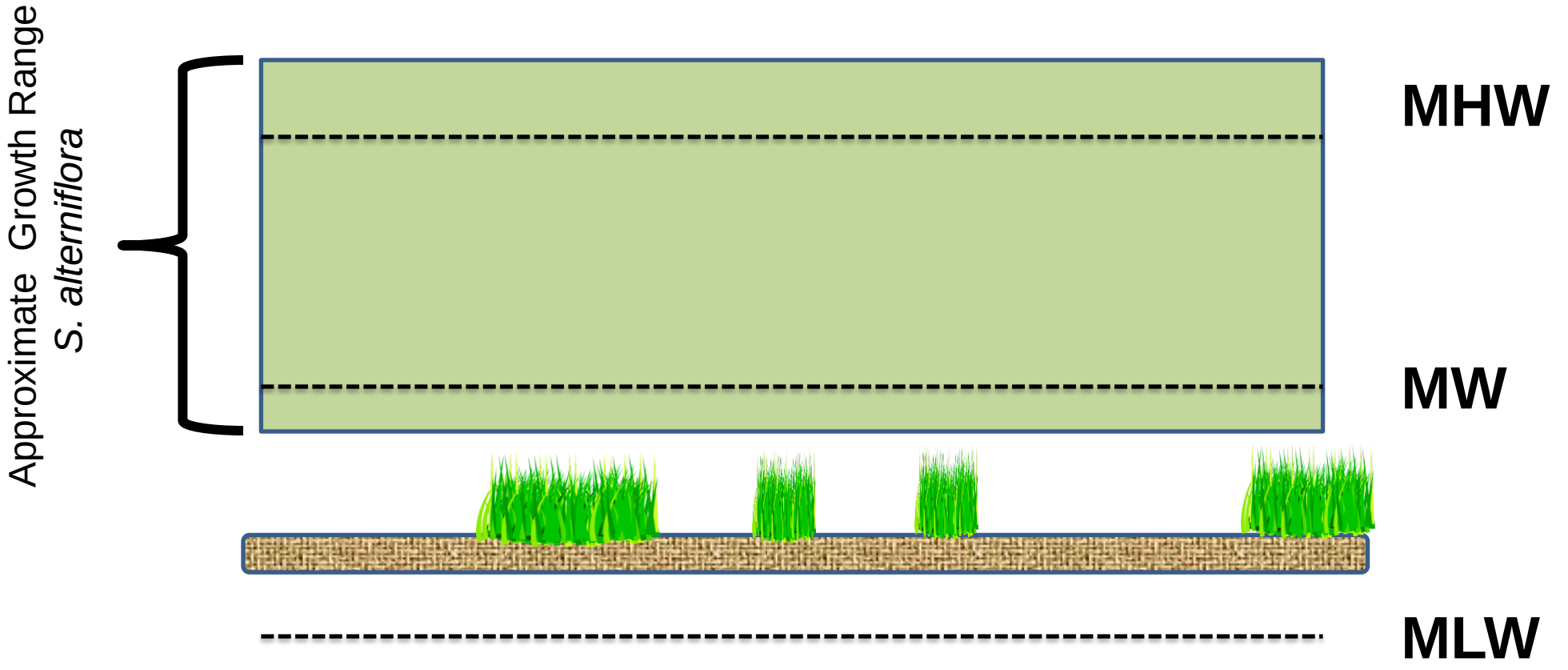


Unhappy Plants on Nearby Living Shoreline

Elevation is key

Optimum Growing Range for *Spartina alterniflora*

Growth rate is a function of depth below MHW



Slide: J. Moody, adapted from James Morris

Optimum Growing Range for *Spartina alterniflora*

Growth rate is a function of depth below MHW

Slide: J. Moody, adapted from James Morris

Motile Fauna

Seines:

deployed at high tide
retrieved at low tide

Minnow pots:

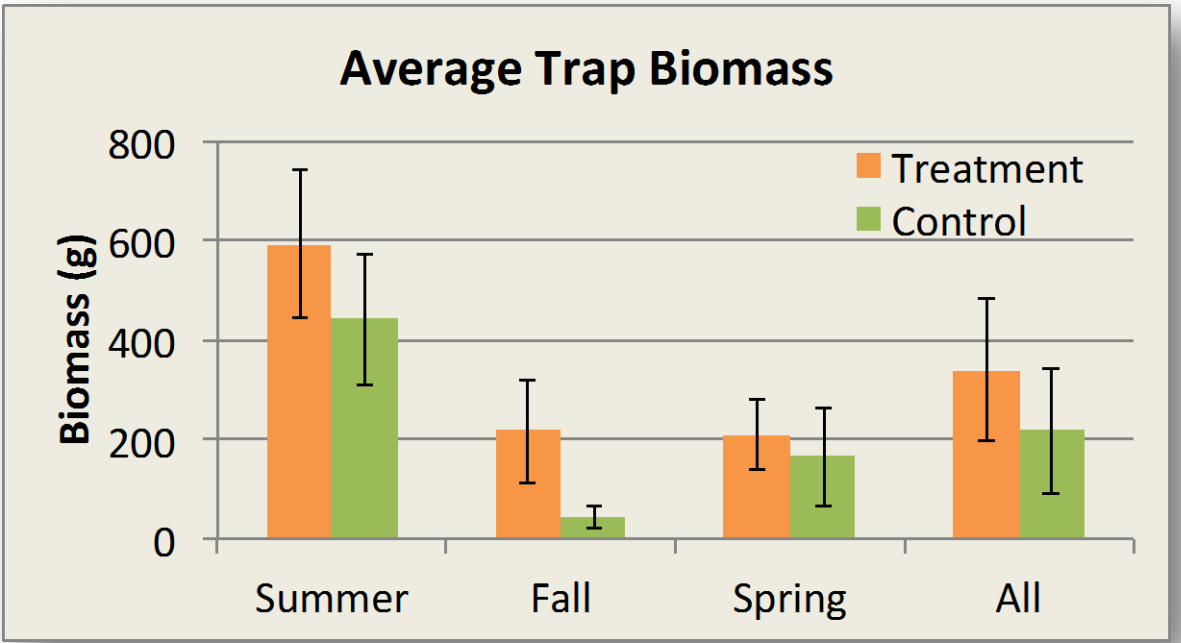
deployed at low tide
retrieved 24 hrs later

Monitoring Data: Minnow Pot Catch

Control: 8 species

Treatment: 9 species

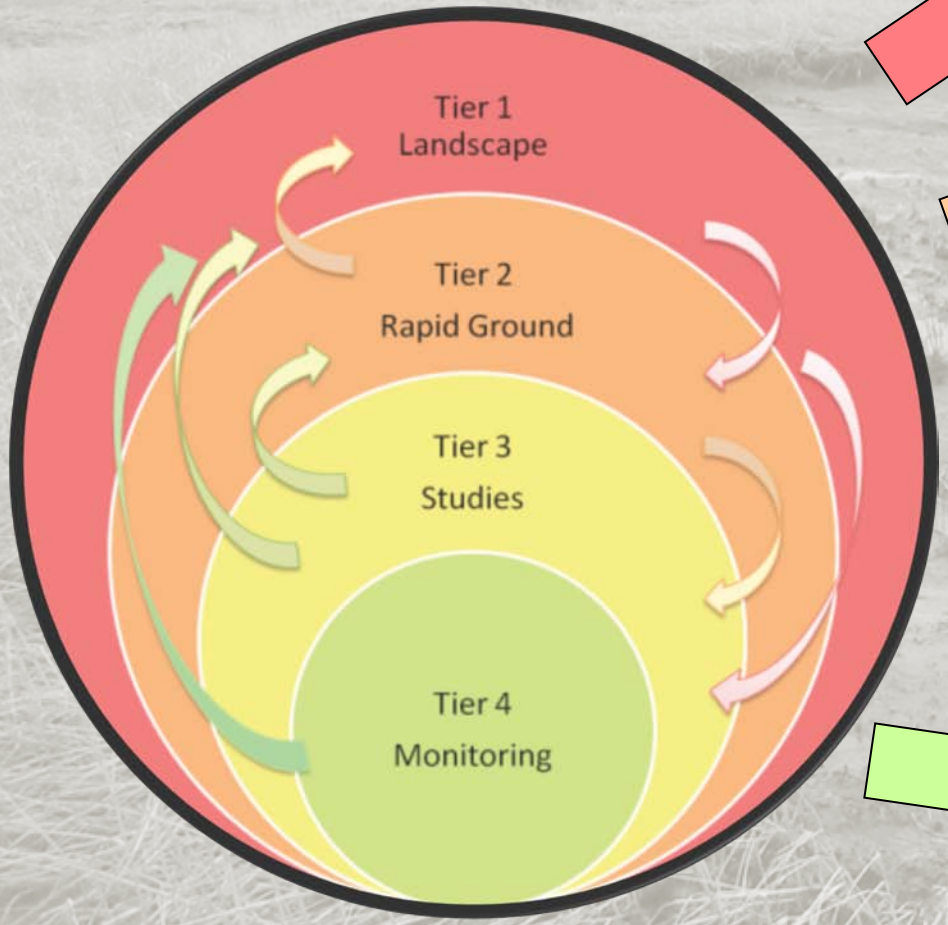
Minnow Pot Species	Control	Treatment
Grass Shrimp	749	771
Mummichog	558	1592
American Eel	29	22
Blue Crab	13	10
Atlantic Menhaden	2	
White Perch	1	10
Spotfin Mojarra	1	2
Striped Bass	1	
Silver Perch		6
Diamondback Terrapin		1
Bay Anchovy		1

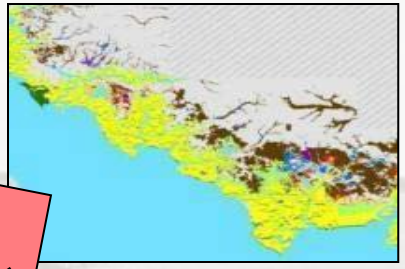


Monitoring

Tap Into Existing Data

e.g., Mid-Atlantic Coastal Wetland Assessment





Remote Sensing

Ground-Truthing

Intensive Studies

Station Monitoring

Monitoring Suggestion

Core Metrics

Consistent, economical metrics and methods for any project

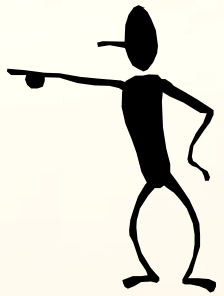
Data sharing to facilitate new projects adaptive management

Supplemental Metrics

Assess performance relative to specific project goals and site conditions

Standard BACI Design

Paradigm Barriers & Shifts



We are not necessarily restoring to past conditions. Restore for the future.

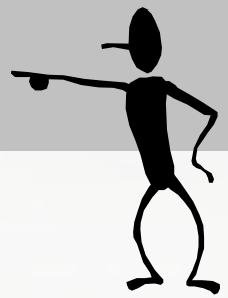
…. but this does not fit regulatory framework

We are not necessarily restoring for posterity. Living shorelines and other tactics may require maintenance and replenishment, much like beach nourishment

…. but the benefits might still outweigh costs

POLICY

Natural Infrastructure Caveats

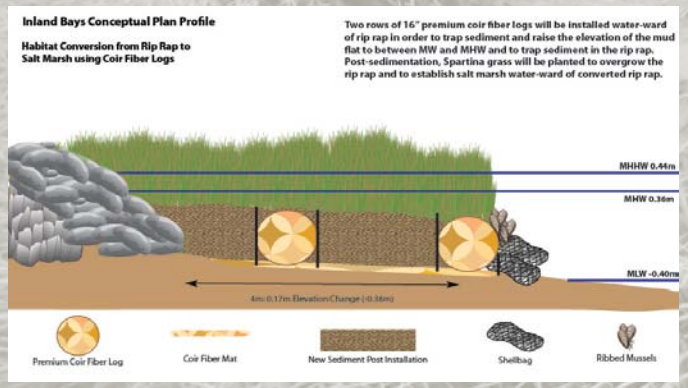


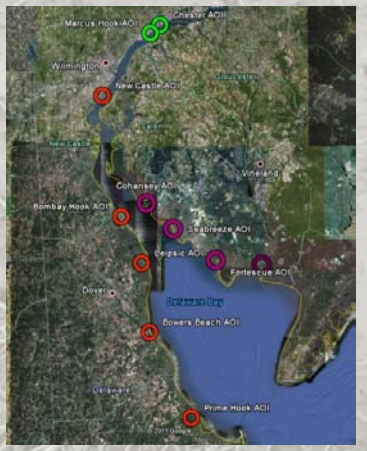
Natural infrastructure tactics may need to be adaptively managed

Think of project/site "service plans" that expect to need some repeated maintenance or augmentation

Next Steps

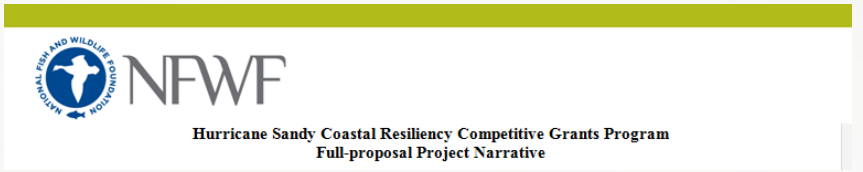
Dozens of pilot projects have been conceptualized
Actual implementation is now needed





Next Steps

NFWF DOI Proposal – Pending



Living Shorelines and Marsh Futures: Integrating Science and Outreach To Guide Successful Coastal Wetland Resilience Projects in DE and NJ

<u>3 NEPs</u>

- Partnership for the Delaware Estuary
- Delaware Center for Inland Bays
- Barnegat Bay Partnership

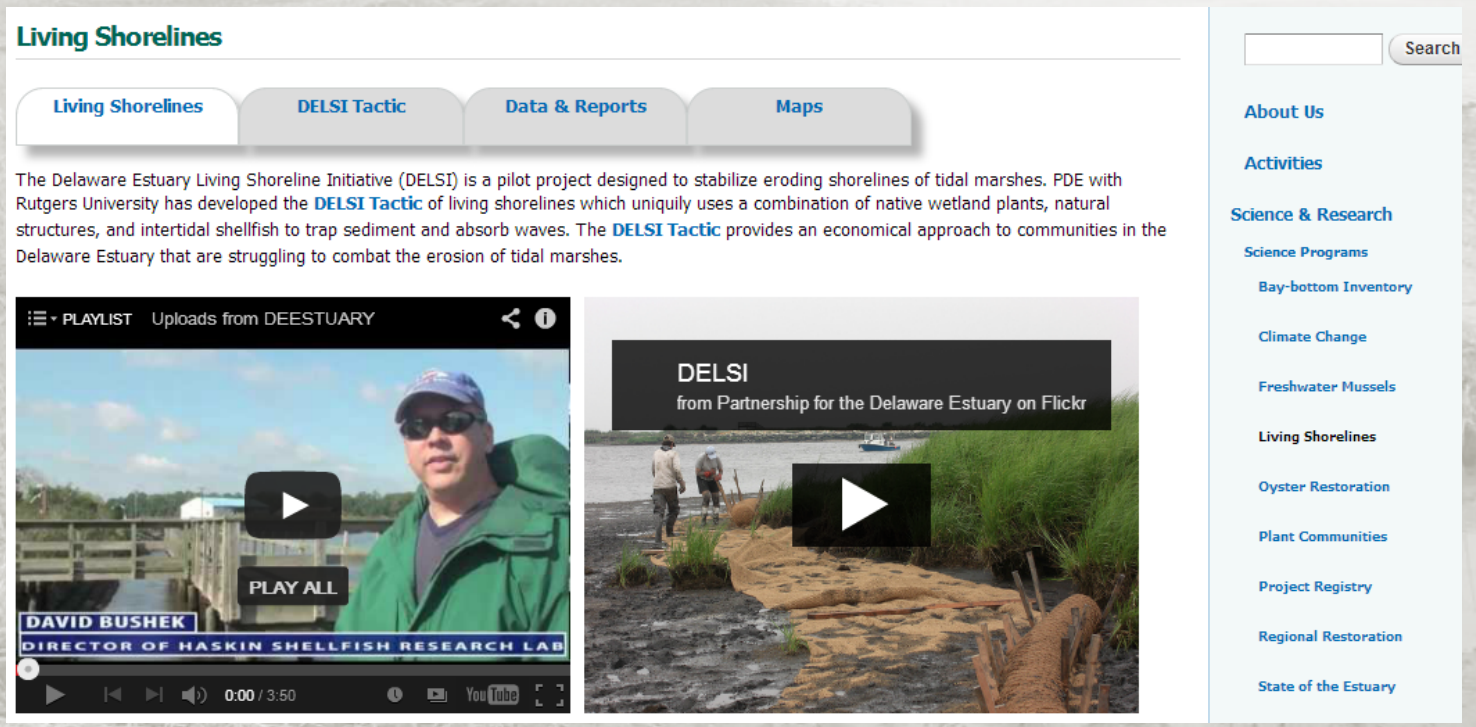
<u>Tasks</u>

- Scientific Analysis and Sharing of Lessons Learned
- Monitoring Standards
- Outreach and Contractor Training
- Nine Demo Projects in DE and NJ *(includes Bombay Hook)*

For More Info

PDE Website

www.DelawareEstuary.org



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